AN EVALUATION OF METHODS TO STUDY INTERSPECIFIC COMPETITION IN HAY AND PASTURE MIXTURES

by

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(Suggested short title)

" To him who is a discoverer in this field the products of his imagination appear so necessary and natural that he would like to have them regarded by others, not as creations of thoughts but as given realities."
Einstein (1934). On the Method of Theoretical Physics. Essays in Science Philosophical Library New York.

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ABBREVIATIONS

Af. ....:	Alfalfa
As. ....:	Alsike
B.T. ....:	Birdsfoot trefoil
Br. ....:	Bromegrass
Comp. ....:	Composition
Compon. ....:	Components
D. or Dens. ....:	Density
DM ....:	Dry matter
D.Wt. ....:	Dry weight
G.C. ....:	Ground cover
G. Wt. ....:	Green weight
K.B. or K. Blue....:	Kentucky bluegrass
L. or Lad. ....:	Ladino white clover
LA ....:	Leaf area
LAI ....:	Leaf area index
Mixt. No. ....:	Mixture number
NAR ....:	Net assimilation rate
O.G. ....:	Orchardgrass
PA ....:	Photosynthetic area
PAI ....:	Photosynthetic area index
PQ ....:	Point quadrat
R.C. ....:	Red clover
R.can. ....:	Reed canarygrass
T. or Tim. ....:	Timothy
T.Fe. ....:	Tall fescue grass
Y./U.A. of G.C. ...:	Yield per unit area of ground cover

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INTRODUCTION

Competition in plant communities is one of these concepts that has been investigated and discussed extensively and yet very few people if any have a thorough understanding of all its intricacies and complexities.

Any study that did or will reveal some of the unknowns of this phenomenon in grassland will be a step in the direction that will ultimately permit the attainment of the ideal pasture plant community. However, presently, until more is known, especially on the value of competition as it occurs in hay and pasture swards, any attempt to come forth with recommendations on the compounding of forage mixtures may be rather vain, because these will be only temporary.

Probably the earliest record of people being aware of competition dates back to the 14th century when Peter de Crescentiis understood that competition existed between trees. Malthus expressed competition upon mankind in terms of population and food supply. De Condolle in the early 19th century gave probably the first definite characterization of plant competition when he stated that all the species of a region, all the plants of a given place are in a state of war with respect to each other. Darwin called this "the struggle for existence" and Spencer "the survival of the fittest". (Clements et al. 1929).

Clements et al. (1929) did probably the most extensive study ever done on plant competition. It is doubtful that anything comparable has been produced since by any group of workers.

Currently, competition studies in grassland are done to any large extent, mainly in Australia, New Zealand and England. Some aspects of it are studied at Wageningen in Holland, various other places in Europe and also in Japan.

Competition has been defined in many ways; Clements et al. (1929) considered it a purely physical process, one that begins only when the immediate supply of a single necessary factor falls below the combined demand of the plant. The factors in question are of course the water supply, the nutrient material, the light and the micro-climate. A definition of competition which was found to be as good as any so far existing, was given by Yamada and Horinchi (1960). These workers defined competition "as interplant action and reaction as plants compete for water,nutrients and light. But such reaction cannot itself be directly observed and consequently can only be recognized indirectly by its visible effect, phenotypic bias". It was however stressed that competition must be clearly distinguished from aninternecine reaction, since the latter shows a bias in one direction only.

Very little work if any has been done to develop techniques which will give measurable value to competition. In the review following, the work of Caputa (1948) is considered and was found to be the only one to have had as an objective to give, if not an absolute value, at least a relative one, to competition as it occurred in simple forage mixtures.

The broad objective of this study was to establish a technique which could be applied to assess competition as it occurs in the forage plant communities. More precisely this investigation, was concerned with obtaining a method that would permit the measuring of competition in hay and pasture mixtures, on the basis of quantitative characters which determine the competitive ability of a plant.

The first method to be used, is the yield per unit area of ground cover as obtained from both the dry matter yield and the point quadrat. The measure was based "on the mathematical concept ofhomogeneity of a unit area as represented by a pin-point". This concept was introduced by Levy and Madden (1933), and limited in this study to a unit area of ground cover. On this basis, it was assumed that a unit area of ground will produce the same yield of dry matter, irrespective of whether the ground was covered by a species in pure stand and the same species in a mixed stand, and therefore there is no competition. The direct objective was then to prove or disprove this hypothesis with the measure "yield per unit area of ground cover", the "total photosynthetic" area and hence the net assimilation rate.

If these studies should prove to be conclusive enough, then it may be envisaged that future research programs should be set up with the objective to study competition, based on the measurement of competition, in hay and pasture mixtures.

This could encompass a more direct study towards the understanding of the effects of water, nutrients, light and the micro-climate on plants when they compete for these factors.

LITERATURE REVIEW

I The Point Quadrat

(i) Ground Cover In past work the term 'cover' has been used to measure a) the relative importance of the species in the plant community, b) to express the area of ground, covered by one species in relation to total ground surface.

Knutti (1961) defined 'cover' as the "vertical projection of the above ground parts onto the ground". For the study he had undertaken he expressed the area covered, in relation to the total ground cover, and the relative importance of the species was expressed in terms of the relationship existing between 'cover' and the total area covered by the investigation.

According to this author, there are 3 main methods of estimating ground cover:

a) Visually (which is used currently by European ecologists).

b) The percentage area estimation, which involves the use of quadrats or grids to give estimates of ground cover.

c) The point quadrat method (abreviated as PQ from here on), from Levy and Madden (1933)

The first two of these are more or less subjective methods and are dependent to a large extent on personal factors.

The third method which will be the only one this literature review will be concerned with, is the most objective of them all. The only sources of subjectivity that could be introduced, would be incomplete knowledge of the species under consideration, meteorological, and others of such character but which are not likely to be met with frequently.

According to Brown (1954), the opinion of most of the investigators that have worked with the point quadrat method is that it "has every prospect of becoming the accepted one, for large scale survey as well as for exact analysis".

Wagner (1952) suggested that in actual practice, one of the more appropriate ways of using the PQ is to measure ground cover of a species. This is done by recording the first hit on each species on any one needle. That this could give an estimate of the area of ground covered by any one species, is readily acceptable, if it is assumed that a point represents, in this method, a quadrat which was smaller and smaller until it became infinite.

Thus up to the present time many workers have used this method.

In a study of herbaceous vegetation Heady (1957) measured and determined the value of height of plants. He suggested that height as he measured it, gave a vertical dimension to the concept of foliage cover.

Jones and Evans (1959) used the averaged species-height, multiplied by the percentage ground cover of the species obtained by PQ analysis to give a H x G value. This was then compared with the dry matter yield obtained from one or 3 one square foot quadrats in 8 comparisons. They obtained highly significant correlationsbetween observed and calculated yields but in general low r^2 values. The H x G factors for each species showed more significant differences between treatments and lower C.V. than the observed yield from that species. These workers concluded that the H x G factor was faster and more precise.

(ii) Density. This has been defined by Goodall (1952) as the number of individuals or shoots per unit area and restricted by Brown (1954) to the number of individuals of a species per unit area. Cottam, et al. (1953) used the same definition for what they termed 'area density'. Furthermore, they defined 'relative density' as a percentage of the total number of individuals present in a plant community. In the first instance the term was applied to the relationship existing, between the number of individuals present and a unit area (quadrat, 100 square metres, acre). In the second instance, density was expressed as the ratio:total number of individuals of one species/total number of individuals of all species multiplied by 100, which appears to be simply the percentage composition of a species in a sward.

Whitman and Siggeirsson (1954) indicated that the point contact method gave them an overall higher density evaluation for most species and groups than the line interception method. In the study they undertook they recorded a) all the hits on a species, b) only the hit when the pin made contact with the base of the plant. They found that the first of these gave a variation that was equal to that obtained with the line interception method, in indicating the presence of a species on a study area, whereas the basal contact method was poorer. The intensity of sampling used by these workers was 120 line transects and 3000 points for the PQ method. The density of the 'all-contact' method was calculated by "expressing the number of hits on any one species per 100 points and multiplying this by 100 minus the percentage bare ground". It may be in order here, to point out that this calculation appe ars to be no different from what Levy (1933) used to obtain what he termed "Percentage cover each species is contributing to the total area".

Cottam and Curtis (1956) did not find 'area density' as defined by Cottam et al. 1953 (see above) a satisfactory measure to study 3 forest communities. Instead they used the amount of area per plant, which according to these authors is related to a mean area (M) which is equal to $^1/$density. Density was then determined per unit area, and obtained from the distance between plants measurement which is equal to the square root of M.

Spedding and Large (1957) measured density with the PQ on the assumption that for a given species, density is directly proportional to the number of hits recorded. This allows them to express density by the mean number of hits (per 100 points) per inch since they also measured height. This same definition or use of density has been used in the present study.

Warren Wilson (1959a) in a paper in which he reports an analysis of the spatial distribution of foliage by a two dimensional PQ method, describes 'foliage denseness' (F). He defines this function as the total area of foliage per unit volume of space. By measuring this F with a PQ on a horizontal and vertical plane, he obtained projections of F_{90} and F_0 which he called 'contact frequency'. This was defined as the number of contacts with foliage per unit length of point quadrat.

(iii) <u>Number of Points</u> The work done on the number of points required in PQ sampling of vegetation was very ably reviewed by Dorothy Brown (1954). However it was found worthwhile to mention some of these studies with little more detail. Clark et al. (1942) found that the number of samples required to determine botanical composition is apparently a function of the grass cover. They did not specify, however, the number of points used in their study. Yet, their results indicated that a satisfactory sampling is obtained when the standard error is less than 5%. In most cases this would require 2000-4000 points or 200-400 stations of a 10 point PQ.

To reduce the error to 1% would require a sampling of 80000 points (approx.). Further, they go on to say that with a ground cover (basal hits only) of 5%, 3600 points are necessary and when this goes up to 18%, 2400 points are sufficient. This of course applies to open rangeland.

Crocker and Tiver 1948 studied cover on grassland in Southeastern Australia. They came to the conclusion that 300-500 point samples per unit area (paddock, field) were a satisfactory number.

Whitman and Siggeirsson (1954) found that on a mixed-grass prairie in North Dakota, 1400 all-contact or 3600 basal-contact points were required to give a sampling error of 10% or less for the major components and one of 10-20% for all the other sepcies or groups except plains grass (Calamagrostis mantanensis). Heady (1957) in measuring height of plants in a 200 acre pasture, in 3 successive samplings used a total of 1890 points. No mention was made, in what proportion these were used. Spedding and Large (1957) in an experiment on height and density in pastures, sampled 10 PQ frames (100 points) 5 times in succession on a 1 acre plot. Johnston (1957) in evaluating methods of measuring grassland vegetation, determined that 10 transects, each 50 feet long will sample vegetation in Southern Alberta with the PQ to 10% of the basal area.

Van Keuren and Ahlgren (1957a) used 20 locations to evakuate the botanical composition of a sward by different methods. Within each location a vertical and inclined PQ (45°)

was used in 4 different positions. Thus 40 points per location and 800 points per method were analyzed. The species in the various pastures studied varied in actual percentage composition from 9.0% to 13.5%. The same authors (1957b) in a study of the same nature, but on several forage mixtures and one pasture did their sampling on 13 feet 2 inches by 30 feet strips. In the mixtures they used 6 positions or 60 points and in the pasture 12 positions or 120 points.

(iv) Botanical Composition In reviewing past studies, 4 main methods to evaluate botanical composition in a sward are encountered: a) visual estimation, b) count list, c) hand separation or weight list, d) PQ method. All of these are also found as various modifications.

Within the PQ method modifications as to angles of inclinations, position of point quadrat with respect to the points of the compass, kinds of hits recorded are frequently used.

Drew (1944) compared the count list, the vertical PQ, the inclined PQ and the weight list, to obtain percentage composition. Ten half-square metre areas of a grass-lespedeza mixture were selected at random, and in each area the stems of individual plants were counted. Following this PQ readings were obtained at 90° and 45° angles at 3 different positions of the PQ. The first hits on a species at one instance and all hits at another were recorded. After these operations each half-square metre area was clipped and the material was hand separated. The results obtained by this worker indicated that the PQ method yielded more satisfactory percentages composition than the count-list method and that the evaluation of correction factors was not necessary. He also found that the inclined PQ, and recording all hits gave better estimations than the other techniques used. But that the stages of development of the species under study determined the type of analysis to be used and "that this method should be evaluated on the basis of repeated trials".

Arny (1948) did a PQ analysis study on alfalfa and grass mixtures at different stages of development. After each reading was completed the area under the PQ (10 x 19 inches) was cut and hand separated. He came to the conclusion that correction factors were necessary for this specific type of sward.

Sprague and Myers (1945) performed a similar experiment on Kentucky bluegrass and white clover. However, they used only the inclined PQ and 2 ways of sampling in view of hand separations. They concluded that samples one-fourth the size (of the large samples used) could be used for hand separations and that correcting data with a constant would provide inaccurate results.

Crocker and Tiver (1948) state that the PQ technique is especially useful in assessing botanical composition changes associated with the improvement of pastures. Leasure (1949) used a) the PQ technique, b) hand separations, c) visual estimations of standing forage by 3 different observers, to determine the botanical composition of miscellaneous grasses. He obtained a bias of ± 10% from the true botanical composition of a simple sampling area and a bias not much different from that for visual estimations.

Van Keuren and Ahlgren (1957a and 1957b) estimated visually the percentage composition of standing forage and cut forage, as well as by PQ. They found that the PQ technique gave reliable results for botanical composition of a sward, and that the visual estimation of standing forage had greater variations than the PQ method. However, in their second study, these authors concluded that both PQ and visual estimation of standing forage provide satisfactory botanical composition estimations. Furthermore, they suggested that correction factors based on yields per hit were better than the regression coefficient based on yield of forage. The regression coefficient according to these authors, did not provide good estimates of yield of forage by the inclined PQ technique.

II Leaf Area Index and Net Assimilation Rate

The subject of leaf area index and net assimilation rate was reviewed quite thoroughly by Watson (1952) under the heading: "The Physiological Basis of Variation in Yield".

Thus, according to Watson, Blackman was the first to develop a technique of growth analysis involving the change in dry weight. However, Gregory was the first to use the function $^1/L$ $^{dw}/dt$ and called it net assimilation rate (NAR). (L was the total leaf area and dw, the dry weight of a plant at any time.) From this Watson suggests that the rate of increase in dry weight per unit leaf area is obviously a measure of what the plant produces in excess by photosynthesis over the loss by respiration. Furthermore, he explains that the relative growth rate (RGR) is the product of NAR and the ratio of leaf area to total dry weight ($^L/w$). This ratio, Watson states, "may be regarded as the amount of growing material per unit dry weight of the plant". Both of these functions RGR and $^L/w$ are complex functions and difficult to interpret and Watson suggests that a form of analysis which does not involve their use is readily obtained. This was arrived at on the basis that the product of NAR and total leaf area give the absolute growth rate in dry weight ($^{dw}/dt$). Taking the integral of this, the accumulation of total dry matter during any time interval is obtained. Fisher, as mentioned by the author, showed that if W_1 and W_2 are the total dry weights at time interval t_1 and t_2 respectively, the mean value of RGR during this time interval is given by $\frac{\log_e W_2 - \log_e W_1}{t_2 - t_1}$ whatever the growth form. Then following Gregory, Watson says, "it has been usual to calculate NAR as $\frac{(W_2 - W_1)\ (\log_e L_2 - \log_e L_1)}{(t_2 - t_1)\ (L_2 - L_1)}$. However, one objection to the overall use of this formula was that only a linear relationship was assumed to exist between L and W. But as Watson points out, if the time interval chosen to measure NAR is sufficiently short, i.e.,1-2 weeks, such an assumption is justified.

Following this, the techniques to measure leaf area were reviewed some of which are: the photometer, tracing, photographing, the estimation of total leaf area from the proportion $^L/w$ of a subsample to the total leaf weight.

Watson was then concerned with, the analysis of yield with the function NAR, which he considered a measure of efficiency and LA, the capacity of the photosynthetic system. He also reviewed the limitations of the concept of NAR, pointing out that the adjective 'net' implies that NAR is not a pure measure of photosynthesis, but depends on the excess of dry matter gain by photosynthesis over the loss by respiration. Watson suggested that the ideal basis on which to express NAR would be one that gives a precise measure of the dry matter accumulation, that is, the 'internal factor' or 'growing material' of the plant. It follows then, that if NAR is expressed on such a basis, it would vary only with external factors and "would be independent of age, nutritional state and species". In this respect photosynthesis would be an appropriate criterion and could be expressed on the basis of leaf area.

Other people have expressed NAR on the basis of leaf dry weight, total protein-nitrogen in the leaf and Williams even used the cytoplasmic protein of the leaf.

The fact that the roots are not considered is another shortcoming to the use of NAR, however, these are only important in the early stages of growth. Similarly, the fact that only the leaf material of the plant is used in the analysis of NAR, may be a drawback, depending on the stages of development and species.

The last 2 parts of Watson's review was concerned with experimental results and the discussion of these, as obtained by many workers in the years prior to 1952. These experiments were categorized under 3 headings: a) Variation of NAR, b) Variation of LAI, c) Importance of these variations in determining yield.

On the variations of NAR Watson concluded that these exist between and within species, with mineral nutrition and water supply, and vary widely with seasonal climatic conditions. However, this is in opposition to Gregory who, as suggested by Watson, considers that NAR in nature is not a very variable quantity.

Furthermore, Watson (1952) reconsidered studies done on the variation of LA with time, by Watson and Boonstra, the causes of the variation with time by Russell and Watson; on intraspecific differences by Boonstra, Watson and Baptiste; the effects of climatic factors by Gregory, Blackman, Rutter, Wilson, Monelise, Milthorpe; the effects of variations due to mineral nutrient supply and water by Watson, Morton, Petrie, Ward, Arthur, Milthorpe, Wadleigh and Gauch. In summarizing the relative importance of these variations in leaf area on yield determinations, Watson suggested that later work has confirmed, in general, that dry matter yield is more dependent on LA than it is on NAR. He considered that there appears to be little opportunity for increasing yield through an increase in NAR and found that there is a need for more work on the physiology of leaf growth and the causes of variation in yield such as leaf production and leaf expansion.

Since 1952 a considerable amount of work on LA and NAR was done throughout the world, especially in Australia and New Zealand.

Thus another review on the significance of LA in pasture growth by Donald and Black (1958), is considered here. These workers considered the inter-relationship of light and LA. They stressed the importance of the significance of the leaf surface-soil surface relation of the pasture crop as formulated and called LAI by Watson. They suggested that this gives a measure which allows the close comparison of weight yields of different crops per unit area of land with respect to the leaf area per unit area of land. They also noted that such a measure appears to be very satisfactory in agriculture.

In considering the LAI values obtained by different workers on different crops, Donald and Black found that pasture crops have probably higher indices than any other field crop. Brougham obtained a leaf area index of 8.9 for a perennial ryegrass-white clover mixture. A leaf area index of subterranean clover was estimated at 8.9 by Davidson and 6.2 by Black. On the other hand, Watsom obtained LAI's between 2.4 and 5.0 for wheat, barley, potatoes, mangolds, kale and sugar beets.

On the effects of light these authors stressed that a leaf system capable of intercepting a maximum of light is of primary importance, but that at too high leaf area index values mutual shading occurs. They also pointed out that Brougham's work confirmed the hypothesis, that maximum rate of growth is dependent on a high rate of interception of light energy.

Furthermore, Davidson and Donald (1958) in a density and defoliation study with particular reference to LAI found that swards of subterranean clover established with 1, 4, 14 and 50 plants per square link, tended all to give a common LAI (about 8.0) at the end of the season.

Similarly, Black (1958) using the leaf area and the light micro-climate to study competition in subterranean clover, found that swards from different initial seed size, reach a point when the growth rate was reduced towards a common ceiling LAI value, and therefore all gave the same final yield.

Finally, Stern and Donald (1961) studied and discussed the relationship of radiation, LAI and crop-growth rate. They indicated that previous evidence showed that for every level of radiation, there appears to exist an optimum LAI with maximum crop-growth rate and that this optimum leaf area index increased with an increase in radiation. With the results they have secured, they have attempted to show such a relationship, but insufficient data did not allow them to reach a conclusion.

Methods to determine LAI A good review of the methods to measure leaf area was presented by Winter et al. (1956) at the Third Easter School of the University of Nottingham, England. Also new techniques to measure leaf growth and leaf area were proposed by Langer; Freeman and Bolas; Maggs; Aspinal, Dorer and Milthorpe; Idle. (Milthorpe 1956).

Warren Wilson (1959b) suggested the PQ to determine leaf area. This was based on the assumption that numbers of contacts per quadrat will give an estimate of the quantity of the foliage. "Theoretically it measures the area of the foliage in vertical projection, expressed as a fraction of the area of ground." Taking into consideration that errors such as needle thickness, variations in foliage angles are easily introduced, Warren Wilson determined the best angles of inclinations that would give an estimate to reasonable degrees of accuracy. His studies indicated that an angle of 29^{o} would give an error of $\pm$ 15%. An inclination of 32.5^{o} corrected by multiplying the number of contacts with the factor 1.1 would give an error of $\pm$ 10%. and the combination of angles 13 $^{\circ}$ and 52 $^{\circ}$ would give an error of $\pm$ 2% when the number of contacts at each angle were corrected with appropriate factors. He even suggested that a combination of 3 angles would give an estimate with an error of $\pm$ 1%. Another technique was proposed by Donald at the Proceedings of the 6th Easter School of the University of Nottingham. This method measures LA, using the principle of interrupting an air flow. It was claimed that this technique was ten times as fast as the pre-existing blue-print method and even more accurate since it gave more uniform observations. (Ivins 1959).

It may be appropriate to conclude this part on LAI and NAR by citing a statement made by Donald at this 6th Easter School just mentioned. He claimed that "as empirical methods had not achieved a great deal in the past, the new approach to pasture evaluation must be in terms of leaf area measurements, for light, temperature and leaf area determine productivity, and leaf area is important in relation to defoliation". (Ivins 1959.)

III Competition in Forage Crops

This part of the literature review may appear rather disjointed and resembles a pile of research papers stacked in chronological order, in some remote part of a library. Yet, the nature of the title and the exclus'vness of the study undertaken prevented any other treatment of the subject since only a few studies were directly and solely concerned with competition and only one, to this author's knowledge ever attempted to measure competition, namely Caputa (1948).

Other workers have studied the nature of competition, the factors governing it, or have only stated that it was occurring and may have evaluated it indirectly. However, it must be noted that in recent years, many great contribtitions were made by scientists of England, New Zealand, Australia, Japan, and others.

This review of literature will then briefly take into consideration, in a chronological order, research work relating directly or indirectly to the study, in whatever form conceivable, of competition in forage crops.

Probably the most extensive study of competition in the plant community ever undertaken was done by Clements et al. (1929). According to Donald (1956) this was "the first substantial contribution to our understanding of competition in pastures". The concepts established by these authors may be used as satisfactory criteria and are still valid. The only change that has been made to Clements' concepts according to Donald (1956) was that "certain plants are able to gain a competitive advantage by the excretion from their roots or leaves of substances which supress neighbouring plant growth. How important this new concept is in competition occurring in pasture plants has yet to be determined. There does not appear to be any substantial proof towards that direction.

Chippindale (1931) in a study not directly concerned with competition, found that upon seeding, _Festuca pratensis_ and _Phleum pratense_ into a _Lolium italicum_ sward, that these two grasses were set back to a rather unusual degree, in their growth. Whem they were transferred to a more favorable environment they were capable of a better development. This capacity of recovery was thought to be a major attribute of these grasses in competing under "feral" conditions. This led to another study by Chippindale (1932), when the effects of the _Lolium spp._ upon the growth of grasses during and following germination were examined. The author evaluated these effects mainly on the basis of seedling counts. Effects of various other factors of competition acting on germination than those due to _Lolium spp._ were discussed.

Varma (1938) in a series of experiments attempted to study the nature of competition between plants in the early phases of development. In one experiment the death rate was used to evaluate competition. It was found that "the intensity of competition is usually greater in mixed cultures than in cultures of individuals of a single species". Yet the author brings forth evidence that competition as severe may be found between individuals of the same species. The depressing effect of one species upon another was also studied and found to be in fact due to toxic soluble substances. However, none of these so-called toxic substances were isolated.

Donald (1946) tested the validity of some of the conclusions reached by American workers, on harmful root interactions which were the cause of additional competition effects. He obtained evidence that the hypothesis of toxic excretions by roots may be disregarded when compounding seed mixtures. Keller (1946) proposed a method for forage crops plant breeders, which would by means of systematic arrangement of species simulate competition "as it is found in the field". Rummell (1946) carried out an experiment in which he attempted to determine competition effects of Bromus tectorum on Agropyron cristatum and Ag. smithii. For this he collected data on the number of seedlings, DM of tops and roots, average height of tops to leaf tips, average lenght of the root system, number of tillers, of rhizomes, and lenght of the rhizomes as well as the number of shoots from the rhizome of bluestem (Ag. smithii). He found that cheatgrass (B. tectorum) affected all of these factors measured from bluestem and crested wheat-grass. However, no evaluation of the degree of competition was obtained.

Caputa (1948) as mentioned previously was the only one, to my knowledge, who reported on measurements of a "competition force" of foliage species. However, as stated by the author no absolute estimations were obtained but merely measures that should be relative to one another. He studied 9 grasses and 4 legumes, almost in all the combinations of two, and in pure stands and obtained seven degrees "competition" on the basis of green weight yields collected during 2 years. A "competition force" was then calculated for each species in each mixture.

Competition indices were given to each species according to a "productivity factor" which was also obtained on a weight basis but of the pure stands, however. This was done by equating all the species in pure stands with the yield of red clover in pure stands. Thus red clover in pure stand obtained a "productivity factor" of 1.0.

Thus to obtain the "competitive force" the author calculated all possible ratios of every species when it was associated with another, on a 2 year average basis. These ratios were then grouped into seven classes of ascending order from -3 to +3; -3 meaning "completely suppressed to invaded" and +3 meaning "completely suppressing to invading". On this basis then every species was grouped with its associated species, and a "competition force" value was assigned to these. Thus for example Lolium italicum headed one group; its green weight in proportion to the 12 species it was associated with, gave 12 ratios, and according to the class these ratios fitted, the species were given the corresponding "competition force" value".

With the competition index, obtained as mentioned above, Caputa calculated a "competition force" of any species X with respect to a species Y. This was done simply by substracting from the competition index of species X, that of species Y. This then may have been an "expected competition force" although this was not stated. Upon comparing this "expected" with the actual values obtained, the author found that they did not always agree, but concluded that this was of little significance.

It should be noted that despite the complexity of this experiment and even though 9 replications were used (these appear nonorthogonal) no statistical analysis whatsoever was performed on the results.

Donald (1951) studied the influence of plant density, of the stage of growth, and of the nutrient supply on intra-specific competition of 3 pasture species. Competition according to the author became operative in dense swards shortly after seeding. Final yield was constant from moderate to high yields, but there was no reduction in the yields of dense swards.

McCloud and Mott (1953) used pure stands of grasses and of legumes, and each species of the pure stands was associated with each other species. They evaluated the interactions of species on a DM yield basis, as a percentage of the yield of the species in pure stands. Among other results, the authors report that "Ladino clover was benefitted by association with all species except bromegrass, and the extremely large benefit from association with birdsfoot trefoil is noteworthy" !

Knapp and Linskens (1952) studied, in Germany, the effects upon one another of grasses and clovers in rye-grass/white clover swards which they called "Lolieto-Cynosuretum typicum". Kubler (1954) made a contribution to the understanding of competition among meadow species. Willougby (1954) studied some of the factors which are operative within a grass-clover relationship. Shallow cultivation, removal of clover from mixed swards, nitrogen and phosphorus during two seasons of the year and continuous phosphorus over the years were investigated. The only data collected was yield of dry matter and the interrelationships of the results were discussed on that basis. Yawalkar and Schmid (1954) evaluated the performance of birdsfoot trefoil alone and in competition with other species in pastures. They collected data on hand separations, visual estimations, and yield. Highest yields were obtained from mixtures with alfalfa and the contribution made by B.T. was found to be small. Tuska and others (1955) conducted an experiment on the Merion bluegrass in the greenhouse. They studied the effects of competition on this grass when seeded in mixtures, as well as heights of cutting and levels of nitrogen. The data collected were,the dry matter of the tops and the roots.

In Spain, Alfonso and Gonzales (1956 and 1958) conducted a series of competition studies with tall oatgrass and lucerne. In their first study the raw protein content of oatgrass was lower when it was sown alone. However, lucerne appeared to yield less raw protein when in mixture than when alone. In the second study the total green weight yields of the mixtures were significantly higher than those of the pure stands.

Blaser et al. (1956a and 1956b) strove to obtain basic information on seeding behaviour of perennial grasses and legumes on the basis of the compatibility of the species involved and their respective botanical composition. In the first study they classified species or varieties into: non-agressive, agressive and very agressive. In the second study they considered alfalfa when grown alone and in mixture with red clover and orchard-grass. They made stand counts, and obtained weights on the above-ground portions of the seedlings. Hay yield and root weights were also reported.

Wilson and Peake (1956) compared total production and seasonal growth trends of 3 grass species grown singly and in mixtures with white clover. Botanical analysis and N determinations were made (crude protein). On this basis they evaluated the effects of competition of one species upon another. According to these workers the growth of each species in a mixture depended on the importance of the factor for which it was unable to compete. They claim that the attitude taken by many workers, namely, that the more diverse the characteristic of the component species, the better they will grow in association with each other is not justified on the basis of their findings. They concluded that "the influence of one species on another was such that none could fully express its individual characteristic."

Donald (1956) in an address given to the 7th International Grassland Congress at Palmerston North, New Zealand, reviewed the work done on competition among pasture plants. He discussed the importance of the work done on the light penetration in pasture swards by Black, Brougham, Davidson and himself, the studies of the supply of nutrients by Anderson, Willougby and others, his own work on the interaction of competition for several factors (published since), plant density and "the effect of the grazing animal and plant competition". He suggested that if nutrients are found in sufficient quantity, so as not to be limiting, and if the same applies for the water supply, then the rate of growth of a sward (of particular genetic composition) will depend on light and temperature only. He went on to say that "if growth is dependent on radiation and temperature and since temperature is not limiting in quantity", light becomes the sole factor for which there is competition among plants. However, it could be assumed with reasonable assurance that a micro-climate in pure stands is not similar to that of another species in pure stand. And since such an environment can be thought of, as being inherent to that species, therefore the species may have developed a requirement for a certain micro-climate that is optimum for its maximum growth. It is then questionable that an optimum temperature for this species, is also available in a mixture; probably to the contrary, it may be a limiting factor.

Further, Donald thinks it is possible that certain species such as the grasses may have an advantage in the use of the incident light since their foliage is displayed at random angles but not so for the clovers which have a horizontal canopy. This appeared to be in opposition to what other people have surmised. On density this worker related the difference in optimum density of annuals versus perennials. He pointed out that the annuals give higher yields and early production, when sown at high rates, whereas the perennials are too often sown at rates that are well above the optimum.

Further, Donald (1956) finds that there is little known on the relationship, grazing animal/pasture, and that more work should be done on the multiple effects of grazing on the factors of competition.

Johnson (1956) studied competition between legume and grass varieties in perennial forage mixtures. Scholl and Staniforth (1957) showed that birdsfoot trefoil was a poor competitor and that upon applying herbicides or by removing the weeds by hand both the yields per plant and the dry matter yield per unit area of birdsfoot increased manifold. Baylor (1958) considered the manner in which several factors of competition affected the establishment and early development of birdsfoot trefoil. They found that the presence of lucerne or timothy had no effect on trefoil in the year of seeding. Competition from lucerne on trefoil was said to have started in the spring of the first year of crop. This worker also found that the top weight and root diameter were good indicators of root development.

Black (1958) investigated the problem of seed size and its relationship with competition in subterreanean clover. He corroborated the evidence brought forth by Davidson and Donald, (1952), that small seeded plants disappeared from a sward before the large seeded ones.

Chamblee (1958), in an experiment to determine the relationships existing between the above and below ground parts of an alfalfa-orchard-grass mixture, found that both species gave higher yield in mixed stands, whether they were partitioned with a metal sheet to a depth of 30 inches in the ground or not. Alfalfa rows gave higher yields when grown between orchard-grass rows, than when grown between other rows of alfalfa.

Donald (1958) set up an experiment using _Lolium perenne_ and _Phalaris tuberosa_ in such a manner that he obtained treatments where no competition, competition for light and competition for both light and nutrients occurred. The nutrient in this experiment was in the form of N. Competition was estimated on the basis of yield of dry matter of the species, per cent nitrogen in the tops and tiller counts at the final harvest. The results obtained by this worker indicated that rye-grass suffered only slightly from competition for either light or nutrients alone, but when the competition was operating for both of these it did not yield significantly different from the pure stand. _Phalaris_ was supressed when competing for either light or nutrients, and when both factors were operative it suffered to such a degree, exceeding the separate effects of both factors. For _Lolium_ the interaction was said to have been negative and for _Phalaris_ positive. This experiment appeared to have been ideally conducted and well planned.

Yet it is to be deplored that the author did not try to measure competition per se. This would have given real value to the findings obtained, more so than qualitative conclusions.

Krilcher and Heinrichs (1958) studied competition occurring in swards of 3 grasses grown alone and in mixture with alfalfa. The grasses used were Agropyron spp. seeded pure in alternate rows with alfalfa, as mixed rows with alfalfa, and in rows only of pure stands. Dry matter yields and hand separation data were collected. At the end of the experiment ground cover was determined for each plot. The authors reported that the 3 groups displayed "changing degrees of response" when seeded in different ways with alfalfa. They also suggested "that grasses should be tested under conditions in which they are most likely to be used". Yet, these workers implied that crested wheat-grass was the most competitive of the grasses, on the basis that its ground cover in mixture with alfalfa was nearly as great as when seeded alone.

Krenzin (1958), Leith and Ellenberg (1958) in Germany, Mouat and Walker (1959) and Tawaii (1959) all investigated the relationship existing between species or within species when sown alone and in mixtures, with or without superimposed treatments.

Gardner (1960) at the 8th International Grassland Congress at Reading, England introduced a method by which he evaluated intercultivar competition in grass species, with relative ease. This technique allowed him to identify positively grasses of similar appearance when growing in an artificial sward in which competition was present. A preconstructed wire mesh allowed the reconstitution of a sward with each grass in a predetermined square of the wire mesh. This latter was placed permanently at ground level. In this manner every plant, in every square could be cut individually and the dry matter per plant recorded. It is obvious that such a technique is of great interest and could be used with even more ease in evaluating competition in swards of various complexity.

Norman (1960) in a series of experiments studied the relationship between competition and defoliation in a permanent pasture. Under different grazing treatments, units (6" diameter) of "no competition" were compared with units of "competition". Further research, according to the author, was done "due to unusual results from competition tests in swards under periodic defoliation" (he referred to his first experiment), "two special effects upon species due to presence of surrounding herbage were investigated." One of these experiments consisted in replacing grazing by cutting treatments, of the "competition" and "no competition units",the other consisted of allowing a "competition period" and a "recovery period" according to species in the two type of units described above. A fourth experiment was set up with two "no competition" and one "competition" treatments. Norman, then superimposed treatments, consisting of cutting all the plants of one series of "no competition"units at the same height and the other, of removing the same proportion of above-ground parts as in the "competition" units. A fifth experiment consisted of cutting test species at 1 inch and 3 inch, in the "no competition" units competing with surrounding herbage cut at 1 inch only and at 3 inches. This would then simulate the effects of selective grazing. The author concluded that factors of competition and defoliation which exerted "maximum influence" upon a species sensitive to all the factors investigated would be (i) normal interactions of competition and defoliation, (ii) the effects of shading causing an erect habit, (iii) the effects of shading causing an increased top:root ratio (no mention was made of this measurement, (iv) the effects of preferential grazing.

Yamada and Horinchi (1960) at the 8th International Grassland Congress of Reading, England, summarized a series of experiments performed by the authors, in past years. They were concerned in studying intraspecific competition in barley, soybean, red clover and wheat and between white clover and orchard-grass. They measured such quantitative characters as height of plant or culm, number of tillers, shoot weight, number of stolons, number of leaves, petiole length, length of stolon and internodes, length of longest stolon. They found that the number of tillers and shoot weight was affected by competition, whereas the height of plants and leaf length were not. In general, the authors suggested that characters of a "quantitative nature" were affected by competition, while characters associated with elongation of tissue remained unaffected. Furthermore, they stated that "the main characters which govern the competitive ability of plants, such as plant height or root length are associated with tissue elongation and are therefore unaffected by competition" and also that such external quantitative characters as those concerned with water, nutrient and light are measures of competitive ability. Should this last statement be reasonably accurate, then it is conceivable that data which are in direct relation with water, light and nutrients should be collected to measure competition.

De Witt and others (1960), also at the International Congress, proposed a theory on competition between plants within mixed crops and swards. As part of this theory they distinguished between five models of competition, based on the concepts which assume that plants within a community are crowding for space. However, the fifth model included detrimental effects of one species on another due to toxic substances. Even though De Witt et al. consider mainly the concept of crowding for space to be operative when competition occurs, they fully recognize, as they state for model (iv) that competition may occur "if some requisite obtained from the soil limits growth and one species can explore the soil to a greater depth than the other". Thus accepting in this instance, that space is not limiting.

Donald (1956) stated quite clearly the role of space in competition work, and deplored the fact that this term is loosely referred to in the literature (this author can only agree e.g. McCloud and Mott (1953) stated that "forage yield of each component of the mixture for the first season seemed to be largely governed by space competition" p. 62, and many others). Donald went on to say that so far there appears to be no evidence that this is a factor of competition as it occurs in pasture swards. No new evidence of this, that seems to be conclusive has been advanced to this date.

MATERIALS AND METHODS

I. EXPERIMENT I

Pasture Mixtures Trial 1960

A. Materials

The research concerned with the data collected for this experiment was carried out during the summer of 1960. This research was purely of an exploratory nature and for this reason was conducted on an early established pasture mixture trial, which was seeded in the spring of 1958.

The soil of the experimental area was of 2 types, differing mainly by the amount of clay present in their composition. They were Chateauguay clay loam and shallow clay loam and St. Bernard loam. Oats had been seeded as a companion crop at the rate of one and a half bushels per acre, and was clipped regularly during the summer of the seeding year.

An application of 0-16-8 fertilizer was done at seeding time at the rate of 300 lb. to the acre and another in the spring of 1959.

The experiment was laid down as complete randomized blocks in 4 replications. The treatments were 17 mixtures of grasses and legumes, in various combinations and complexity (see fig. 1). The species seeded were as follows:

Climax timothy	Avon orchard grass
Certified Lasalle red clover	Reed canary grass
California Certified Ladino clover	Alsike clover
Empire birdsfoot trefoil	Kentucky 31 Tall fescue
Vernal alfalfa	Lincoln bromegrass

Together with this pasture mixture trial, pure stand cuts were obtained from a timothy (heights of cutting) trial, and from filler plots of each a brome grass variety trial and alfalfa variety trial.

The size of each plot was 51 x 8 links, of which a strip of 40 x 5 links was harvested or approximately 8 square metres. The harvesting was done with a self-propelled "Gravely" clipper, having a 5-link cutting-bar and pan attachment, at a height of approximately 1½ inches.

A point quadrat apparatus with a frame containing ten finely pointed needles or pins was used at an inclination of approximately 45°, to collect data on ground cover.

B. Methods

a) Cutting

The pasture mixture was cut 5 times in 1960 at approximately monthly intervals. However, the 4th cut of timothy had to be discarded due to droughty conditions and consequently gave insignificant yield. Cut 2 and 3 of alfalfa and brome were not available due to an error in procedure.

b) Point Quadrat Analysis

Before every cut (2-3 weeks) a point quadrat analysis

PASTURE MIXTURE TRIAL EXPERIMENT I

Seeded May 6th, 1958

Mixtures (Rates of seeding in lb./acre)	Blocks A	B	C	D
Timothy (8), Red Clover (6)	1	11	2	9
Timothy (8), Red Clover (4), Alsike (3)	2	15	1	8
Timothy (8), Red Clover (4), Ladino (2)	3	12	7	5
Timothy (8), Red Clover (4), Alfalfa (6)	4	5	4	17
Timothy (8), Red Clover (4), Birdsfoot(5)	5	7	14	10
Timothy (8), Red Clover (4), Alfalfa (3) Ladino (1)	6	8	11	15
Timothy (8), Alfalfa (8)	7	3	15	16
Timothy (8), Alfalfa (6), Birdsfoot (5)	8	14	16	2
Timothy (8), Alfalfa (6), Alsike (3)	9	2	8	6
Timothy (8), Alfalfa (6), Ladino (2)	10	9	3	11
Timothy (8), Ladino (2)	11	17	10	3
Timothy (8), Birdsfoot Trefoil (6)	12	4	17	7
Bromegrass (12), Birdsfoot Trefoil (6)	13	6	9	4
Reed Canary (8), Birdsfoot (6)	14	1	6	13
Orchard Grass (6), Ladino (6)	15	16	5	14
Fescue (8), Birdsfoot (6)	16	10	13	1
Bromegrass (12), Alfalfa (8)	17	13	12	12

Fig. 1. Plan showing location of mixtures in blocks

was performed on each plot of the mixtures and pure stands, except for cut 1, for which no such data was made available. The point quadrat readings were taken at the rate of 4 stations or 40 needles per plot for cut 2 and subsequently 5 stations per plot. For cut 5 the analysis was done on blocks A and C only of the pasture mixtures, but after cut 5, an additional analysis was obtained on all plots of all blocks to give results 5'(see calculations).

c) Harvesting and Hand Separations

After each cutting of a plot, throughout the season, 2 samples were collected for dry matter evaluation and hand separations. Of cut 4 only blocks A and C were hand separated, and cut 2 of the pure stands was not hand separated either.

The samples for dry matter evaluation were collected in drying trays and brought in to be weighed and dried. The samples for hand separation, obtained by picking 2-3 handfuls of material just cut, were collected into small cotton bags. They were then stored in a refrigerated room in which the temperature was kept approximately at 35°F. When time permitted these samples were separated into their respective components and "others". These components were then oven-dried to a constant moisture and weighed to the nearest gram .

The weighing of the plot material, at cutting, was done on a 50 kg. dairy spring type scale, to the nearest.50 gm. The samples and hand separated material were weighed on a "Mettler" electric scale in grammes.

d) Calculations

Dry matter was obtained in the usual manner, i.e., from computation of the green and dry weights. Percentage composition of the mixtures and pure stands was determined from the dry weights of the separated material.

This percentage composition was then used in the determinations of the contribution of each species to the total yield. From the point quadrat analysis, the ground cover was calculated, as well as the yield per unit area of ground cover. (For more details see experiment II.) Also from the point quadrat analysis, when the percentage composition was not available, it was calculated directly from the hits recorded for the species and others.

With the percentage composition values of cut 5 and the ground cover calculated from the point quadrat analysis obtained after cutting, a yield per unit area of ground cover for a cut named 5' was calculated. (The cut 5' was so named, because the same dry matter yields were used as in cut 5.)

EXPERIMENT II

A. Materials

a) Pasture Mixtures and Pure Stands

Experiment II was conducted in 1961, it was the main project for this thesis. It was carried out on 2 forage mixture trials, i.e., a hay and a pasture mixture trial, established for mixture studies by the Agronomy department of Macdonald College, on their experimental land.

1. Design

The pasture mixture trial was set up in randomized blocks of 4 replications and of plot size 51 x 10 links. The harvested area was 40 x 5 links or approximately 8 square metres.

In addition to the mixture trial, pure stands of each of the sepcies, except alsike, were established in randomized blocks of 2 replications only, but of same plot size and seeding rates. These and 3 complementary mixtures to the mixture trial were established next to the latter in the same field. (See field plan fig. 2.) Limitations of the space available did not permit the replication of reed canary grass and Kentucky blue grass, neither did it permit the establishment of a pure alsike stand. The two grasses mentioned were seeded as fillers on the West side of the experimental area; no fillers were seeded on the East side.

Random tables were used to randomize the mixtures and pure stands of blocks B, C, D and F. (See fig. 3 and 4.)

2. Soil Characteristics

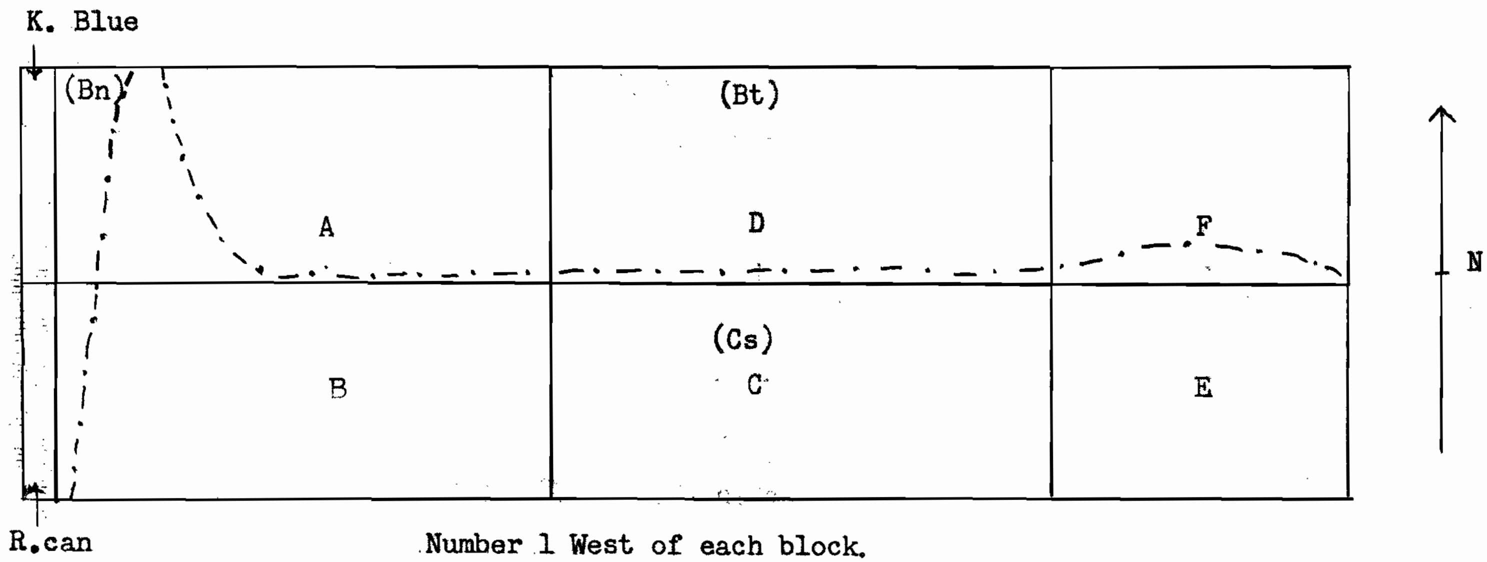
Three soil types were represented in the experimental area. A small patch of St. Bernard sandy loam was found on the West side of the area; Chicot light sandy loam made up all of the blocks A, C and E, as well as a small area of block B, and St. Benoit light sandy loam made up the remainder of the area, namely blocks B, D and F. (See fig. 2.)

Two soils differed very little from each other they are of the Chicot and St. Benoit types. Both of these have developed from sandy alluvial material. Their differences in the drainage was not apparent. Rather, blocks C and D were more droughty than A and B. St. Bernard was developed directly from the calcareous till underlying the whole area.

3. Seeding and Management

Oats was used as nurse crop and was seeded at the rate of 1½ bushels to the acre over the whole experimental area before the treatments were put in. These were seeded on the 2nd and 3rd day of May under windy conditions, at the rates outlined on fig. 3 and 4. The treatments were 15 different mixtures of various complexity for the mixture trial plus 3 complementary mixtures in blocks E and F. Four grass species and six legume species were used. The names of the varieties are outlined in fig. 4.

A mixed fertilizer 2-12-10 was applied at the time of seeding at the rate of 300 lb./A. over the whole area. In the spring of 1961 a top-dressing 0-20-20 at the rate of 300 lb./A. was applied to all plots. This was supplemented with 40 lb./A. of N, of the form of 33.3% ammonium nitrate, in all pure stands of the species.



Number 1 West of each block.
Plot size : 10x51 links (not to scale)

Soil types:

(Bn) - St. Bernard ~~sandy~~ loam
(Bt) - St. Benoit light sandy loam
(Cs) - Chicot sandy loam

Fig. 2. Field Layout. Pasture Mixture Trial

PASTURE MIXTURE TRIAL EXPERIMENT II

Seeded May 3, 1960

Mixtures (Rates of seeding in lb./acre)	Blocks A	B	C	D
Timothy (8), Red Clover (5)	1	10	10	1
Timothy (8), Red Clover (5), Alfalfa (5)	2	12	1	13
Timothy (8), Red Clover (5), Alsike (5)	3	3	14	7
Timothy (8), Red Clover (5), Ladino (1)	4	1	13	4
Timothy (8), Red Clover (5), Alfalfa (5), Ladino (1)	5	8	5	10
Timothy (8), Red Clover (5), Birdsfoot Trefoil (5)	6	15	9	11
Timothy (8), Alfalfa (5)	7	6	8	5
Timothy (8), Alfalfa (5), Ladino (1)	8	4	4	6
Timothy (8), Alfalfa (5), Birdsfoot Trefoil (5)	9	13	12	12
Timothy (8), Alsike (5)	10	11	2	15
Timothy (8), Birdsfoot Trefoil (5)	11	9	15	9
Timothy (8), Ladino (1)	12	2	6	3
Bromegrass (15), Birdsfoot Trefoil (5)	13	5	11	14
Reed Canary grass (15), Birdsfoot Trefoil (5)	14	14	3	8
Kentucky bluegrass (8), Birdsfoot Trefoil (5)	15	7	7	2

Fig. 3. Plan showing location of mixtures in blocks
(Plot size 51 x 10 links)

PASTURE MIXTURE TRIAL (Cont.)

Treatments (Rates of seeding in lb./acre)	Blocks E Plot No.	Blocks F Plot No.
Timothy (8)	1	5
Red Clover (5)	2	9
Alfalfa (5)	3	7
Bromegrass (15)	4	4
Ladino (1)	5	3
Birdsfoot Trefoil (5)	6	6
Timothy (8), Birdsfoot Trefoil (5), Ladino (1)	7	8
Timothy (8), Bromegrass (15), Birdsfoot Trefoil (5), Ladino (1)	8	1
Timothy (8), Bromegrass (15), Alfalfa (5)	9	2

Filler on West end of Block A	Reed Canary grass (15)
Filler on West end of Block B	Kentucky Bluegrass (8)
Timothy	Climax timothy
Red Clover	Registered Lasalle red clover
Alfalfa	Vernal
Bromegrass	Lincoln bromegrass
Ladino Clover	Pilgrim Ladino clover
Birdsfoot Trefoil	Empire Birdsfoot Trefoil
Reed Canary grass	Common
Kentucky Bluegrass	Common
Alsike Clover	Common

Fig. 4. Plan showing location of pure stands and mixtures in blocks

In 1960, the oats and weeds were controlled by clipping the whole area regularly. The weed problem became serious in the form of voluntary Ladino clover, which infested blocks A and B quite heavily, as well as parts of C and D. The latter two blocks were weeded by hand in the spring of 1961, as much as was safely feasible. Also blocks E and F were cleaned of all their weeds. After the 3rd cut in August, lamb's quarters (Chenopodium album) was a problem in some of the pure stands, especially so in the grasses. This was remedied by pulling a "Weed-bar" over the plots. The rate of application amounted to approximately 4 ounces per acre of liquid 2,4-D-ester.

The harvesting was done with a "Gravely" tractor as described previously and the weighing was done with the same scales as mentioned before. The green material was dried by forced air ovens which bring the moisture down to a constant level in 4-6 hours depending on the compactness of the material.

b) Hay Mixtures and Pure Stands

1. Establishment

The experiment was set up in the same manner as the pasture mixture trial. The mixtures were laid down as randomized blocks in replications of 4 and the pure stands in replications of 2 only and plot size 51 x 8 links. A timothy, red clover mixture was added in these two blocks, to complement the mixture trial. The timothy pure stands were obtained of 2 Climax timothy filler plots, on the East of blocks E and F. (See Fig.5.)

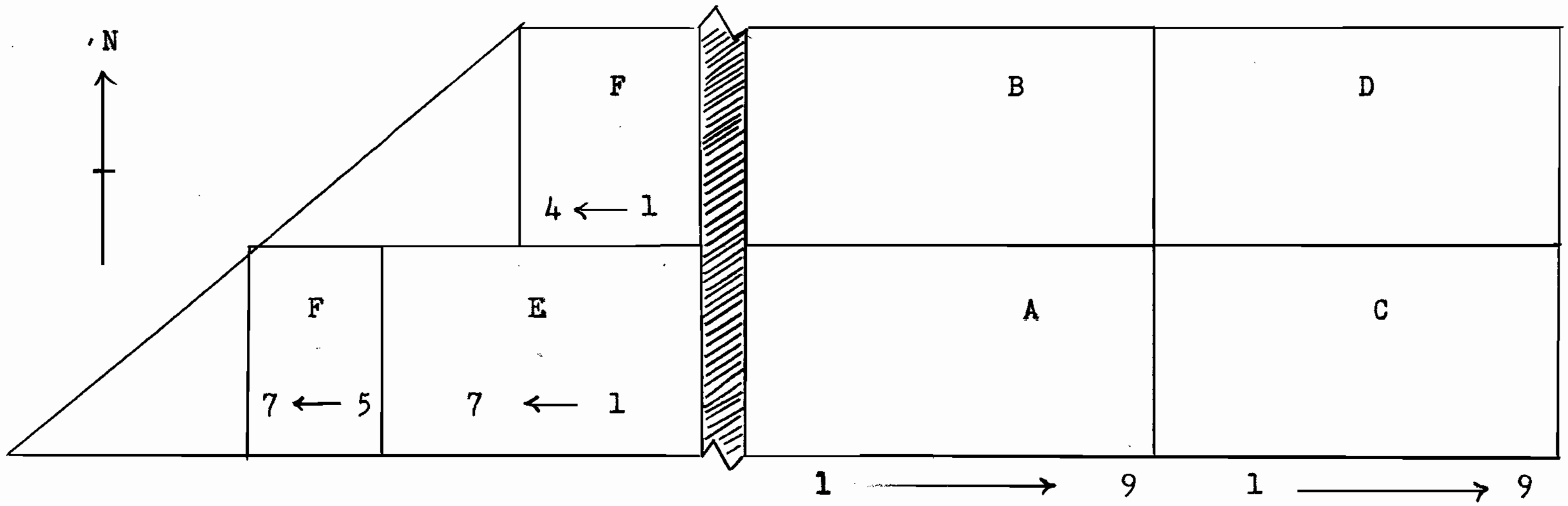
The species that went into the mixtures were mostly hay species as can be seen in fig. 6. The rate of seeding was common for the mixtures and pure stands or nearly so. (See fig.6).

The soil type of the pure stands was St. Zotique silt loam accumulated by erosion or by other means. This soil is very poorly-drained and belongs to the ground water podzol great soil group. The mixtures were on Chateauguay shallow clay loam, a soil type already described under the pasture mixtures.

2. Seeding and Management

Both the pure stands and the mixtures were seeded May 5th, 1960 on a calm, sunny day. As for the pasture mixtures, oats were used as a nurse crop and seeded at a rate of 1½ bushels per acre. At seeding time a mixed fertilizer of formula, 0-20-20, was applied at the rate of 200 lb./A. The following spring the whole area was given a top-dressing of 8-16-16 at the rate of 300 lb./A.

During the seeding year, the weeds and the companion crop were cut regularly at 6-8" in height. During 1961 no specific weed control was carried out. Dandelions (Taraxacum officinale) and black medic (Medicago lupulina) were removed, as much as possible, by hand, in the early spring. Also in the fall of 1960 the whole experimental area was cut to 1½ inches so as to remove the stubble left by the companion crop. No data was gathered from the cut.



Timothy variety trial between blocks A-B and E-F

Plot size : 8 x 51 links
(not to scale)

Soil types -

Blocks E and F : St. Zotique silt loam accumulated by erosion
" A,B,C,D, : Chateauguay shallow clay loam

Fig. 5. Field Layout. Hay Mixture Trial

HAY MIXTURE TRIAL

Seeded May 5th, 1960

Mixtures (Rates of seeding in lb./acre)	Blocks A	B	C	D
A Tim. 8, Red Cl. 3, Alf. 5	1	9	8	4
Al Tim. 8, Red Cl. 3, Alf. 5, Lad. 1	2	6	6	2
B Tim. 8, Red Cl. 5, Alsike 3	3	8	5	9
C Tim. 10, Red Cl. 5, Lad. 1	4	5	4	7
Ev Tim. 8, Red Cl. 4, Viking Bft. 5	5	7	9	1
Ee Tim. 8, Red Cl. 4, Empire Bft. 5	6	1	7	8
Em Tim. 8, Red Cl. 4, Morshank Bft. 5	7	3	1	6
G Brome 15, Alf. 8	8	2	3	5
Jv Tim. 8, Viking Bft. 5	9	4	2	3

	Blocks E	F
Timothy 8, Red Clover 5	1	1
Red Clover 5	2	4
Alsike 3	3	3
Alfalfa 8	4	2
Ladino 1	5	5
Birdsfoot Trefoil 5 (Viking)	6	7
Bromegrass 15	7	6
Timothy 8	8	8

Fig. 6. Plan showing location of mixtures and pure stands in blocks

B. Methods

a) Pasture Mixtures and Pure Stands

1. Harvesting

In the fall of 1960, after the rest period of September and October, a late cut was obtained, for both the removal of the stubble of the companion crop and for data purposes. All the harvesting was done at approximately one and one half inches.

In 1961 the plots were cut at intervals of 4-5 weeks, thus giving 5 cuts for the whole season. Samples for dry matter evaluations and for hand separations were collected at each cutting in the manner already described.

2. Point Quadrat Analysis

Point quadrat readings were obtained for cuts 1, 2, 3 and 5 of 1961 previous to cutting. For the fall cut of 1960, the analysis had to be performed after the cut was taken, and therefore with practically no re-growth. The readings for cut 4 were taken at the time of cutting, as well as some extra-ordinary readings on cut 3.

The time of recording had been determined by the stage of growth of the material. The stage of growth chosen, was that stage when the material had recovered reasonably well, but so that it was not too high for the point quadrat apparatus used. This required that the plants had to be no higher than the lower transverse bar of the frame holding the pins of the instrument. However, for May, June and July unfavorable meteorological conditions, rain and wind, did not permit a rigid comformation to such a schedule.

The point quadrat analysis of 1960, was performed at an angle arbitrarily set at 45° . Otherwise, for the part concerned with the determinations of yield per unit area of ground cover, i.e., cuts 1, 2 and 3 the angle was chosen according to Warren Wilson (1959). This work, which was done for the purpose of obtaining more reliable results in determining leaf area index by point quadrat, was assumed to be equally applicable for ground cover measurements. In it, Wilson found that an angle of 29° inclination with a plane gave an error of ± 15%. An angle of 32.5° with which a factor of 1.1 was used was found to give an accuracy to ± 10%. Nevertheless, the 29° angle was chosen, since no corrections were necessary and it was considered to be sufficiently accurate. The angle of 32.5° was, however, used without correction factor, for some special point quadrat analysis at the cutting of the 3rd harvest.

The first point quadrat analysis on the pasture mixtures and pure stands was done after the fall cut of 1960, as stated previously. An angle of inclination of 45° was used and the number of points amounted to 50 or 5 stations per plot. Only the first hit on a species was recorded, the first hit on "others" and bare ground. There was no re-growth whatsoever.

Readings of all plots of blocks E and F, as well as of the reed canary and Kentucky bluegrass pure stands, were obtained previous to the first cut of 1961. However, only blocks C and D of the mixture trial were analyzed. The inclination of the quadrat frame was at a set angle of 29°.

While for block C only the first hit of a species and "others" was recorded in this first analysis, for blocks D, and F all the other hits on every species seeded in the respective mixtures were recorded. "Others" were considered as one species.

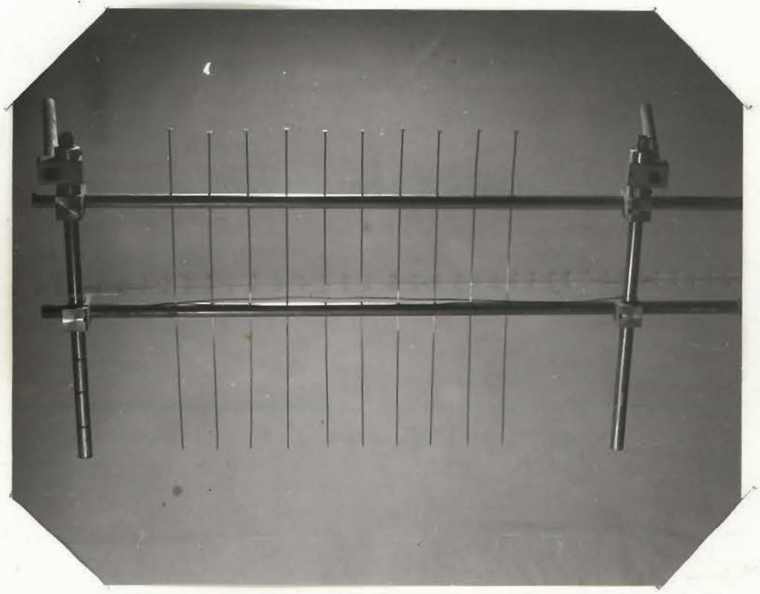
The second point quadrat analysis was performed 15 days after the first cut or 20 days previous to the second cut. The first hit on the seeded species and "others" was recorded on blocks A, B and C, and all the hits on every species and "others" on blocks D, E and F. The same inclination of angle was used.

The third analysis was obtained after 13 days of re-growth or 16 days before cutting. Every hit on every seeded species and "others" was recorded on all plots of blocks C, D, E and F and on the plots in A and B that were not too dense with volunteer Ladino clover. The angles of inclination used were 29°, for blocks C. D. E. F and 45° for blocks A and B, as well as for a second analysis of blocks E and F. The reason for the use of a different angle on blocks A and B was that the material was too high for the 29° angle of inclination.

For the analysis, as well as for the hand separations of cut 3, 4 and 5 of mixtures(ix) of blocks E and F, bromegrass and timothy were not distinguished from each other. A third set of point quadrat readings was obtained for this cut 3, and that just before cutting. The pure stands of block F, mixtures 1 of block C, 6 of B, and 1, 6, 13 of D were analyzed. The recording was done with an improved point quadrat (see fig. 7) at am angle of 32.5° and with 30 points or 3 stations per plot. The point quadrat frame was improved by increasing its overall height, which made it more readily usable in material of 1.5-2.0 feet tall. This additional height was obtained by fitting the frame with longer legs and needles. The improvement also consisted in calibrating it with angles of 52°, 45°, 32.5° and 29°.

The plots were then cut, but after cutting, to complement the readings already obtained, as just mentioned, 10 stations of 1 needle were recorded on the remaining borders of the plots. (5 on each border.) The plots analyzed were 1 to 8 of block E, 7 and 8 of block F and 1, 4, 6, 8, 9, 11, 12, 13 of blocks C and D. The mixtures chosen were those that were considered to be more of the pasture type. Mixture 10 was not analyzed since there was no pure stands available and mixtures 14 and 15 were left out because their respective grass pure stands had been cut and discarded by error.

A new line of work was introduced slightly before the 4th cut. This new approach was in conjunction with the work of measuring leaf area index and net assimilation rate as will be described later. It was found necessary to bring in this work at this moment to clarify the manner in which point quadrat



Original apparatus. Note 2" markers on rod

Improved apparatus. Note 2" markers on rod

Fig. 7 Point Quadrat Apparatus

analysis was obtained in cuts 4 and 5.

A sub-plot of one square metre was located at the end of the plot adjacent to the inner pathway. This was done for the following mixtures: 1, 4, 6, 8, 9, 11, 12, 13, 14, 15 of blocks C and D and of all pure stands and mixtures of blocks E and F.

Measurement was done with a square metre quadrat, made of stiff welding rods and strengthened by two rods across the centre. The location of the sub-plots was made permanent by driving in two stakes at each inside corner of the sub-plots. (See fig. 8). A point quadrat analysis was obtained at cutting time of the 4th harvest of each of these sub-plots. This analysis was done with an inclination of 45°, at one station or 10 points per sub-plot. Since it was considered that sufficient data had been gathered for yield per unit area of ground cover studies, no analysis was performed on the remainder of each plot. Twenty days after the 4th cut, i.e., around the 20th of September, half of each sub-plot, the western half, was cut for leaf area index studies. At the same time the point quadrat analysis was performed before cutting on this sub-plot. Again the inclination was 45° and 10 points per sub-plot. Four additional stations were recorded through the remainder of each plot thus giving 50 points or 5 stations per plot as in cuts 1, 2 and 3. These then were the last point quadrat readings recorded for the pasture mixtures and pure stands.

b) Hay Mixtures and Pure Stands

1. Harvesting

This experiment was treated as hay and was therefore only cut when the legume species were about one quarter in bloom. This permitted the collecting of 3 cuts during the season of 1961. The methods used in harvesting the hay mixtures and the pure stands were the same as for the pasture mixtures. Samples for dry matter determinations and percentage composition were collected and processed similarly.

The re-growth of alsike clover in the 3rd cut was so insignificant that it was not collected for data, when it was in pure stand. However, the mixture containing alsike was cut for data purposes.

2. Point Quadrat Analysis

Again the methods employed in this case were very similar to those of the pasture mixtures, although no extraordinary analysis was done, neither was the improved point quadrat used.

For cut 1, weather conditions and circumstances did not allow the analysis of all the blocks. The first hit on every species and "others" were recorded at an angle of 29° for blocks A, D, E and F. For cut 2, all blocks were analyzed for every hit on each seeded species and "others". The inclination of the frame was at 45°, because the material was too high for a lesser angle and according to Warren Wilson (1959) larger angles increase the error.

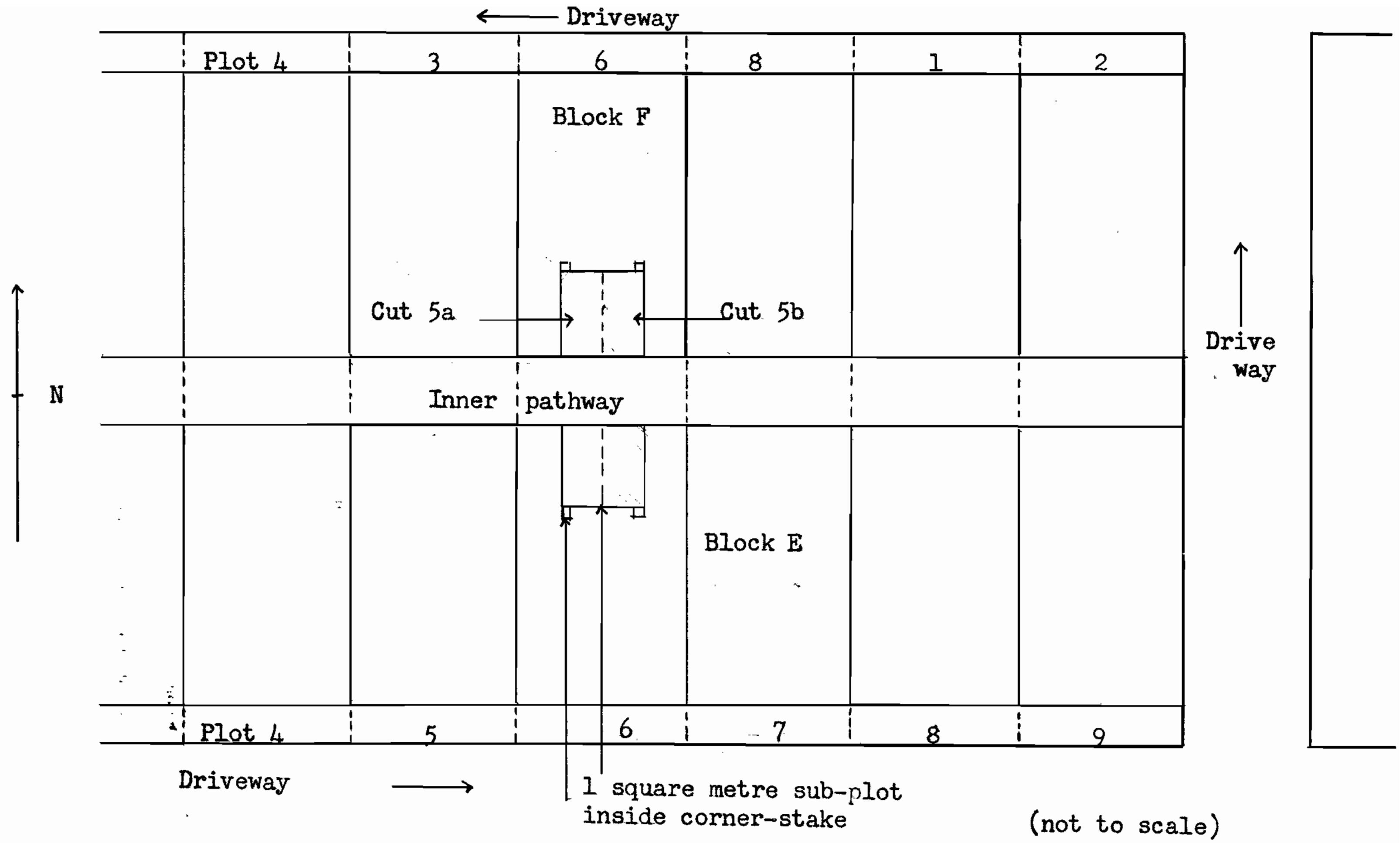


Fig. 8 Layout explaining sub-plots in Pasture Mixtures.

c). Methods for the Study of Photosynthetic Area and Net Assimilation Rates

The materials used for this study were the same as those used for yield per unit area of ground cover studies in hay and pasture mixtures. However, not all the mixtures were used. In the pasture mixtures those that were more of the pasture type and in the hay mixtures those that were more of the hay type were selected. Thus in pastures, mixtures 1, 4, 6, 8, 9, 11, 12, 13, 14 and 15 of blocks C and D and (vii), (viii) of blocks E and F. All the pure stands were included. In hay, mixtures 1, 2, 4, 5, 8, 9 and (i) of blocks A, B, C, D, E and F as well as all the respective pure stands except alsike clover, for the reason mentioned above. Sub-plots were established on all of these.

For harvesting the sub-plots, as described previously, the square metre quadrat was laid down over the 2 pegs and all the area inside the quadrat was cut with a sickle. Thus for cut 4 the entire square metre sub-plot was harvested. After 20 days of recovery the western half of the sub-plot was clipped and gave data for 5a. Thirty-three days later or at the end of the complete regrowth period (53 days) cut 5c was obtained from the eastern half of the sub-plot. Thus cut 4, 5a and 5c were collected for the pasture mixtures and pure stands. Also sub-plots of cut 3 in the hay mixtures and pure stands were harvested. As soon as the material was cut, it was stored in a refrigerated room until it could be hand separated. When this was done, discs were punched out from the leaves of each species in the mixtures but not from "others". The components were then oven dried and weighed, including "others". The discs were punched out in view of the evaluation of the photosynthetic area index by the disc method as used by other workers. These discs were cut out with cork-borers ranging in size from 3.9 mm. in inside diameter to 11.9 mm., there were six different bores.

The number of discs punched out were determined quite arbitrarily, depending on the leaf size. For example on all clovers 50 discs of the largest bore were used. For the other species the numbers ranged from 100 to 300 depending on the size of the leaf and the amount of material available. One exception in this procedure had to be made for the leaves of Kentucky bluegrass. Due to the narrowness of that species' leaf, discs could not be obtained and therefore about 50 5 cm. segments were cut out.

The discs that were so obtained were recovered in small pill-tins in which they were oven dried. An ordinary thermostat controlled laboratory oven was used for this purpose. A number of consecutive weighings indicated that the time required to obtain a constant moisture content was approximately 12 hours. On this basis, all the discs were weighed on a micro-balance to the closest milligram after 12 hours of drying.

d) Definitions and Calculations

1. Ground Cover

This value refers to the portion of ground covered by a seeded species. If a point could be so enlarged as to give area, the ground covered by a species would be a proportion of the total area, covered by the sum of the area of each seeded species, "others" and bare ground. The following formula was used according to Levy and Madden (1933):

$$\text{Ground cover} = \frac{\text{Number of first hits recorded of species}}{\text{Total number of points analyzed}} \times 100$$

For this value only the first hit on each species, as one needle went through the sward, was recorded. Thus, e.g. if, as in cut 2, the number of first hits on reed canary grass in the pure stand were 36, then the ground cover was

$$\frac{36}{50} \times 100 = 72.$$

2. Yield per Unit Area of Ground Cover

If the assumption (for this work) that a point can be enlarged to give area, is accepted, then it can also be said that a certain yield can be obtained from such an area, if it is covered by plants. Thus the yield per unit area of ground cover was defined as the amount of dry matter a unit area of ground cover may yield in grams. For this study a plot of size 400 square links, or $^{1}/250$ of an acre or approximately 8 square metre was used. The formula developed was therefore:

Yield per unit area of ground cover =

$$= \frac{\text{Dry matter per plot of seeded species}}{\text{Ground cover of this seeded species}}$$

The dry matter of a seeded species referred to in the text and in the tables as "DM of component" was obtained by multiplying the hand separation percentage composition of a seeded species by the total yield of the mixture or pure stand in which the species was found. Thus, e.g. if reed canary grass in cut 2 (1961) made up to 65.2% of the pure stand sward and its DM was 2347 gm./plot, then the Y./U.A. of G.C.= $\frac{2347}{72}$= 32.6 gm. on a plot $^{1}/250$ of an acre.

3. Density

Density in past work has been defined in various terms. Here it is simply referred to as a function of all hits on a species and the total number of points recorded. This was referred to as the relative frequency of each species by Levy and Madden (1933).

$$\text{Thus: Density} = \frac{\text{All hits recorded of one species}}{\text{Total number of points used}} \times 100$$

4. Yield per Point "Density"

This could be defined as the amount of dry matter obtained for one point from a species of known "density". The calculations followed to give this value were of the same pattern as those of yield per unit area of ground cover. Thus:

$$\text{Yield per point density} = \frac{\text{Dry matter per plot of a species}}{\text{Density}}$$

5. Averages

The averages of the percent composition values for cuts have been calculated by taking the mean of the percent composition of each block.

The averages of the yield per unit area of ground cover have been calculated in the same manner in all cases. That is the dry matter contributed by a component of a mixture or pure stand, to the total yield was summed up, and the sum of the ground cover of this component was also obtained. The average yield per unit area of ground cover was calculated by the formula described above, namely $\frac{\text{Total DM of component}}{\text{Total ground cover of component}}$.

The averages of 2 blocks, or a complete cut, or of a series of cuts, e.g. the "seasonal average" of cuts 1, 2, 3, of the pasture mixtures, were obtained in this manner. However, the analysis of variance of the latter average as found in the appendix tables was based on the means of the yield per unit area of ground cover.

6. The Competition Index

This was defined as a measure of the ability of a species to express its production potential of dry matter in terms of grams per unit area of ground cover when in association with one or more forage species and in relation to its production in pure stand. The index was obtained from a ratio of an observed yield and an expected yield. The obseved was the average yield per unit area of ground cover of a species when found in a mixture and the expected, its average yield per unit area when this species was seeded as a pure stand.

Thus: Competition Index $= \dfrac{\text{Observed } Y./_{U.A.} \text{ of G.C.}}{\text{Expected } Y./_{U.A.} \text{ of G.C.}}$

e.g. Competition Index of reed canary grass in cut 2 $= \dfrac{7.8}{32.6} = 0.24.$

The competition index was also applied to mixtures in which case it simply measured the average competitiveness of species in a certain mixture. The calculations were: the ratio of the sum of the $Y./_{U.A.}$ of G.C. of the species in a mixture and the sum of the $Y./_{U.A.}$ of G.C. of these same species in individual pure stands; e.g. the competition index for the pasture mixture 2 (from table 17) was the sum of the $Y./_{U.A.}$ of G.C. of timothy 9.9, of red clover 20.4, of alfalfa 24.3 divided by the sum of the $Y./_{U.A.}$ of G.C. when these species were in pure stand, i.e., 33.3 for timothy, 23.2 for red clover and 32.9 for alfalfa.

Thus: Competition Index of mixture 2 $= \dfrac{9.9 + 20.4 + 24.3}{33.3 + 23.2 + 32.9} = 0.61.$

7. <u>Methods of Calculating PA, PAI, and NAR</u>

Photosynthetic area (PA) and photosynthetic area index (PAI) were used in the part of the project pertinent to them, instead of leaf area, and leaf area index. This was so, because the values for these expressions had been obtained, by the method of proportions, in which the weights of the discs punched from each species, the total area of these discs and the total dry matter of the species per m^2 sub-plot were the known variables. In cut 5a, 5b and 5c of the pasture mixtures the DM yield per half sub-plot was adjusted to a yield per m^2 sub-plot.

The formula for PA was then:

$$\frac{\text{Weight discs (gm.)}}{\text{Area of discs} (dm^2)} = \frac{\text{Weight species (gm./}m^2)}{PA}$$

transposing, $PA = \dfrac{\text{Weight of species (gm./}m^2) \text{ x Area of discs} (dm^2)}{\text{Weight of discs (gm.)}}$

e.g. the pure stand of timothy gave 0.133 gm. of disc weight whose area were 0.3495 dm^2 and a yield of DM of 28 gm./m^2.

Then $PA = \dfrac{28 \text{ x } 0.3495}{0.133} = 73.49 \ dm^2$.

The photosynthetic area index (PAI) is the index obtained when the photosynthetic area is expressed in the same unit of measurement as the area of ground from which it has been obtained. For example in cut 5a, table A107, the timothy pure stand of block E had a PA of 73.49 dm^2 per square metre sub-plot and a photosynthetic area index of $\dfrac{73.49 \ dm^2}{100 \ dm^2}$ or 0.7349.

The net assimilation rate (NAR) which has been frequently referred to, in the past by other workers as the efficiency (E) of a plant has been calculated according to the formula from Watson (1952):

$$NAR = \frac{W_2 - W_1}{t_2 - t_1} \text{ x } \frac{\log_e L_2 - \log_e L_1}{L_2 - L_1}$$

where: W_1 = DM (gm) at time t_1 (weeks)

W_2 = DM (gm) at time t_2 (weeks)

L_1 = PA (dm^2) at time t_1 (weeks)

L_2 = PA (dm^2) at time t_2 (weeks)

Thus for timothy (table A107):

$$NAR = \frac{28 - 0}{3.0} \times \frac{\log_e 73.49 - \log_e 0}{73.49 - 0}$$

$$= \frac{28}{3} \times \frac{4.2971}{73.49} = 0.546 \text{ gm.}/\ dm^2/\text{week}$$

Following this NAR was then defined as the net amount of dry matter (in grams per square metre plot) produced by the total photosynthetic area (in dm^2) per unit time (in weeks) once respiration has taken place from the entire plant.

It is obvious that for cuts of the hay mixtures, cut 4, 5a and 5c of the pasture mixtures, the formula above was greatly simplified since W_1, L_1 and t_1 were non-existent and therefore equal to zero. Thus NAR $= \frac{W2}{t2} \times \frac{\log_e L2}{L2}$.

8. <u>Analysis</u>

The analysis of variance for a complete randomized block design has been used and the means were compared with Duncan's Multiple Range Test according to Robinson (1959).

Small point quadrat apparatus
July 21.1960

Pasture mixture trial. July 25. 1961
Note the inner pathway

Brome-trefoil and reed canary-
trefoil mixtures. Note volunteer Ladino
in the latter mixture. July 25.1961

METEOROLOGICAL CONDITIONS

All the meteorological data in the dissertation were obtained from the "Annual Summary for Dorval Weather Report" published every year by the Federal Department of Transport, Canada. In 1959 according to this Report, the annual mean meteorological conditions were approximately normal and that, all in all, 1959 could be considered a normal year.

Meteorological Conditions for the Growing Seasons of 1960-1961

Growing Season 1960

April. Temperature wise, April averaged close to the expected values. The rainfall was heavier, i.e., 3.45" as compared to the normal of 3.04". (The normal is taken as the means of the periods 1942-1960.) The last freezing temperature occurred on the 26th. And only 0.4" of snow fell as compared to the normal of 4.6".

May. The month of May was the warmest on record, with a mean of 61.5°F. as compared to the average of 55.1°F. for the period of 1942-1960. The temperature never fell below 36.1°F. and the total rainfall for the month was above normal with 3.45" as compared with 3.04".

June. June was also above normal in temperature, with 66.1°F. as compared to 55.1°F. for the normal. However, the warmest day experienced was only 86.4°F. Only 2.58" of rainfall were recorded as compared to the normal of 3.18".

Table 1 Summary of the Meteorological Conditions in 1960.
Dorval, Que. 1960.

Month	Temperature °F.						Precipitation		
	Mean		Mean (24 hourly values)	Extreme		Mean	Total Monthly	No. Days (Trace or more)	Mean
	Max.	Min.		Max.	Min.	1942-1960			1942-1960
Jan.	21.9	7.5	14.8	37.2	-17.4	15.1	2.48	21	3.31
Feb.	28.3	14.6	22.2	42.7	0.4	15.5	6.90	24	2.83
March	30.3	15.8	23.5	42.7	-8.2	28.1	2.37	24	3.21
April	50.4	34.0	42.2	76.6	23.5	41.2	3.45	21	3.04
May	71.5	51.1	61.5	85.3	36.1	55.1	1.88	16	2.98
June	75.6	56.0	66.1	86.4	40.9	64.7	2.58	17	3.18
July	78.3	58.5	63.5	88.9	50.2	70.1	3.48	16	3.56
Aug.	80.1	55.8	68.9	89.7	45.1	67.8	1.19	11	2.77
Sept.	69.7	49.8	60.2	89.9	33.4	59.7	2.27	18	3.23
Oct.	55.2	38.5	47.5	64.8	29.7	47.7	4.34	15	2.99
Nov.	46.1	34.5	40.4	59.3	25.3	34.7	3.46	19	3.76
Dec.	27.6	10.5	20.2	55.6	-9.0	19.4	2.61	23	3.55
Year	52.9	35.6	44.7	89.9	-17.4	43.3	37.01	225	38.41

July. This was a rather cool month, therefore breaking the trend taken by the 3 previous months. The mean temperature was 62.5°F. as compared to the normal of 70.1°F. No temperature above 88.9°F. was recorded. Rainfall was close to normal with 3.56" as compared to 3.48". On the 22nd a record of one hour rainfall of 1.07" was established.

August. During this month dry seasonable temperatures were prevailing. The mean was slightly above normal, but none reached the 90°F. level. There were only 8 days of measurable precipitation giving a low total of 1.19" as compared to the normal of 2.77".

September. The temperatures were normal with a mean of 60.2°F. as compared to the normal of 59.7°F. However, the highest temperature of the year was recorded on the 8th, 89.9°F. The total rainfall was 2.27" well below the normal of 3.23", making this the 5th consecutive month with a rainfall below the expected. It can be easily deduced then, that the conditions for establishing forage mixtures were most unfavorable.

October. Seasonable temperatures prevailed with a mean of 47.5°F. as compared to the 1942-1960 average of 47.7°F. However, the highest maximum temperature of 64.8°F. was well below the normal maximum of 75.3°F. The first freezing temperature occurred on the 19th, a low of 29.7°F. on the 21st. The total rainfall of 4.34" was much above the normal of 2.99", thus giving the new seedings a chance to recover from the shortage of water during the previous 5 months.

Growing Season 1961

The forage mixtures recovered fairly well from a winter that seemed to be not too rigorous. November 1960 was a mild month with maximum daily temperatures of 45°F. or above for 20 days, and minimum daily temperatures of 35°F. or less for 22 days. This seemed to be quite favourable for translocation of sugars. December 1960 had a good snow cover especially on the coldest days. Cold weather and below normal snowfall during the months of January and February and March, did not adversely affect the forage mixtures, although above freezing day temperatures and below freezing night temperatures were experienced quite frequently.

April. Cool, cloudy and wet weather prevailed with a mean of 41.2°F., and yet close to the normal of 42.7°F. Also 6 days of below freezing temperature were recorded. Precipitations of 4.21" were well above the normal of 2.92" and only 4 days were recorded as being partly cloudy or clear for the larger part of the day.

May. This was the third consecutive month with mean temperatures below the normal. Record low temperatures were experienced on 5 days of which 3 were the last days of the month. A killing frost in many areas, with 29.8°F. occurred on the 31st of the month. The precipitations were close to normal with 24.6" vs 2.86". Only 3 days were clear and sunny.

Table 2 Summary of the Meteorological Conditions in 1961.
Dorval, Que., 1961

Month	Temperature °F. Mean Max.	Mean Min.	Mean (24 hourly values)	Extreme Max.	Extreme Min.	Mean 1942-1960	Precipitation Total Monthly	No. Days (Trace or more)	Mean 1942-1960
Jan.[i]	16.0	-1.1	8.0	40.7	-17.1	15.1	1.32	12	3.31
Feb.	27.6	11.4	20.3	44.7	-14.2	15.5	2.81	9	2.83
March	35.3	17.9	27.2	58.2	- 0.7	28.1	2.71	10	3.21
April	48.5	34.1	41.2	66.8	27.2	42.7	2.94	17	2.67
May	63.0	42.5	53.6	86.8	29.8	56.0	2.46	12	2.86
June	72.8	53.8	64.0	85.4	40.3	65.1	5.17	16	3.00
July	78.6	61.4	69.5	87.2	50.4	70.5	3.07	16	3.59
Aug.	77.6	59.5	68.6	88.1	47.3	67.9	5.41 (ii)	10	2.77
Sept.	75.9	55.2	65.6	88.1	37.0	60.2	0.83	5	3.22
Oct.	60.5	41.6	51.1	75.3	27.1	48.7	2.55	12	2.86
Nov.	43.2	31.1	37.2	64.0	18.3	35.7	2.46	16	3.31
Dec.	30.2	18.6	24.4	46.9	1.6	20.0	3.41	15	3.47

(i) The last 13 days in January averaged just below zero temperatures, the longest cold spell of any month on 20 yr. record.
(ii) Record at Dorval.

June. The 4th consecutive month with temperatures below normal. The mean was 64.0°F vs 65.1°F. for the normal. It was a cool and wet month with 2.17" above the normal of 3.0". The 29th and the 30th were probably the only days that could have been called normal and sunny.

July. The 5th consecutive month of below normal temperatures, i.e., 69.5°F. vs 70.5°F. Rainfall was a little below normal too, with 3.07" vs 3.59". The amount of sunshine increased considerably, but nevertheless was still below normal for this month.

August. This is the first month since April to have a temperature that was about normal. Nevertheless, the mercury failed to reach 90°F. Precipitations were much above normal with a record high of 5.41" as compared to the normal of 2.73", and the previous record in 1959 of 5.22". There were 12 days of sunny and clear weather.

September. The mean temperature of this month, of 65.6°F. was above the normal of 60.2°F. Also the average minimum was above normal. The rainfall of 0.83" was only 25% of the normal for the month.

October. October was mild with a mean temperature slightly above normal. The rainfall of 2.55" was 0.31" below normal.

EXPERIMENTAL RESULTS

I Experiment I. Pasture Mixtures Trial 1960

1. Hand Separations and Point Quadrat Analysis

The results obtained throughout the year or season 1960 are quite characteristic of the exploratory nature of this work. Also for this reason the yields of dry matter of the mixtures are not reported anywhere, but the yields of individual components are found in the appendix.

a) Pure Stands

Of the pure stands timothy was rather low yielding. Table A1 (the letter A in this case refers to the appendix tables) gives the yields of dry matter of all the pure stands in their respective available cuts. These exceptionally low yields of timothy were attributed to: a) a large amount of dandelions, which contributed a high percentage of the yield as seen in table $A1_a$, and b) drought conditions prevailed throughout the summer.

Similarly, the drought affected adversely the yields of brome and alfalfa pure stands.

Table $A1_a$ indicates the percentage composition and point quadrat analysis of the pure stands. In this table, the low percentage of pure timothy and brome, seem to indicate a direct relationship, in all cuts with the high bare ground values. Cut 2 of alfalfa had a high amount of weeds other than dandelions, which resulted in a low bare ground. However, at cut 5, drought and frost had killed most of these weeds, leaving a large amount of bare ground.

The percentage composition of timothy dropped from 42.3% at the beginning of the season to 23.2% at the 5th cut. That of pure brome increased from 70.6% to 91.4% and alfalfa also increased from 33.3% to 96.0%.

b) Pasture Mixtures

In tables A2 to A7 of the appendix appear the percentage composition of the mixtures, as obtained from hand separations, and their respective ground cover values.

In all the mixtures where red clover or alsike had been one of the components, the percentage timothy was relatively high for all cuts. The reason for this was that these two legumes had disappeared from the sward due to winter killing or other reasons, leaving only the grasses with or without other legumes and "others".

Mixtures with alfalfa or birdsfoot alone showed almost the opposite trend, i.e.,these two legumes outyielded the various grasses with which they were associated. The exception to this was found in the first cut where timothy, brome and tall fescue contributed a higher percentage to the mixture yield than birdsfoot. These same tables mentioned above show the ground cover obtained for cut 2, 3, 4 and 5, as well as the ground cover obtained from the analysis done after cut 5 was harvested. Ground cover was low in the mixtures in which red clover had disappeared and also in a few of the simple mixtures. It was found to be as low as 28% in mixture 3 at cut 5.

In general it appeared, that the mixtures of this trial had stabilized in favor of the more long-lived species. The net result, in terms of ground cover, was that the mixtures which originally had red clover, Ladino or alsike, gave much higher bare ground readings.

2. Yield Per Unit of Ground Cover

a) Pure Stands

Table A8 shows the yield per unit area of timothy in cuts 2, 3 and 5' and of brome, alfalfa in cuts 2, 5 and 5'. It is to be noted here that the yields per unit area of ground cover of timothy were extremely low in cuts 3 and 5'. This was attributed to heavy weed infestation in this pure stand. In cut 3 the yield per unit area of timothy was only close to 1.0 gram. In cut 5 the yield was even lower; namely 0.10 gram per unit area of ground cover or 10 grams for 100% ground cover. Both brome and alfalfa had relatively similar high yields to timothy in cut 2. Cut 5 and 5' for which the same yield but different ground cover were used, show a marked decline in yield per unit area. Brome went from 58.5 gm. per unit area of ground cover down to 3.2 gm./unit area of ground cover. Alfalfa went from 26.4 gm. to 6.0 gm. per unit area of ground cover. These yields, however, were still markedly larger than those of timothy.

b) Mixtures

In tables A9 to A14 appear the yield per unit area of ground cover, of timothy, alfalfa and brome when found in mixtures of various complexities.

The highest yield per unit area, in cut 2, of timothy was obtained in mixture 11 where it was associated with Ladino. The lowest of timothy in this same cut, was when it was associated with red clover, alfalfa and Ladino in mixture 6. In cut 3 this order was changed to some extent. The mixture in which timothy yielded most was number 12, where it was associated with birdsfoot trefoil. This however was followed closely by mixture 11. The lowest yield per unit area of ground cover of timothy in this cut 3, was found in mixture 7 when it was associated with alfalfa. In cut 5 the highest yielding timothy was in mixture 5, when it was in mixture with red clover and birdsfoot trefoil, (practically only the latter was present). The lowest yields of timothy in this cut were obtained when it was associated (theoretically) with red clover, red clover and alsike, or alsike alone. Since this was indicated previously, these legume species had almost completely disappeared from the stand, it may be presumed that timothy was lacking their beneficial effect.

The two mixtures which contained brome, namely mixture 13, where it was associated with trefoil and 17 with alfalfa, showed that the yield per unit area of brome stayed relatively constant throughout the season. Brome with trefoil gave the higher value, in both cut 2 and cut 5.

The yields per unit area of ground cover of alfalfa in cut 2 were all relatively high. In this cut the highest yield per unit area was obtained when it was in association with timothy and birdsfoot in mixture 8. In cut 5 the highest yield obtained was when alfalfa had been associated with red clover and timothy. Alfalfa yielded least in both cuts when associated with brome alone.

Table 3 is a summary of the yields per unit area of ground cover of timothy, alfalfa and brome in the mixtures as compared to their behaviour in pure stands.

Since none of the results of experiment I were statistically analyzed the extent of the differences occurring cannot be judged, except in cases where these differences were large. Thus from table 3 without calculating competition indices, it was observed that the grasses in cut 2 had an index of competition of less than 1.0, whereas the only legume, alfalfa, had competition indices above 1.0 in all cases except for mixture 17. In cut 3 only timothy in mixture 7 yielded less than the pure stand . In cut 5' every competition index of timothy was above 1.0. However, brome in the mixtures of cut 5', yielded less than the pure stand. In cut 5 alfalfa was showing good competitive ability too.

Table 3 Average Yield per Unit Area of Ground Cover of a Species in Pure and Mixed Stands (in gm.) 1960 Pasture Mixtures. Experiment I. (2nd year of production)

	Species										
	Timothy				Alfalfa			Brome			Mixtures
Mixt. No.	Cut 2	Cut 3	Cut 5	Cut 5	Cut 2	Cut 5	Cut 5	Cut 2	Cut 5	Cut 5	
1	12.7	2.0	1.03	0.50							Timothy, Red Clover
2	12.7	2.2	1.07	0.62							Timothy, Red Clover, Alsike
3	13.2	1.9	2.94	0.59							Timothy, Red Clover, Ladino
4	6.2	1.7	1.62	0.57	31.1	18.8	9.1				Timothy, Red Clover, Alfalfa
5	9.4	3.2	8.50	1.34							Tim., Red. Cl., B.T.
6	4.3	2.3	1.31	0.85	32.7	12.4	16.0				Tim., Red. Cl., Alfalfa, Lad.
7	5.6	0.8	1.75	0.50	32.1	12.7	9.2				Timothy, Alfalfa
8	4.5	2.2	1.94	1.03	42.6	16.1	13.4				Timothy, Alfalfa, B.T.
9	5.2	1.2	1.04	0.84	28.4	18.1	13.6				Timothy, Alfalfa, Alsike
10	6.1	2.6	1.92	1.15	29.8	13.6	19.5				Timothy, Alfalfa, Ladino
11	14.6	4.1	1.83	0.79							Timothy, Ladino
12	9.3	4.5	4.33	2.17							Timothy, B.T.
13								5.3	5.3	2.9	Brome, B.T.
17					24.3	9.3	9.8	3.9	5.2	2.1	Brome, Alfalfa
Pure Stands	37.1	0.96	--	.09	26.4	12.9	6.0	58.5	4.5	3.2	

Underscored values indicate a competition index of less than 1.0.

What was called cut 5', had been calculated to find whether there existed a relationship between it and cut 5. No such tendency was readily observed in timothy. However, upon calculating the coefficient of correlation in timothy, it was found that "r" gave a value of .58, just significant at the 5% level. It should be noted that a value of r = .58 accounts only for 33.2% of the variability existing between these two ways of measuring yield per unit area of ground cover. (See materials and methods.) This was not considered sufficient, to say that one method is as good as the other, for timothy. For alfalfa on the other hand a correlation factor r = .07 was obtained, which was obviously not significant. Therefore, in this case the two methods are definitely not the same.

EXPERIMENT II

Pasture Mixtures and their Pure Stands 1960-1961

1. Yields of DM of the Pure Stands and 3 Mixtures 1960-61

Tables A15 to A20 show the green and dry weights of the pure stands and 3 mixtures. The analysis of variance of the fall cut of 1960 gave no significant differences between treatment(1) means, which included the 6 pure stands and 3 mixtures. All other cuts, i.e., cuts taken in 1961, gave high significance for these same treatments except cut 5 in which they were only significant to the 5% level. In table 4 appear differences between treatment means in pounds per acre of the pure stands and 3 mixtures, but excluding the reed canary and Kentucky blue grasses. According to Duncan's multiple range test all treatment means with the same lower case letter do not differ significantly from each other.

The mean yields of cut 1 show no significance between the yields of the pure stands of red clover, brome and Ladino. Timothy gave the highest yield in this cut and was significantly different from all pure stands and the 3 mixtures except brome. Alfalfa yielded significantly less than any of the pure stands in both cuts 1 and 2.

(1) Treatment refers to such variables as mixtures, species etc.

Table 4 Yields as Pounds of Dry Matter per Acre.
Pure stands 1960-1961. Pasture Mixtures. Experiment II

	1960	Cut 2	Cut 2	Cut 3	Cut 4	Cut 5	Total
(i) Tim.	331 a	1623 a	3835 a	770 c	259 c	335 c	6823 ab
(ii) R.C.	510 a	1273 b	1890 c	1464 ab	820 b	659 ab	6106 ab
(iii) Af.	394 a	493 c	749 d	1118 bc	1247 a	768 ab	4375 c
(iv) Br.	371 a	1401 ab	2405 bc	1285 ab	280 c	313 c	5686 b
(v) Lad.	494 a	1253 b	2189 bc	1487 ab	933 b	853 ab	6716 ab
(vi) B.T.	438 a	726 c	2573 b	1097 bc	940 b	501 bc	5837 b
(vii) T., Lad., B.T.	364 a	1172 b	2589 b	1412 ab	856 b	766 ab	6796 ab
(viii)T.,Br.,Lad.,B.T.	477 a	1303 b	2454 bc	1591 a	997 b	860 a	7206 a
(ix) T.,Br.,Af.	249 a	631 c	881 d	775 c	1028 c	684 ab	3949 c
S.D.	67.63	115.99	253.57	158.57	90.48	117.58	438.70
C.V.	13.51	11.66	12.87	14.31	12.21	20.35	8.14
F. treat.	2.6	18.19**	22.38**	6.034**	22.39**	5.15*	10.71**
Date	Nov. 2	May 23	June 26	July 26	Sept. 1	Oct. 25	

Total does not include the 1960 cut
S.D. in gm./plot x 1.1034 for lb./A.

Means followed by the same lower case letters are not significantly different from each other at the 5% level. Duncan's Multiple Range Test.

Considering the mixtures, in this comparison, it is noted that (vii) and (viii), which differed only in the presence or absence of brome, were not significantly different from each other throughout the testing season. Mixture (ix) together with the pure stand of alfalfa, was the lowest yielder in cuts 1, 2, 3. In cut 4 and 5 both of these improved, so that mixture (ix) was not significantly different from mixtures (vii) and (viii) nor was it different from red clover, Ladino and birdsfoot trefoil. However, alfalfa was the best yielder in cut 4 and significantly different from all other treatments. In the seasonal means, both of these treatments took the last rank, significantly different from all others.

Timothy and brome behaved similarly throughout the season. They were only significantly different from each other in cut 2 where brome yielded less than timothy and in cut 3 when the roles were just the reverse, timothy being among the lowest yielding of all treatments. In cuts 4 and 5 they were both the lowest yielders, significantly so, except from trefoil in cut 5.

Red clover and Ladino never differed significantly from each other throughout the season. They ranked among the highest yielders towards the end of the season. Birdsfoot trefoil was quite average, at times, yielding significantly less than the lowest yielding treatment.

From the season's total it is observed that the highest yields, but not significantly different, were obtained from timothy, red clover, Ladino and mixtures (vii) and (viii). Only mixture (viii) however differed significantly from alfalfa, brome, trefoil and mixture (ix).

2. Yields of DM of the Pasture Mixtures Trial 1960-61

a) Yields of DM 1960. In table A21 the yields of the cut taken in the fall of 1960 are shown together with differences that appeared between their means. Mixtures 1, 2, 3, 4, 5, 6, 7, 8, 9 and 12 all gave means that were not significantly different from each other. Mixtures 2, 5 and 8 were significantly different from all others. Mixtures 1, 3, 4, 6 and 9 were not significantly different from the lowest yielders, which were the simple mixtures.

b) Yields of DM 1961. The green weights, percentage dry matter and the dry weights are found in tables A22 to A26 for all 5 cuts of 1961. An analysis of variance was done on every cut, but since we were not directly concerned with the yields per acre, only a summary of Duncan's Multiple range test is reported for all cuts and the seasonal average. This summary, showing the behaviour of mixture means throughout the season is seen in table 5.

From cut 1 it can be seen that the highest yielding mixtures which were not significantly different from each other, were mixtures 2, 3, 4, 5, 6, 8, 10 and 12. Of these only mixtures 5 and 8 were significantly different from the 7 remaining mixtures. The 4 lowest mixtures in this cut, which were mot significantly different from each other were the simple mixtures 11, 13, 14 and 15. Mixtures 14 and 15 yielded significantly less than any of the 11 remaining mixtures. From cut 2 it is seen that mixtures 2, 4, 5, 6, 8, 9, 11, 12, 13 and 14 were all the highest yielding. But of these only mixture 14 was significantly higher yielding than the 5 remaining mixtures. Mixtures 1, 3, 10 yielded least with no significant differences between them. Mixture 10, in which alsike was associated with timothy, and which has very little ability to recover, yielded significantly less in this cut 2, than any other mixtures, excluding 1 and 3. This was also true in cuts 3 and 4, although the mixtures that were not significantly different from it, varied.

In cut 3, the highest yielding mixtures were 2, 4, 5, 7, 8, 9. Mixture 8 was the only mixture to be significantly different from all other 9 mixtures. The lowest yielders were 1, 10 and 11. Mixtures 10 and 11 were significantly different from all others except from 1.

In cut 4, mixtures 2, 4, 5, 7, 8, 9 were the highest yielding, with 7 and 9 being significantly different from all others. There were 11 mixtures in this cut that ranked 2nd and no one mixture that yielded significantly less than all others. In cut 5 there was no significant difference within mixtures at the 5% level.

Thus to summarize these 5 cuts, there did not appear to be any definite trends in the yields of these 15 mixtures. The whole picture appeared to be rather confusing. As the season advanced the differences became less apparent, to finally not give any difference in the fall cut. This latter in this sense was very different from the fall cut of 1960.

A trend that seemed to be of some significance, was that mixtures 2, 4, 5 and 8 appeared in all cuts as the highest yielders, and that mixtures 1, and 15 never appeared among the highest yielders, and that the simple mixtures, except mixture 7, only yielded well in cuts 1 and 3.

The season's total showed just as little difference as cuts 2, 3, 4 and 5. There were 9 mixtures not significantly different from each other in rank one. Of these mixtures, 2, 5, 8, 9 were significantly different from the other 6 mixtures. Ranking third and last were 10 mixtures which were not significantly different from each other and all of which had the same rank as in cut 4. Of these mixtures, 10 yielded significantly less than the remaining 5.

If mixtures 2, 4, 5 and 8 were the most persistent yielders, mixtures 2, 5, 8 and 9 were the top yielders in this mixture trial. All of those were complex mixtures, all had alfalfa in them except 4, and all had timothy.

Among the lowest yielding mixtures, i.e., consistently so, mixtures 1, 10 were found in cuts 2, 3, 4 and mixture 11 in cuts 1, 3, 4. All 3 of these were simple mixtures. Standard deviations from the error mean have been calculated for all cuts

Table 5 Yields as Pounds of Dry Matter per Acre. Pasture Mixtures 1961.
Experiment II

Mixture No.	Cuts: Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Total
1. T.R.C.	1533 bcd	1937 cd	1216 def	1266 bcd	716 a	6668 bc
2. T. R.C. Af.	2142 ab	2270 abc	1619 abc	1591 ab	1017 a	8638 a
3. T. R.C. As.	2066 ab	1938 cd	1385 bcde	1295 bcd	565 a	7249 abc
4. T. R.C. L.	1995 ab	2190 abc	1607 abcd	1337 abcd	602 a	7731 abc
5. T. R.C. Af. L.	2324 a	2276 abc	1665 ab	1460 abc	941 a	8666 a
6. T. R.C. B.T.	2010 ab	2265 abc	1417 bcde	1229 bcd	182 a	7704 abc
7. T. Af.	1633 bc	2094 bc	1760 ab	1675 a	948 a	8111 ab
8. T. Af. L.	2328 a	2326 abc	1817 a	1510 abc	717 a	8698 a
9. T. Af. B.T.	1590 bcd	2500 ab	1665 ab	1689 a	964 a	8408 a
10. T. As.	2128 ab	1554 d	1008 f	1021 d	616 a	6327 c
11. T. B.T.	961 de	2608 ab	1190 f	1238 bcd	663 a	6660 bc
12. T. L.	1865 ab	2254 abc	1524 abcde	1309 bcd	633 a	7585 abc
13. Br. B.T.	1158 cde	2332 abc	1537 abcde	1159 cd	605 a	6791 bc
14. R.can. B.T.	834 e	2719 a	1235 cde	1305 bcd	608 a	6701 bc
15. K.B. B.T.	784 e	2162 bc	1464 abcde	1283 bcd	956 a	6649 bc
	$\bar{x}_1$=1690	$\bar{x}_2$=2228	$\bar{x}_3$=1474	$\bar{x}_4$=1358	$\bar{x}_5$=756	$\bar{x}$=7506
S.D.	375.06	292.69	214.87	196.19	213.59	886.92
C.V. %	22.19	13.13	14.58	14.45	28.25	11.15
F. treat.	6.64*** Sign. at 0.1%	3.10** Sign. at 1%	3.82*** Sign. at 0.1%	3.08** Sign. at 1%	1.93	3.38** Sign. at 1%
Date Cut	May 23	June 26	July 26	Sept. 1	Oct. 25	

Means followed by the same lower case letter are not significantly different from each other at the 5% level Duncan's Multiple Range Test.

and the seasonal average, as well as the coefficient of variability. From the latter it can be observed that except in cuts 1 and 5, the CV's were all less than 15%. A high CV of 28.2% was obtained in cut 5.

3. Percentage Composition and Point Quadrat Analysis 1960-61

a) Pure Stands. In tables A27 to A32 appear both the percentage composition by weight as obtained from hand separations and the point quadrat analysis, of all cuts harvested on the pure stands. Averages were calculated of each of these, of each table, and the results are seen in table 6. A point to note here is that whenever two ground cover values were averaged, the result is simply the total of all the number of hits entering in these two figures. This is quite clear when it is considered that the maximum number of hits on a species in two analyses is equal to 100 points, as only one hit on each of the 100 needles analyzed was recorded.

From table 6 it is seen that the cut of the fall of 1960 gave a high percentage for "others". This was due to the fact that the stubble of the companion crop was incorporated into the cut material. These then, had to be accounted for as "others" in order to obtain the actual weight of each component. The effects of the stubble was also reflected in the bare ground values, which were high throughout this cut, because dead material was not recorded at all.

Table 6

Average Percentage Composition and Ground Cover
Pasture Mixtures and Pure Stands 1960-1961
(Experiment II)

	Cut 1960		Cut 1		Cut 2		Cut 3		Cut 4		Cut 5	
Components	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.
i Tim.	10.8	17	100	59	99.3	67	64.6	36	80.8	55	89.1	53
Others	89.2	3	tr	2	0.7	-	35.4	10	19.2	15	10.9	12
B.G.		80		42		33		57		60		42
ii R.C.	55.9	42	100	75	99.2	60	92.9	41	74.2	75	74.1	71
Others	44.1	2	-	-	0.8	-	7.1	19	25.8	30	25.9	14
B.G.		56		25		40		47		20		21
iii Af.	24.4	15	99.3	19	98.0	12	84.8	29	67.6	65	75.9	40
Others	75.6	5	0.7	-	2.0	-	15.2	44	32.4	95	24.1	45
B.G.		80		81		88		39		-		31
iv Br.	5.6	16	100	47	92.7	56	48.0	33	54.2	80	68.2	39
Others	94.4	3	-	-	7.3	12	52.0	22	45.8	40	31.8	21
B.G.		81		53		37		52		15		46
v Lad.	30.0	37	98.3	69	100	86	100	71	92.3	90	99.4	95
Others	70.0	-	0.7	-	-	-	-	-	7.7	-	0.6	-
B.G.		64		31		14		29		10		5
vi B.T.	35.7	35	98.9	53	97.3	73	88.3	65	69.2	90	80.2	74
Others	64.3	4	1.1	3	2.7	1	11.7	9	30.8	35	19.8	24
B.G.		61		44		27		31		10		14
vii Tim.	2.9	7	11.9	25	20.4	25	1.7	9	0.7	(2)	3.0	4
Lad.	21.4	30	54.3	54	71.9	62	97.2	64	97.5	100	75.4	93
B.T.	15.9	13	31.4	21	7.2	29	1.1	18	1.7	11	0.6	(.2)
Others	58.8	-	2.4	-	0.5	-	-	-	0.1	-	21.0	-
B.G.		52		25		19		27		-		5

Table 6 continued.

Components	Cut 1960		Cut 1		Cut 2		Cut 3		Cut 4		Cut 5	
	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.
viii Tim.	3.1	5	16.6	24	12.4	15	1.7	4	1.8	6	1.5	5
Br.	5.2	10	1.7	10	0.6	9	0.1	4	0.6	6	2.0	5
Lad.	19.5	14	51.2	49	77.1	68	96.4	58	95.7	95	95.5	92
B.T.	17.6	13	29.1	42	9.5	35	1.8	10	1.9	6	1.0	3
Others	54.6	-	1.4	-	0.4	-	-	-	-	-	-	-
B.G.		62		17		17		32		5		7
ix Tim.	8.1	13	23.1	33	39.1	45	12.0	23	6.5		9.8	
Br.	3.1	8	7.1	16	1.8	9		16				
Af.	19.2	5	68.7	10	58.1	3	82.0	4	69.8		75.4	
Others	69.6	4	1.1	-	1.0	-	6.0	10	23.7		14.8	
B.G.		70		58		43		57				
R.can.	3.7	8	100	24	85.2	72	(66)	66	93.2	70	91.7	68
Others	96.3	34	0	-	14.0	-	(34)	34	6.8	20	8.3	18
B.G.		60		76		28		22		10		28
K.Blue	2.6	16	98.3	52	99.0	92	(91.7)	66	82.4	70	98.5	68
Others	97.4	38	1.7	-	1.0	-	(8.3)	6	17.6	-	1.5	-
B.G.		48		48		8		32		30		30

Averages of Blocks E and F except for K.Blue and R.can.
Ave. G.C. = Total hits of E & F.

However, according to the ground cover values, "other" species seemed to be rather prominent in the alfalfa pure stands. But when the percent composition of these is considered it is noted, that their contribution to the sward by weight was relatively small. Towards the end of the season, in cuts 3, 4, 5, weeds made up almost half of the total yield.

The amount of bare ground at the beginning of the season was relatively high for timothy, alfalfa, brome and trefoil, none of which showed a very regular stand. As the season progressed the bare ground decreased in the alfalfa and trefoil stands but did not change in the timothy and brome stands. Red clover and Ladino had fairly uniform stands, but red clover probably less than Ladino, because it was thinned by disease. Ladino maintained a high ground cover throughout the season, approaching 100 in cuts 4 and 5.

b) Percentage Composition of the Pasture Mixtures

The details of the percentage composition and of the point quadrat analysis of every species, in every mixture, in every cut are found in tables A33 to A40. A summary of these tables, in the form of averages per cut is found in table 7 of the text.

A general observation may be made at first, namely that the grasses as expected, contributed very little to the total yield in the first year of production. Also that the high percentages of "others" in some of the mixtures, may be due solely to the invading Ladino clover in blocks A and B.

Table 7 Average Percentage Composition and Ground Cover
Pasture Mixtures 1960-1961
Experiment II

Mixture		Cut 1960		Cut 1		Cut 2		Cut 3		Cut 4		Cut 5	
		% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.
1	Tim.	5.4	8.5	10	22	29	28.5	13	16	9	40	20	16
	R.C.	46.5	40.5	90	75	68	52	79	32	60	80	63	58
	Others	48.1	6.5	tr	-	3	9.5	8	25	31	55	17	29
	B.G.		53		18		26		39.5		-		15
2	Tim.	4.8	8	7	16	16	19.5	4	12	4		8	
	R.C.	34.1	20.5	59	79	52	42	45	40.5	27		24	
	Af.	18.0	7	29	13	23	19	36	12	43		48	
	Others	43.1	4.5	5	-	9	10.5	15	29	26	-	20	
	B.G.		64		13		29.5		27.5				
3	Tim.	3.8	4.5	9	22	14	17	7	9	6		11	
	R.C.	25.0	25.5	36	44	48	41	49	27	49		52	
	As	31.0	13.5	44	63	13	30	2	11	tr		18	
	Others	40.0	5	11	-	25	19	42	37.5	45		19	
	B.G.		50.5		7		19.5		33				
4	Tim.	5.7	8	16	32	12	19.5	5	7	1	(2)	4	6
	R.C.	28.6	24	49	59	28	39	14	53.5	15	40	7	18
	Lad.	26.9	27	35	54	60	68	81	30	81	75	88	80
	Others	38.8	1.5	tr	-	tr	0.5	tr	2	3	10	1	1
	B.G.		42.5		12		10		23.5		-		13
5	Tim.	4.2	4.5	8	25	11	16	2	8	2		4	
	R.C.	27.4	28.5	36	52	28	43.5	14	18	11		5	
	Af.	26.5	4.5	32	11	15	10.5	22	13	26		35	
	Lad.	17.3	15.5	23	43	46	51.5	61	51.5	60		56	
	Others	33.2	0.5	1	2	tr	-	1	2	1		tr	
	B.G.		76		9		17.5		22.5				

Table 7 continued.

Mixture	Cut 1960		Cut 1		Cut 2		Cut 3		Cut 4		Cut 5	
	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.
6 Tim.	4.8	5.5	10	32	15	24	7	13	7	45	16	24
R.C.	33.8	23.5	75	73	67	54.5	64	48	54	65	54	60
B.T.	7.6	11.5	10	22	8	15.5	7	18	7	45	6	28
Others	53.8	5.0	5	-	10	12	22	22	32	30	24	6
B.G.		52		5		20		25		-		17
7 Tim.	9.1	11.5	16	46	29	39	6	23	5		7	
Af.	33.5	6.5	80	21	60	33	80	22.5	64		67	
Others	57.4	16	4	-	11	17	14	36.5	31		26	
B.G.		71.5		35		37		34				
8 Tim.	9.9	12	13	30	13	23	2	9	1	6	2	4
Alf.	23.9	3	41	12	21	21	21	12	38	35	41	9
Lad.	29.7	31.5	44	70	65	73.5	77	64	60	95	57	84
Others	36.4	-	2	-	1	2	tr	0.5	1	-	tr	-
B.G.		59.5		18		13.5		26.5		5		12
9 Tim.	7.9	7	14	49	18	40	9	13.5	9	65	16	32
Af.	23.7	7	55	14	43	23	54	22	63	50	62	14
B.T.	19.0	11	30	43	34	37	30	35	13	95	12	59
Others	49.5	2	1	3	5	6	7	17	15	10	10	15
B.G.		72		24		21		31		-		11
10 Tim.	5.4	4.5	10	26	32	23	23	14	24		35	
Als.	40.6	31.5	82	88	34	47.5	18	30	19		3	
Others	54.0	5.5	8	3	34	25	59	38	57		62	
B.G.		64.5		9		25.5		28				

Table 7 continued.

Mixture	Cut 1960		Cut 1		Cut 2		Cut 3		Cut 4		Cut 5	
	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.	% Comp.	G.C.
11 Tim.	7.8	7	24	38	22	24.5	17	15	16	80	35	33
B.T.	28.1	18	63	49	58	55	49	31.5	25	90	43	65
Others	64.1	6	13	-	20	21	34	34	59	30	22	8
B.G.		70		33		17.5		31.5		10		19
12 Tim.	8.0	9	20	32	20	23	5	8	4	6	5	8
Lad.	47.6	27	79	76	80	77.5	94	66	95	95	93	90
Others	44.4	7.5	1	-	tr	-	1	0.5	1	-	2	-
B.G.		57.5		13		12		29		-		10
13 Br.	4.2	9	29	29	9	16.5	9	12	15	40	30	42
B.T.	23.6	15	52	47	60	56.5	72	64	35	75	22	62
Others	72.2	14	19	-	31	23	19	27	50	45	48	20
B.G.		62		36		21		22		15		12
14 R.C.	2.0	2.5	4	4	1	4	2	4	3	6	13	4
B.T.	32.0	21	75	56	65	55	69	55	31	100	24	48
Others	66.0	14.5	21	-	34	34	29	23	66	75	63	38
B.G.		63.5		44		23		35		-		24
15 K.B.	2.0	5	18	26	5	29	16	23	28	80	40	36
B.T.	25.4	23.5	58	43	49	61.5	69	57	32	65	15	51
Others	72.6	11	24	-	46	18	15	16	40	35	45	26
B.G.		62.5		46		14.5		27		10		16

Each cut is the average of the 4 blocks A, B, C and D for % composition
Mixt. 14 and 15 cut 1 are a 3 block average. " " "
Mixt. 13, 14, 15 cut 3 " " " " " " " "

In the fall cut of 1960 the contribution to the sward by the seeded species was relatively small, as compared to 1961. This was due to both the high amount of invading Ladino clover and the stubble of the companion crop as mentioned above. The largest contribution to this cut was made by the clovers and alfalfa. Birdsfoot trefoil yielded well only in mixture 9 and in the simple mixtures 11, 13, 14 and 15.

1961. In mixture 1 timothy did not contribute uniformly throughout the season. As expected red clover gave a high percentage at the beginning, and then declined as the season progressed.

In mixture 2 timothy behaved as above, red clover decreased from cut to cut and alfalfa increased.

Timothy behaved similarly again in mixture 3, red clover increased after each cut, which was in direct relationship with the decrease of alsike encountered after each cut. The contribution of the latter was very high in the first cut, but insignificant in cuts 3 and 4.

The sward of mixture 4, which was dominated by Ladino clover, showed a marked decrease of timothy as well as of red clover. In mixture 5, which was a complex mixture of 3 legume and one grass species, timothy contributed less to the sward than in any other mixture. Red clover contributed well at the beginning, but decreased to 5% only in cut 5. Ladino gave the highest percentage of the total yield in this mixture. Mixture 6 was very similar to mixture 1, in that the largest contribution was done by red clover. Timothy and birdsfoot trefoil were of little importance.

Mixture 7 was a simple mixture of timothy, and alfalfa was similar to mixture 1 in percent composition of the components. Alfalfa contributed to most of the yield.

In mixture 8 in which alfalfa was in mixture with Ladino, the latter made up most of the yield especially in cuts 2, 3, 4. Timothy decreased rapidly towards the end of the season. The contribution of alfalfa was more uniform.

The association of trefoil, with timothy and alfalfa as in mixture 9, had the effect of increasing the contributions of both timothy and alfalfa. Trefoil gave a good 36% of the yield in cuts 1, 2, and 3.

Mixtures 10 to 15 were simple mixtures in which timothy was seeded with alsike, Ladino and birdsfoot, and in which trefoil was seeded with brome, reed canary and Kentucky blue grass. As in mixture 3, alsike in mixture 10 only contributed well to the first 2 cuts. Although timothy increased from cut to cut, it was not the major yielder, due to the high amount of voluntary Ladino in blocks A and B.

Trefoil was the biggest contributor in mixture 11, and the timothy percentage was higher than in any other mixture.

In mixture 12 Ladino was the major contributor throughout the season. The timothy percentage was 20% in cuts 1, 2, but only 5% in 3, 4 and 5.

Mixture 13 was similar to mixture 11. Trefoil was most prevalent by yield, and brome gave 29% and 30% in cuts 1 and 5 respectively.

Mixture 14 was somewhat disappointing, in that a poor establishment of reed canary did not result in as uniform a stand as could have been expected. Trefoil behaved similarly as in the other simple trefoil mixtures. Reed canary contributed an average of 2.5% of the composition in cuts 1 to 4. It was better in the 5th cut with 13%.

Mixture 15 was a very uniform mixture more so as the season progressed. This feature was characteristic in blocks C and D, which were relatively free from the voluntary Ladino clover. The percent of trefoil was somewhat less than in mixture 11, 13, 14 and that of Kentucky blue grass as good or better than that of timothy in 11, and brome in 13. The high values of "others" were Ladino clover.

Table 6 referred to previously regarding the pure stands, also contains the 3 mixtures that complemented the mixtures trial.

Mixture (vii) and (viii) were very much alike since their only difference was the addition of brome in mixture (viii). The largest contribution to both of these swards was made by Ladino clover. The percentage of Ladino had increased from 20% to 95% from the fall 1960 to fall 1961. Trefoil yielded close to 30% in the 1st cut of 1961 but fell to barely 1% in the fall of 1961. Timothy appeared to be somewhat better in its yielding ability than brome, but both made very little contribution to the sward.

Mixture (ix) had a very clumpy stand throughout the season, especially due to alfalfa. The contributions of timothy and brome were relatively small.

c) Point Quadrat Analysis of the Mixtures

Tables A33 to A38 also contain the point quadrat analysis of every mixture in every cut, which includes the number of hits recorded on a component and its respective calculated ground cover. In table 6 also appears a summary of the average ground cover values for each cut of the 1960-61 season. In the case where only 2 blocks (C and D) were analyzed with 5 stations per plot or 50 points, the average ground cover for the cut was the total number of hits for the cut. Where all 4 blocks were analyzed, the average ground cover was half the total number of hits. Ground cover of cut 4 was not considered in the same light as all other cuts, since the analysis was obtained in a manner that was very different from the normal. Also in cut 5 some of the mixtures had no analysis done on them for reasons stated previously. (Materials and Methods.)

Considering the results of cut 1, 2, 3 and 5 it was observed that the values of ground cover were related to some extent to the values of percent composition. This appeared to be true of the grasses, and clovers at any rate. It is not true for alfalfa in cuts 2 and 3 especially, for which correlations were calculated. In cut 2 a correlation coefficient of r -.17 was obtained and in cut 3 of r .32, both of which were not significant. This tends to show that there is no relationship between percent composition and ground cover in alfalfa. However it was striking to find that the ground cover for this species was consistently lower than the percent composition. Another observation from table 7 is that the ground cover of alfalfa when it was associated with trefoil, was consistently lower than the latter, yet alfalfa contributed more to the sward than trefoil.

Again in table 6 appear the ground cover values of mixtures (vii), (viii) and (ix). With respect to ground cover the mixtures (vii) and (viii) were much alike, as was found for percentage composition. The ground cover of Ladino increased as the season progressed and that of trefoil, which was low, decreased to insignificance. The grasses had very little ground cover too. In mixture (ix) alfalfa had very low ground cover.

Table A39 contains all observations taken for density studies during the season of 1961. It is probably sufficient to say, for the moment, that relatively higher densities were obtained for the clovers and trefoil than for either alfalfa or the grasses. Further results related to density will be reported on later in the text.

In table A40 appears the point quadrat analysis performed with the improved point quadrat. From this table it is observed that a greater number of hits were obtained than in previous analyses, a characteristic which was not due directly to the point quadrat, but rather to the fact that the readings were obtained at cutting time, when both ground cover and density were greater.

4. Yield per Unit Area of Ground Cover. Pasture Mixtures and Pure Stands. 1960-61

a) Individual Cuts

For this part of the dissertation, it was considered more appropriate, for reasons that will be obvious, that the pure stands and the mixtures be reported simultaneously.

Tables A41 to A48 show the detailed calculations and results of the yields per unit area of ground cover, of all cuts of the pure stands. Tables A49 to A65 show the detailed calculations and results of the mixture components, in all cuts. Also included were results of densities and point density yields, but none of these were averaged or included in a final summary.

In most of these tables each block contains data under seven different headings. No new headings were added but in some instances, a few are absent. Thus column 1, headed "Mixt. No.", should be understood as denoting all species entered into the results, with the corresponding mixture number preceeded by the species name. The heading 2, "Total DM", should be understood as the total dry matter obtained from the specific mixture. Column 3, "% comp." was meant to be the proportion in percentages of a specific species contributed to the mixture. "DM of component" or DMof species in pure stands, should be read as the amount of dry matter in grammes per plot a species in mixtures or pure stand contributed to the sward as in column 4. Density and ground cover, columns #5 and #6 respectively, are the same as explained in the materials and methods. Column #7, which is only found in D of cut 2, in C and D of cuts, 3, 4 and 5 headed "Y./$_{\text{Point density}}$" should be read as the yield per point of density in grams per plot. The last column, that is 8, which was considered the ultimate end of this study, and which is headed as "Y./$_{\text{Unit area}}$" should be understood as the yield per unit area of ground cover as explained and defined in the materials and methods.

To avoid a long report on all individual tables of every cut the data is presented in a form of a summary for all cuts in tables 8 to 13. In these tables appear the average yields per unit area of ground cover obtained of blocks C,D for the species in the mixtures and of blocks E,F for their respective pure stands. (Reed canary and Kentucky blue pure stands were not replicated.) Blocks A and B were not included due to the volunteer Ladino problem.

In these tables, down the most left hand column, the mixtures with their respective numbers were reported. Along the top are found all species that entered into the various mixtures. And along the bottom appear the values of the respective pure stands.

In table 8 the underscored results represent all these

Table 8

Average Yield per Unit Area of Ground Cover
of the Grass and Legume Components (gm.)
Pasture Mixtures and Pure Stands
Nov. 2nd, 1960.

Mixt. No.	Timothy	Brome	R.canary	Kent.Blue	Red Clover	Alfalfa	Ladino	Bf.trefoil	Alsike
				Components					
1	3.8				6.3				
2	4.1				9.6	<u>5.2</u>			
3	3.5				<u>5.4</u>				6.6
4	3.3				6.8		5.4		
5	7.0				7.8	10.1	5.9		
6	3.8				<u>5.4</u>			<u>3.1</u>	
7	3.3					33.8			
8	4.2					46.8	5.0		
9	3.4					12.8		7.0	
10	2.9								5.6
11	4.1							10.8	
12	3.1						7.7		
13		2.2						7.1	
14			5.8					7.0	
15				1.8				5.0	
vii	<u>1.4</u>						<u>2.3</u>	4.2	
viii	2.7	2.4					5.2	6.4	
ix	1.4	0.9				8.5			
Pure Stands	1.9	1.2	1.3	1.0	6.2	6.0	3.6	4.0	

Ave. of blocks C, D and E,F.
Underscored values indicate a competition index of less than 1.0.

species that gave a $Y./_{U.A.}$ smaller than their respective pure stands. A ratio of 1.0 between the $Y./_{U.A.}$ of the species in the mixture and the $Y./_{U.A.}$ when in pure stand, indicated that the mixture did not suffer from competition, nor did it benefit from the associated species. Competition indices (see materials and methods) were calculated for all species (except alsike clover) in all cuts. The results appear in table A66 to A71.

Then from table 8 it can be noted that most species yielded appreciably more in mixed stands than in pure stands, and therefore all these for which this is true the competition index was more than 1.0. However, alfalfa in mixture with timothy and red clover, red clover in association with alsike clover and timothy, red clover and trefoil in association with timothy, timothy and Ladino mixed with trefoil and finally timothy, brome in association with alfalfa, were the exceptions, and gave competition indices of less than 1.0.

In table 9, which is the summary of the first cut of 1961, the underscored values represent those species, in mixtures, that yielded more than their respective pure stands. It is quite apparent from this table that the yield trends were just reversed in cut 1. Few of the species when found in mixtures, yielded more than their respective pure stands, and therefore most gave a competition index of less than 1.0. In this category, were found all the grasses, all of which appeared to be much suppressed by their associated legumes.

In this first cut red clover in mixtures 1, 2, 5 and 6,

Table 9

Average Yield per Unit Area of Ground Cover of the Grass and Legume Components (gm.)
Pasture Mixtures and Pure Stands, Cut 1, 1961.

Mixt. No.	Timothy	Brome	R.canary	Kent.Blue	Red Clover	Alfalfa	Ladino	Bf.trefoil	Alsike
	Components								
1	4.8				18.3				
2	7.9				16.8	14.7			
3	8.5				13.1				16.8
4	5.8				15.2		7.6		
5	7.1				17.0	23.5	9.1		
6	4.4				16.1			8.6	
7	3.0					45.4			
8	8.0					41.8	13.4		
9	2.9					16.9		11.3	
10	5.1								17.2
11	4.0							10.8	
12	6.9						16.6		
13		6.9						11.7	
14			15.8					15.2	
15				4.6				9.7	
vii	5.5						10.8	14.9	
viii	9.2	1.8					11.9	8.6	
ix	3.8	2.4				40.1			
Pure Stands	24.9	26.4	36.6	15.5	15.4	23.4	16.2	12.3	

Ave. of Blocks C, D, and E, F.
Underscored values in this and the following four tables indicate a competition index greater than 1.0.

alfalfa in mixtures 5, 7, 8 and (ix), Ladino in mixture 12, trefoil in mixture 14 and (vii) competed favorably with their associated species.

In cut 2, table 10, the competition pressure that the species were exerting on each other was even more apparent. Only 3 species in 5 different mixtures were able to assert themselves and produce more per unit area of ground cover than their respective pure stands. Of these, again, there were none of the grass species. Red clover in mixture 1 only, alfalfa in mixtures 9 and (ix) and Ladino in mixtures (vii) and (viii), were able to attain a competition index of more than 1.0.

However, it is of some interest to note that grasses in the mixtures, with some exception, doubled or tripled their yields per unit area. At the same time though some of their respective pure stands also increased their $Y./_{U.A.}$. Reed canary and timothy actually decreased in $Y./_{U.\ A.}$.

Table 11 relates the average $Y./_{U.A.}$ of cut 3, obtained by 2 slightly different methods. The values under (b) represent these obtained from a point quadrat analysis taken at cutting time. Then, if the yields of (a) were representative of a unit area of ground cover after a week or two of regrowth, those under (b) represented yields per unit area of a ground cover, which at the time of cutting appeared to be near a maximum, for certain species. Then, in other words, whereas in the first instance, the results indicated, to some extent, the ability of a species to yield, when having a certain ground

Table 10 Average Yield per Unit Area of Ground Cover of the Grass and Legume Components (gm.) Pasture Mixtures and Pure Stands, Cut 2, 1961.

Mixt. No.	Components Timothy	Brome	R.canary	Kent.Blue	Red Clover	Alfalfa	Ladino	Bf.trefoil	Alsike
1	12.2				30.5				
2	8.4				26.0	28.0			
3	14.4				25.5				9.1
4	9.4				15.3		16.1		
5	9.5				14.2	4.2	19.5		
6	18.9				27.1			14.2	
7	10.8					35.8			
8	9.9					22.8	18.9		
9	12.6					58.0		22.8	
10	16.9								11.7
11	14.9							23.5	
12	18.0						20.5		
13		9.3						22.0	
14			7.8					29.6	
15				2.9				21.8	
vii	19.3						27.2	5.8	
viii	18.5	1.4					25.2	6.0	
ix	6.4	1.4				162.3			
Pure Stands	51.7	36.4	32.6	44.8	28.3	55.6	23.1	31.5	

Ave. of Blocks C, D, and E, F.

Table 11 Average Yield per Unit Area of Ground Cover of the Grass and Legume Components (gm.) Pasture Mixtures and Pure Stands, Cut 3, 1961.

Mixt. No.	Tim. a	Tim. b	Br. a	Br. b	R.can.	K.B.	R.C. a	R.C. b	Af. a	Af. b	Lad. a	Lad. b	B.T. a	B.T. b	As.
1	5.9	1.9					29.3	12.5							
2	3.4						20.0		51.4						
3	6.2						24.2								2.3
4	6.1	1.0					9.7	4.8			20.4	12.7			
5	4.8						17.0		24.0		19.5				
6	7.2	2.4					18.8	9.3					7.3	2.8	
7	1.9								69.0						
8	5.8	0.7							58.9	7.4	21.6	11.9			
9	8.8	2.6							59.6	19.9			12.4	6.1	
10	13.6														4.3
11	10.6	2.0											17.6	6.7	
12	4.1	1.3									23.2	13.7			
13			6.9	3.4									15.5	9.9	
14					7.1								13.8		
15						8.0							15.3		
vii	2.4	0.9									19.5	12.4	0.8	0.4	
viii	5.8	0.6	0.9	0.2							24.0	13.9	2.4	0.8	
ix	2.1		2.2						144.9						
Pure Stands	12.6	5.6	16.7	6.6	--	--	30.1	14.3	29.6	13.6	18.7	14.0	13.6	8.8	

Ave. of blocks C, D and E, F except for R. canary which is from B and D.
a represent ave. from the standard method.
b represent ave. when point quadrat analysis was done at the time of cutting.

cover, in the 2nd instance the yield of a species is related to a maximum ground cover.

On observing the yield per unit area of ground cover under (a) of the results of table 11, it is noted that, alfalfa, Ladino clover and trefoil in certain mixtures were less subject to adverse effects of the associated species, then in previous cuts. Thus alfalfa in mixture 2, Ladino in mixtures 4 and 5, alfalfa in mixture 7, alfalfa and Ladino in mixture 8, alfalfa in mixtures 9 and (ix), trefoil in mixture 11, Ladino in 12, trefoil in 13, 14, and ladino in (vii) and (viii), all of these gave a competition index greater than 1.0. Red clover in mixture 1, had an index just slightly less than 1.0 and therefore was not much different than in the previous cuts.

The grasses, contrary to their behaviour in cut 2 showed an overall decrease in both the mixtures and the pure stands, therefore showing little change in their competition index. An exception to this was timothy in mixture 10, which despite a decrease, gave an index greater than 1.0

In table 12 appear only a fraction of the mixtures of the experiment (see materials and methods), with the average yields per unit area of ground cover. This table was obtained from tables A62 and A63. In these, the unseparated part of the sub-plot was recorded as grams per square metre, and left as such. Since the entire sub-plot was separated, there were no percent composition to be entered. The contribution to the mixtures by the individual species, however, was recorded in

Brome-trefoil and timothy-alfalfa-
trefoil mixtures. Block C July 25.1961

Kentucky bluegrass-trefoil
mixture. Block C. July 25.1961

Timothy-red clover-trefoil mixture
Block C. Note improved PQ. July 25.1961

grams per plot, which was obtained in multiplying by the figure 8. (1 sub-plot = 1/8 of a plot approx.). This was done to bring the yields per unit area to gm/point/plot, as in previous cuts.

The results of table 12, of the 4th cut were obtained in the same manner as the (b) values of cut 3, i.e., the ground cover data were obtained from an analysis done at cutting time.

In this cut timothy gave competition indices greater than 1.0 in three instances, i.e., in mixture 4, 6 and (viii). Fewer of the legumes were able to yield more in mixtures than in pure stands. Of these, red clover in mixture 9, Ladino in mixture 4 and 12 gave a competition index greater than 1.0. However red clover in mixture 1, alfalfa in mixture 9 and Ladino clover in mixture (viii), were very close for an index of 1.0. Trefoil in all mixtures appeared to have been set back by the associated species, (or itself).

The results of table 13, cut 5, were obtained in the regular manner. It is worthwhile to note from this table that the grasses improved in their ability to yield. So much so that timothy in 5 different mixtures, as well as reed canary and Kentucky blue grass were able to give competition indices greater than 1.0. This was the timothy in mixtures, 1, 6, 9, 11 and (vii).

Also red clover in mixture 6 and alfalfa in mixtures 8 and 9 competed favorably with their associated species, ladino in mixture 4 was the only one to give an index of 1.0, but ladino in mixture 12 and (viii), was not very much below 1.0.

Table 12 Average Yield per Unit Area of Ground Cover of the Grass and Legume Components (gm.) Pasture Mixtures, Cut 4, 1961.

Mixt. No.	Timothy	Brome	R.canary	Kent.Blue	Red Clover	Alfalfa	Ladino	Bf.trefoil
				Components				
1	2.2				7.7			
4	7.8				3.0		11.5	
6	4.4				9.2			3.8
8	1.7					4.7	9.6	
9	3.2					6.0		6.7
11	2.6							8.1
12	2.9						11.3	
13		3.4						9.8
14			4.5					7.7
15				4.7				7.5
vii	3.2						8.9	1.9
viii	4.6	2.4					10.7	1.2
Pure Stands	4.0	3.6	9.0	8.3	7.9	6.2	10.8	11.0

Ave. of blocks c, D and E, F. (obtained at cutting time)

Table 13 Average Yield per Unit Area of Ground Cover of the Grass and Legume Components (gm.) Pasture Mixtures, Cut 5, 1961.

Mixt. No.	Components							
	Timothy	Brome	R.canary	Kent.Blue	Red Clover	Alfalfa	Ladino	Bf.trefoil
1	5.5				7.3			
4	2.5				4.8		8.8	
6	7.0				9.1			2.5
8	4.9					33.7	6.4	
9	6.2					20.4		2.8
11	7.1							2.8
12	2.9						8.0	
13		4.3						3.2
14			9.1					2.7
15				11.6				2.9
vii	5.8						7.2	2.5
viii	2.3	3.9					8.0	1.9
Pure Stands	5.1	5.5	8.4	7.5	8.1	15.5	8.1	4.9

Ave. of blocks C, D and E, F.

None of the trefoils yielded well.

b) <u>Seasonal Averages, cuts 1, 2, 3</u>

In Table A72 appears the analysis of variance of the pure stands, in A73 of grasses, including the pure stands of timothy and brome, and in A74 the analysis of variance of the legumes also including their respective pure stands except alsike. These analyses of variance were performed on the data of tables 14, 15 and 16.

No significant F value was obtained for species in the pure stands, and a high coefficient of variability. An F significant to the 1% level was obtained for grasses and a CV of 46.6% which is rather high. Significance for both legume species and replications was obtained in the analysis of the yield per unit area of the legumes, and the CV (21.8%) was less than half of the one of the grasses.

Following the analysis of variance "Duncan's Multiple Range" test was applied on both the grasses and legumes with their respective pure stands.

The results are reported in table 17. As expected the pure stands showed relatively high values in the grasses and were significantly different than all the grasses in mixtures. There were little significant differences between the grasses in mixtures. Brome in mixture (viii) and (ix) was much suppressed but was significantly different from timothy in mixture 12.

Table 14

Seasonal Average Yield per Unit Area of Ground Cover
of the Pure Stands (gm)
Pasture Mixture Cut 1, 2, 3 1961

	Blocks									
	E					F				
Species	Total DM	Ave. % Comp.	Total DM of Species	Total Ground Cover	Ave. Yield per Unit Area	Total DM	Ave. % Comp.	Total DM of Species	Total Ground Cover	Ave. Yield per Unit Area
Tim.	5475	95.0	5203	164	31.7	5815	95.8	5572	160	34.8
R.C.	4325	97.0	4197	164	25.6	4063	98.0	3980	188	21.2
Af	1803	91.3	1646	46	35.8	2475	92.8	2298	74	31.1
Br.	4358	18.8	3435	174	19.7	4872	87.9	4281	100	42.8
Lad.	4640	99.7	4628	226	20.5	4297	99.3	4266	226	18.9
B.T.	4215	96.0	4046	222	18.2	3753	96.3	3614	160	22.6
R.can	3633	88.9	3225	96	33.6					
K.Blue	4981	98.9	4925	144	34.2					

R.can & K.Blue ave. of cut 1 & 2 only

Table 15 Seasonal Average Yield per Unit Area of Ground Cover of the Grass Components (gm)
Pasture Mixtures Cut 1, 2, 3 1961

	Blocks									
	C					D				
Mixture No.	Total DM	Ave. % Comp.	Total DM of Component	Total Ground Cover	Ave. Yield per Unit Area	Total DM	Ave. % Comp.	Total DM of Component	Total Ground Cover	Ave. Yield per Unit Area
Tim. 1	4588	8.6	394	46	8.6	4534	12.3	559	62	9.0
2	5010	10.9	544	52	10.5	4462	11.3	505	54	9.4
3	4449	11.5	512	44	11.6	4550	12.5	569	64	8.9
4	4869	8.8	427	76	5.6	5036	9.1	456	46	9.9
5	5135	7.0	362	56	6.5	5009	8.5	424	44	9.6
6	4700	11.7	548	74	7.4	4591	13.7	627	72	8.7
7	2614	28.0	732	120	6.1	5635	9.1	513	102	5.0
8	5112	10.3	529	46	11.5	5596	7.0	391	62	6.3
9	4181	18.5	773	88	8.8	4139	16.5	681	112	6.1
10	4540	9.2	417	48	8.7	3482	20.2	702	58	12.1
11	3927	15.8	620	76	8.2	3582	22.9	821	88	9.3
12	4641	14.4	667	94	7.1	5267	14.0	740	36	20.6
vii	4675	14.9	695	64	10.9	4702	12.4	585	54	10.8
viii	4732	11.7	556	44	12.6	4963	9.8	487	42	11.6
ix	2600	21.0	546	110	5.0	1543	24.8	382	92	4.2
Br. 13	4117	11.0	453	54	8.4	3616	13.6	493	70	7.0
viii	4675	0.3	15	16	0.9	4963	1.1	53	30	1.8
ix	2600	3.1	80	38	2.1	1543	5.9	91	44	2.1
R.can 14	B4306	1.8	78	14	5.6	3972	4.5	179	14	12.8
K.Bl 15	4084	11.8	482	86	5.6	2332	16.0	373	80	4.7

Table 16 Seasonal Average Yield per Unit Area of Ground Cover of the Legume Components (gm) Pasture Mixtures Cut 1, 2, 3 1961

		Blocks									
		C					D				
Mixture No.		Total DM	Ave. % Comp.	Total DM of Component	Total Ground Cover	Ave. Yield per Unit Area	Total DM	Ave. % Comp.	Total DM of Component	Total Ground Cover	Ave. Yield per Unit Area
R.C.	1	4588	91.2	4185	162	25.8	4534	85.1	3860	164	23.5
	2	5010	71.3	3570	192	18.6	4462	80.1	3575	158	22.6
	3	4449	52.6	2342	126	18.6	4550	51.5	2343	104	22.5
	4	4869	39.8	1936	144	13.4	5036	37.9	1910	142	13.5
	5	5135	35.8	1839	102	18.0	5009	39.5	1978	140	14.1
	6	4700	74.6	3505	176	19.9	4591	74.7	3428	178	19.3
Af.	2	5010	14.1	705	22	32.0	4462	8.2	366	22	16.6
	5	5135	9.8	501	16	31.3	5009	6.1	306	28	10.9
	7	2614	57.3	1497	22	68.0	5635	88.2	4970	110	45.2
	8	5112	18.4	942	30	31.4	5596	27.9	1560	44	35.5
	9	4181	14.7	615	14	43.9	4139	27.8	1149	36	31.9
	ix	2600	74.4	1934	22	87.9	1543	64.9	1001	12	83.4
Lad.	4	4869	51.5	2507	138	18.2	5036	51.7	2603	182	14.3
	5	5135	47.1	2420	134	18.1	5009	45.2	2265	152	14.9
	8	5112	69.0	3529	196	18.0	5596	64.5	3609	206	17.5
	12	4641	85.2	3955	194	20.4	5267	85.9	4526	234	19.3
	vii	4675	76.0	3554	182	19.5	4702	73.9	3477	178	19.5
	viii	4732	74.8	3540	166	21.3	4963	77.4	3839	184	20.9
B.T.	6	4700	12.6	593	62	9.6	4591	11.3	519	50	10.4
	9	4181	64.6	2701	158	17.1	4139	53.6	2220	146	15.2
	11	3927	82.4	3236	144	22.5	3582	73.7	2639	152	17.4

Table 16 continued.

Mixture No.		C Total DM	C Ave. % Comp.	C Total DM of Component	C Total Ground Cover	C Ave. Yield per Unit Area	D Total DM	D Ave. % Comp.	D Total DM of Component	D Total Ground Cover	D Ave. Yield per Unit Area
B.T.	13	4117	81.5	3355	160	21.0	3616	81.0	2930	208	14.1
	14	B4306	85.0	3662	198	18.5	3972	71.0	2821	148	19.1
	15	4084	84.3	3443	166	20.7	2332	74.9	1746	148	11.8
	vii	4675	8.1	380	82	4.6	4702	13.0	610	54	11.3
	viii	4732	11.7	555	106	5.2	4963	11.8	586	68	8.6
As	3	4449	34.1	1520	154	9.9	4550	33.2	1509	104	14.5
	10	4540	37.6	1705	156	10.9	3482	77.7	2706	196	13.8

In the legumes more striking differences were obtained. The pure stand of alfalfa was significantly different from both the trefoil and Ladino pure stand, but not so from the red clover. This difference however did not show in the analysis of variance of the pure stands alone. The mean yields per unit area of ground cover of alfalfa in mixtures 7 and (ix) were significantly different from each other. Also both of these yielded significantly more than the respective pure stand. Furthermore alfalfa in mixtures 7, 8, 9, (ix) yielded significantly more than any other pure stand except red clover, and more than any other species in mixtures except alfalfa in mixture 2 and red clover in mixture 1.

Red clovers in mixtures were not significantly different from the pure stands, neither were they different between each other.

Similarly there was no significant difference between Ladino in pure stands and Ladino in mixtures, neither was there a significant difference between the Ladino in mixtures. The yield per unit area of trefoil pure stand was significantly different only from the least yielding trefoils in mixtures (vii) and (viii).

Since alsike did not have a pure stand, it was not compared in that manner. Yet it is worth noting that its yield per unit area in mixture 3 and 10 was only significantly different from red clover in mixture 1 and was not significantly different from alfalfa in mixture 5. Also alsike in mixture 3 did not

Table 17. Seasonal Mean Yield per Unit Area of Ground Cover of Grasses and Legumes in Mixtures and in Pure Stands. Cut 1, 2, 3 1961. Duncan's Multiple Range Test at the 5% Level.

Grasses

Pure Tim.	33.25	a
Pure Br.	31.25	a
Tim. 1	8.8	bc
2	9.95	
3	10.25	
4	7.75	
5	8.05	
6	8.05	
7	5.55	
8	8.90	
9	7.45	
10	10.40	
11	8.75	
12	13.85	b
vii	10.85	bc
viii	12.10	
ix	4.60	
Br. 13	7.70	
viii	1.35	c
ix	2.10	c
R.can14	9.20)	not
K.Bl.15	5.15)	tested

Legumes

R.C. 1	24.65	de
2	20.60	efg
3	20.55	efg
4	13.45	efghi
5	16.05	efghi
6	19.60	efgh
Pure R.C.	23.40	def
Pure Af	33.45	cd
Af 2	24.30	def
5	21.10	efg
7	56.60	b
8	33.45	cd
9	37.90	c
ix	85.65	a
Pure Lad.	19.70	efgh
Lad. 4	16.25	efghi
5	16.50	efghi
8	17.75	efghi
12	19.85	efgh
vii	19.50	efgh
viii	21.10	efg
Pure B.T.	20.40	efg
B.T. 6	10.00	ghi
9	16.15	efghi
11	19.95	efgh
13	17.55	efghi
14	18.80	efghi
15	16.25	efghi
vii	7.95	hi
viii	6.85	i
As. 3	12.20	fghi
10	12.35	ghi

Means with the same lower case letter(s) are not significantly different at the F .05 level.

yield significantly less than alfalfa in mixture 2.

In table 18 appears the seasonal average of the yields per unit area of ground cover, of all the species obtained from cuts 1, 2, 3, and as calculated in tables 14, 15, 16. Table 19 shows the average competition indices of each species as well as those of each mixture.

From table 18 it can be observed that none of the grass species gave a mean yield for cuts 1, 2 and 3 that was greater than the mean $Y./_{U.A.}$ of their respective stands. Of the red clover only the one in mixture 1 yielded more than the pure stand. This was apparent from all cuts; however the difference was not significant. Alfalfa in 4 of the mixtures had a competition index greater than 1.0. But only alfalfa in 7 and (ix) was significantly greater than the pure stand. Ladino in mixtures 12 and (viii) gave an index greater than 1.0, Ladino in (vii) came close to one. Birdsfoot trefoil did not have any competition index equal to 1.0. But trefoil in mixture 11 gave an index of .98 and in mixture 14 of .93.

The competition indices of table 19 show that mixture (ix) gave the highest compatability between species with an index of .98. This mixture was followed by (vii) with .82 and by #8, 9 with indices of .70 and .68 respectively. However, the significances of the differences were not established.

Table 18 Seasonal Average Yield per Unit Area of Ground Cover of the Grass and Legume Components (gm.) Pasture Mixtures and Pure Stands, Cuts 1, 2, 3. 1961.

Mixt. No.	Timothy	Brome	R.canary	Kent.Blue	Red Clover	Alfalfa	Ladino	Bf.trefoil	Alsike
					Components				
1	8.8-				24.7				
2	9.9-				20.4	24.3			
3	10.0-				20.4				11.7
4	7.2-				13.4		16.0		
5	7.9-				15.8	18.3	16.4		
6	8.0-				19.6			9.9	
7	5.6-					49.0+			
8	8.5-					33.8	17.8		
9	7.3-					35.3		16.2	
10	10.6-								12.5
11	8.9							19.8	
12	10.1-						19.8		
13		7.6-						17.1	
14			9.2					18.7	
15				5.2				16.5	
vii	10.8-						19.5	7.3-	
viii	12.1	1.5-					21.1	6.6-	
ix	4.6-	2.1-				86.3+			
Pure Stand	33.3	28.2	33.6	34.2	23.2	32.9	19.7	20.1	

Underscored values indicate a competition index greater than 1.0.
+ indicates values significantly greater than those of the respective pure stands. Duncan's test at the 5% level.
- indicates values significantly smaller than those of the respective pure stands. Duncan's test at the 5% level.

Table 19. Average Competition Indices
Pasture Mixtures. Cut 1, 2, 3.

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af	Lad.	B.T.	Mixtures
1	.26				1.06				.59
2	.39				.88	.74			.61
3	.30				.88				(.76)
4	.22				.58		.81		.48
5	.24				.68	.56	.83		.54
6	.24				.84			.49	.49
7	.17					1.49			.82
8	.25					1.03	.90		.70
9	.22					1.07		.81	.68
10	.32								(.50)
11	.27							.98	.54
12	.30						1.00		.56
13		.27						.85	.51
14			.27					.93	.52
15				.15				.82	.40
vii	.33						.99	.36	.51
viii	.36	.05					1.07	.33	.41
ix	.14	.07				2.63			.98

Indices of mixtures 3 and 10 were obtained by giving alsike a competition index of 1.0

III. Hay Mixtures and their Pure Stands

1. Yields of Dry Matter

a) Pure Stands

Table A75 shows the yields of DM of each individual species in every block of each 3 cuts obtained. An analysis of variance has been performed on each cut and on the season's total. Differences existing between species have been analyzed with Duncan's multiple range test, and the summary of these is presented in table 20 of the text.

For all cuts, as well as the season's total a highly significant F value for treatments was obtained. Cuts 2 and 3 gave standard errors of their respective means that were twice as great as these of cut 1 and the season's total. Yet cuts 2 and 3 had the lowest coefficient of variability.

The pure stand of alfalfa, which was the highest yielding species in every cut, ranked first and was significantly different from all other species on a seasonal average, which was based on the average of 3 cuts obtained during the season. However it was not significantly different from mixture (i), which was included in blocks E and F, nor from the red clover and alsike pure stands in cut 1. It was significantly different from all in cut 2, but not from mixture (i), red clover and trefoil in cut 3.

Ladino was the lowest yielding species almost throughout

Table 20. Yields as Pounds of Dry Matter per Acre. Pure Stands 1961 Hay Mixtures. Experiment II

Treatment		Cut 1		Cut 2		Cut 3		Total	
i	Tim.R.C.	5730	a	1748	b	1820	ab	9298	b
ii	R.C.	5459	abc	1845	b	1702	ab	9006	b
iii	As.	5622	ab	890	d	-	-	6512	cd
iv	Af.	6423	a	2651	a	1942	a	11016	a
v	Lad.	3315	d	1576	bc	214	d	5105	d
vi	B.T.	4204	d	2025	b	1727	ab	7956	b
vii	Brome	4453	bcd	1103	cd	1385	bc	6941	c
viii	Tim.	4392	cd	1163	cd	1059	c	6614	cd
SE$\bar{x}$ (lb/A.)		339.49		148.50		140.80		467.08	
CV		9.7%		12.9%		14.2%		8.5%	
Treat. F		9.02**		14.54**		18.42**		16.46**	

Means followed by the same lower case letter are not significantly different from each other at the 5% level. Duncan's Multiple Range Test.

the season. It was not, however, significantly different in yield from trefoil, brome and timothy in the first cut. Its performance was better in the 2nd cut, when no significant difference was obtained between it and mixture (i), red clover, trefoil, brome and timothy. In the 3rd cut it yielded significantly less than any other species except alsike, which had so little regrowth that it was not cut. On a seasonal basis Ladino gave the least amount of dry matter per acre, yet this was not significantly different from alsike and timothy.

The timothy, red clover mixture and the red clover pure stand yielded similarly throughout the season. Both of these, and birdsfoot trefoil were not significantly different and came second in rank. Also, brome and timothy gave a pattern of dry matter production that was similar. Throughout the season they were never significantly different. Alsike yielded only well in the first cut, when it was among the top producers.

b) Hay Mixtures

In tables A76 to A78 appear the DM yields of the hay mixtures, obtained for each block in every cut. Analysis of variances were done on each cut and the total yields of the season. Duncan's test was also used to compare differences existing between means, and the summary appears in table 21. The variance for treatment was significant at the 5% level in cut 1, at the 1% level in cut 2 and not significant in cut 3. The season's totals gave an F value for treatments that was highly

Table 21. Yields as Pounds of Dry Matter per Acre. Hay Mixture 1961.

Experiment II

Mixtures	Cut 1	Cut 2	Cut 3	Total
1. Tim.,R.C.,Af.	6238 b	3277 a	2156 a	11947 ab
2. Tim.,R.C.,Af.,Lad.	6282 b	3166 a	2145 a	11593 abc
3. Tim.,R.C.,As.	6162 b	2062 b	2319 a	10544 de
4. Tim.,R.C.,Lad.	5928 b	2214 b	2030 a	10172 e
5. Tim.,R.C.,B.T.v.	6457 ab	2445 b	2392 a	11294 bcd
6. Tim.,R.C.,B.T.e.	6046 b	2185 b	2327 a	10559 de
7. Tim.,R.C.,B.T.m.	6302 b	2346 b	2277 a	10925 cde
8. Brome,Af.	7103 a	3072 a	2233 a	12408 a
9. Tim.,B.T.v.	5965 b	2439 b	2289 a	10693 cde
SE$\bar{x}$ (lb/A.)	206.79	157.35	73.90	315.44
CV	6.6%	12.2%	6.6%	5.7%
Treat.F.	3.07*	8.70**	2.31(F.05:2.36)	5.48**

Means followed by the same lower case letters are not significantly different from each other at the 5% level. Duncan's Multiple Range Test.

significant.

From table 21 it can be noted that the alfalfa-brome mixture in cut 1 gave the highest yield, but this was not significantly different from mixture 5. In cut 2 this was also the case, but the difference between its yields and those of mixture 1 and 2 was not significant.

On a seasonal basis the performance of mixture 8, was outstanding and the dry matter yield obtained for the 3 cuts were significantly higher than those of all other mixtures, except mixtures 1 and 2. Mixture 1, 2 and 5 did not give differences among each other that were statistically significant, and neither did mixtures 2, 5, 7 and 9, although mixture 2 was yielding significantly more than mixtures 3, 4, and 6. Mixture 4 was the lowest yielding, but was not significantly different from 3, 6, 7 and 9.

2. Percentage Composition and Point Quadrat Analysis

a) Pure Stands

Tables A79 to A81 relate the results obtained from hand separations and point quadrat analysis of the pure stands and one supplemental mixture. The same data as for pasture mixtures is presented, i.e., percentage composition, hits, ground cover and density for the seeded species and "others". A summary of these data is presented in table 22, in which the results appear in the form of averages of each cut.

The percentage contribution to the total yield, of these

Table 22. Percentage Composition and Point Quadrat Analysis. Pure Stands 1961. Hay Mixtures.

Experiment II

Species		Cut 1 % Comp.	Cut 1 Ground Cover	Cut 2 % Comp.	Cut 2 Ground Cover	Cut 2 Density	Cut 3 % Comp.
i	Tim.	21.8	16	23.6	12	16	22.4
	R.C.	77.8	64	73.9	25	40	71.4
	Others	0.4	tr.	2.5	1	1	6.2
	B.G.		28		43	43	
ii	R.C.	92.8	74	95.4	33	54	87.8
	Others	7.2	tr.	4.6	5	5	12.2
	B.G.		26		63	63	
iii	As	98.6	79	12.0	14	18	
	Others	1.4	tr.	88.0	2	2	
	B.G.		21		84	84	
iv	Af.	99.5	59	98.1	36	46	98.7
	Others	0.5	tr.	1.9	4	4	1.3
	B.G.		41		61	61	
v	Lad.	94.8	77	97.3	87	142	84.0
	Others	5.2	tr.	2.7	1	1	16.0
	B.G.		23		13	13	
vi	B.T.	87.2	47	88.2	33	41	83.6
	Others	12.8	tr.	11.8	9	9	16.4
	B.G.		53		60	60	
vii	Br.	92.8	50	86.4	24	31	88.2
	Others	7.2	tr.	13.6	21	21	11.8
	B.G.		50		59	59	
viii	Tim.	84.1	48	92.8	21	29	77.7
	Others	15.9	tr.	7.2	14	14	22.3
	B.G.		52		65	65	

pure stands treated as hay remained high throughout the season. The percentage composition of alsike, which was as low as 12% in the 2nd cut and insignificant in the 3rd cut, was the only exception to this generality. It is obvious then that "others" did not add much to the sward, and the weeds were therefore no problem.

The ground cover of the pure stands in proportion to that of "others" was smaller than would be indicated by the percentage composition. This was a direct consequence of the large amount of bare ground obtained for certain species. In the first cut the number of hits on bare ground in alfalfa, trefoil, brome and timothy stands amounted to about the same number as the hits on these species themselves. In no case, in this cut was there any ground cover recorded for "others".

In the 2nd cut the bare ground increased considerably in the red clover and alsike stands which was probably the direct result of disease in red clover and poor recovery of alsike. Also the ground cover of alfalfa, brome, trefoil and timothy decreased to some extent. This was accompanied by an increase in "others" in the stand of both of these species.

Data on density was obtained only in cut 2. It can be seen that the magnitude of the density values was dependent on the type of species involved, i.e., relatively high for the legumes and low for the grasses. Ladino gave a density of 142, timothy one of 29. Alsike with a density of 18 was the exception. No point quadrat analysis was performed on cut 3.

b) The Hay Mixtures

The detailed results from the hand separations and point quadrat analysis of the mixtures are presented for every cut in tables A82 to A85. A summary of these results appears in table 23 in the form of averages.

The percentage contributed by each species to the total yield of the mixture was relatively constant throughout the season, except the contribution made by alsike to mixture 3, which decreased from 37% to 1% in cut 2 and only a trace in cut 3.

The grasses contributed relatively little in the complex mixtures, but were yielding better in the cuts 1 and 2 of the simple mixtures 1, 7 and 8. Timothy in all cuts of mixture (1) made up a little over 20% of the stand. In mixture 9 it contributed 35% in the first cut, 25% in the 2nd and 14% in the 3rd cut. It averaged approximately 13% of the total yield in mixture 7, 14% in mixture 6 and close to or more than 8% in mixtures 5, 4 and 3. It was insignificant in mixtures 1 and 2. Brome in mixture 8 had a percentage of 39, 18 and 38 in cuts 1, 2 and 3 respectively.

When red clover was not in association with alfalfa, i.e., in mixtures 3, 4, 5, 6 and 7 it contributed, on an average, close to 80% of the yield. In mixtures 1 and 2 this decreased to less than 10% on an average basis. Alfalfa supplied 80% or more of the yield in its respective mixtures. Birdsfoot trefoil yielded well, only in the simple mixture 9, in which its mean percentage was close to 68%, for the season. Of the

Table 23. Percentage Composition and Point Quadrat Analysis. Hay Mixtures 1961.

Experiment II

Mixtures	Cuts 1 % Comp.	1 Ground Cover	2 % Comp.	2 Ground Cover	2 Density	3 % Comp.
1. Tim.	3	6	4	4	4	0.22
R.C.	25	57	11	18	22	1
Af.	71	61	82	30	36	97
Others	1	7	3	3	3	2
B.G.		7		52	52	
2. Tim.	6	12	3	6	6	1.82
R.C.	23	44	12	12	18	0.5
Af.	66	63	80	20	24	96
Lad.	5	34	4	12	14	2
Others	tr.	3	1	5	5	tr.
B.G.		-		56	56	
3. Tim.	5	3	12	3	3	7
R.C.	55	75	82	32	43	84
As	37	58	2	6	6	tr.
Others	3	5	4	2	2	9
B.G.		7		61	61	
4. Tim.	5	8	10	4	4	8
R.C.	82	69	71	38	54	73
Lad.	11	51	17	20	32	16
Others	2	21	2	1	1	3
B.G.		7		34	34	
5. Tim.	6	16	11	5	7	6
R.C.	86	82	84	50	88	83
B.T.v.	6	42	3	3	4	8
Others	2	18	2	1	1	3
B.G.		3		44	44	
6. Tim.	14	13	13	4	6	14
R.C.	79	84	81	39	60	80
B.T.e.	3	31	3	2	3	1
Others	4	7	3	2	2	5
B.G.		8		55	55	

continued/

Table 23. continued

Mixtures	Cuts 1 % Comp.	Cuts 1 Ground Cover	Cuts 2 % Comp.	Cuts 2 Ground Cover	Cuts 2 Density	Cuts 3 % Comp.
7. Tim.	12	14	13	12	13	15
R.C.	77	73	78	40	62	79
B.T.m.	7	47	5	6	6	3
Others	4	10	4	tr.	1	3
B.G.		3		46	46	
8. Br.	39	44	18	33	38	2
Af.	61	69	82	28	32	98
Others	tr.	6	tr.	2	2	tr.
B.G.		15		42	42	
9. Tim.	35	39	25	22	27	14
B.T.v.	50	55	73	42	56	83
Others	15	32	2	3	4	3
B.G.		20		40	40	

B.T.v.: Variety Viking; B.T.e.: Variety Empire;
B.T.m.: Selection of Morshansk.

three varieties used in mixture with red clover and timothy, Viking produced most with approximately 8% of the total yield.

In the first cut, averages obtained from the point quadrat analysis, of blocks only, indicated a relatively low bare ground.

It appears that in general the ground cover of the species in the various mixtures followed a distribution which was similar to that of the percentage composition. An exception to this, was trefoil which had ground cover of 42, 31, 47 in mixtures 5, 6, and 7, whereas its contribution to the dry matter of the sward was less than 8% in all 3 cases.

In cut 2 a general decrease in ground cover was experienced. This drop may have been due, either to disease in certain species or due to the fact that not much regrowth had taken place at the time of analysis.

In mixture (i) of the 1st cut red clover covered 4 times as much ground as timothy, in cut 2 this was changed to half as much. In mixture 1 red clover covered nearly as much ground as alfalfa, in cut 2 it was little more than half of that of alfalfa. In mixture 2 the ground cover of red clover, alfalfa and Ladino was approximately in the proportion 1: 1.5: 0.75 in the 2nd this changed to 1: 2: 1 approximately. In cut 3 red clover decreased from 75% to 32% ground cover, but alsike experienced an even worse decline, i.e., from 58% to 6%.

In mixture 4 the proportion of red clover:Ladino was in the order of 1.3: 1 approximately in the first cut and 1.9 : 1 in the 2nd cut. In mixtures 5, 6 and 7 as already reported the ground cover of trefoil was relatively high in the first cut only. The proportion of red clover - trefoil was on the average 2 : 1 in the first cut and 11 : 1 in the second cut.

In mixture 8 alfalfa decreased considerably in ground cover after the first cut when it was 69%, as to 44% for brome. In the second cut this had changed to 28% for alfalfa and 33% for brome.

Also mixture 9 decreased in ground cover yet the proportion of the 2 species, i.e., timothy, trefoil stayed very much the same, 1 : 1.4, from the first cut to the 2nd cut.

3. Yield per Unit Area of Ground Cover in Hay Mixtures and Pure Stands

It should be noted once more that yields under this heading refer to yields per unit area of ground cover.

In table A86 appear the calculations and results of the pure stands in cut 1 and 2. In tables A87 to A92 appear those of the grasses and legumes, when in mixture, of cuts 1 and 2, and table A93 shows a summary of the average yields of the grasses and legumes in cut 2. The calculations of the seasonal averages of the pure stands, grasses and legumes are presented in table A96.

A summary of the average yields of both cut 1 and 2, of the grasses, legumes and pure stands appears in table 24.

This table, which was organized in the same manner as these of the pasture mixtures, shows in one column the $Y./_{U.A.}$ of

Table 24. Average Yield per Unit Area of Ground Cover of Hay Mixtures and Pure Stands 1961. (Cut 1 and 2) (gm)

Mixt. No.	Timothy Cut1	Timothy Cut2	Brome Cut1	Brome Cut2	Red Clover Cut1	Red Clover Cut2	Alfalfa Cut1	Alfalfa Cut2	Ladino Cut1	Ladino Cut2	Birdsfoot trefoil Cut1	Birdsfoot trefoil Cut2	Alsike Cut1	Alsike Cut2
(i)	75.8	31.4			64.1	46.7								
1	50.9	23.9			21.0	11.5	70.1	53.2						
2	31.1	11.0			33.1	19.3	45.3	70.9	14.8	6.3				
3	115.7	85.0			38.2	55.0							34.8	6.1
4	40.2	47.0			62.7	34.6			10.6	14.8				
5	38.3	46.0			58.9	36.2					9.2	21.0		
6	33.5	59.9			66.5	44.1					4.9	21.2		
7	41.3	22.5			60.5	40.7					9.7	17.9		
8			60.5	10.8			58.3	59.4						
9	41.1	24.2									45.0	36.2		
Pure Stands	68.7	46.5	74.9	35.8	65.1	37.4	97.3	65.4	37.0	16.0	71.9	49.0	63.7	6.9

Cut 1 is average of blocks A and D only.
No significant differences in the grasses of both cuts.

cut 1 and in the other $Y./_{U.A.}$ of cut 2. The competition indices appear in tables A94 and A95, for cuts 1 and 2 respectively.

From table 24, it can be observed that timothy in the first cut of mixtures (i) and 3 yielded more than the pure stand. In mixture 3 this was 115.7 gm. per unit area of ground cover, which gave an index of 1.87. In cut 2 of mixture (i) it yielded less than the pure stand, but it yielded close to or more than the pure stand in mixture 3, 4, 5, 6 and 7. Brome in both cuts produced less dry matter per unit area of ground cover than the pure stand.

It should be noted here that an analysis of variance on the grasses, tables A99 and A100, did not show any significance for treatments in either cut . A high error variance and therefore high coefficients of variability, 84.8% and 94.3% respectively were obtained in cut 1 and 2. This may be attributed to large variabilities in both hand separations and point quadrat analysis where extremely low populations are encountered, which was the case for the grasses in these hay mixtures.

Red clover, in mixture 6, was the only legume species to yield more than the pure stand in cut 1. However in cut 2, when it was found in mixtures (i), 3, 6 and 7, it was superior to the pure stands, and in mixtures 4 and 5 came close to it.

Alfalfa in mixture 1 of cut 1, gave a relatively high yield, in mixture 2 of cut 2 it produced more than the pure stand.

In no case did Ladino, trefoil and alsike yield more than their respective pure stands. Trefoil in mixtures 5, 6 and 7 appears to have suffered heavily from competition of the associated species. The composition indices were .13, .07 and .14 respectively for Viking, Empire and Morshansk, in cut 1. In cut 2 they were .43, .54 and .28 respectively.

Alsike in cut 2 gave an index close to 1.0, which was not quite as expected.

A summary of the average performance, for the season, of the pure stands, grasses and legumes obtained from table A96 is shown in table 25. The respective competition indices appear in table 26.

That only timothy in mixture 3 and red clover in mixture (1) yielded more than their respective pure stands is outstanding from this table. However, the analysis of variance, table A98, performed on the grasses, shows once more no significance between treatments. A high error variance and high CV of 70.4% were obtained.

Timothy in mixture (1) produced approximately the same amount of dry matter per unit area of ground cover, as the pure stand. Very little difference can be observed when it was in mixtures 4, 5 and 6. It gave the lowest index when it was in association with red clover and Morshansk trefoil in mixture 7. Brome was very similar to the latter in mixture 8.

The highest yielding red clover was obtained when it was associated with timothy alone. In mixtures 3, 4, 5, 6 and 7 the competition indices that were calculated were much the same.

Table 25. Seasonal Average Yield per Unit Area of Ground Cover. (gm) Hay Mixtures and Pure Stands. Cut 1, 2, 1961.

Mixt. No.	Tim.	Brome	R.C.	Af.	Lad.	B.T.	As.
(i)	56.8		59.2				
1	33.2		17.3-	61.7-			
2	21.7		28.1-	55.8	11.3		
3	95.4		45.9				30.2
4	43.6		48.0		12.5		
5	41.2		46.4			10.7 -	
6	44.3		52.6			7.2 -	
7	29.4		50.1			11.2 -	
8		29.2		58.8 -			
9	32.8					39.7 -	
Pure Stands	61.9	62.2	57.0	85.2	25.9	62.4	54.7

Underscored values indicate a competition index greater than 1.0
(-)Indicates values significantly smaller than these of the respective Pure Stands. Duncan's Test at the 5% level.

Table 26. Average Competition Indices of Hay Mixtures. Cut 1, 2, 1961.

Mixt. No.	Tim.	Brome	R.C.	Af.	Lad.	B.T.	As.	Mixture
(i)	.92		1.04					.98
1	.54		.30	.72				.55
2	.35		.49	.65	.44			.51
3	1.54		.80				.55	.99
4	.70		.84		.48			.72
5	.67		.81			.17		.54
6	.72		.92			.12		.57
7	.47		.88			.18		.50
8		.47		.69				.60
9	.53					.64		.58

The lowest yielding red clover was recorded when it was found with timothy and alfalfa.

In mixture 2 the addition of Ladino seems to have boosted red clover to some extent, i.e., from a yield of 17.3 gm. in mixture 1, it increased to 28.1 gm. in mixture 2.

Although the alfalfa was found to achieve the highest yields per unit area under a hay management, it did not in any mixture outyield its pure stand. It gave the highest amount of dry matter per unit area of ground cover in mixture 1, which would probably explain the lowest yield of red clover recorded in the mixture.

Ladino yielded very poorly as a result of its association in mixtures 2 and 4. Its competition indices were even lower than that of alsike, which was .55.

As in each individual cut the poor ability of trefoil to compete was also reflected in the average of the 2 cuts. The highest production of trefoil per unit area of ground cover was attained when it was seeded with timothy. The lowest yield was experienced when Empire trefoil was in mixture 6, thus giving an index of competition of .12. Viking and Morshansk had an index of .17 and .18 respectively.

The competition index of a mixture as a whole is also shown on table 26. It can be noted from these indices that mixtures (1) and 3 were highest with .98 and .99 respectively. It may therefore be assumed that the compatibility between the species involved, in these 2 mixtures was nearest to the ideal for hay mixtures. This however may not necessarily indicate that such mixtures will be the highest yielding, since mixture 4 which had an index of .71, gave the lowest yield per acre. All other mixture indices ranged between a low of .50 and .60.

Table A97 and A101 show the analysis of variance performed on the total yield per unit area of ground for the season, of the pure stands and legumes respectively. For both, significance between treatments was obtained. The CV's were 13.2% and 21.3% respectively. From these, it appears that the variation due to error in the legumes, was about of the same magnitude as in the pasture mixtures.

Duncan's test which is found in table 27 shows, differences existing between species. From the pure stands alone it is noted that the significant differences existing between the legumes were of the same order as when these pure stands were incorporated among the "legumes" in mixtures. On table 26 under "Pure Stands" it is seen that alfalfa yielded significantly more than red clover, alsike and Ladino, but was not significantly different from trefoil. Red clover was not significantly different from trefoil and alsike, but produced significantly more than Ladino. The latter two were not significantly different from each other.

Brome and timothy in pure stands yielded significantly less than alfalfa, but not less than red clover or trefoil. They yielded significantly more than alsike or Ladino.

Of the legumes in pure stands and in mixtures, alfalfa seeded alone gave an outstandingly high yield. It produced

Table 27. Mean Seasonal Yield per Unit Area of Ground Cover of Pure Stands and Legumes. Hay Mixtures. Cut 1 and 2, 1961.

Pure Stand

Timothy	115.25	b
Red Clover	103.15	bc
Alfalfa	162.80	a
Brome	112.05	b
Ladino	52.95	d
Birdsfoot trefoil	132.25	ab
Alsike	70.50	cd

Means followed by the same lower case letter are not significantly different from each other at the 5% level. Duncan's Multiple Range Test.

Legumes

Mixture No.		Y./Unit Area	
Pure Red Clover		103.15	cde
"	i	112.50	bcde
"	1	38.05	gh
"	2	45.80	fgh
"	3	102.75	cde
"	4	103.55	bcde
"	5	103.05	cde
"	6	105.55	bcde
"	7	106.00	bcde
Pure Alfalfa		162.80	a
"	1	114.10	bcd
"	2	146.10	ab
"	8	115.85	bcd
Pure Ladino		52.95	fgh
"	2	26.20	h
"	4	28.40	h
Pure B.T.		132.25	abc
"	5	32.40	gh
"	6	14.75	h
"	7	37.90	gh
"	9	84.55	def
Pure Alsike		70.50	efg
"	3	39.65	fgh

Mean total for this analysis was obtained of blocks A and D only.

significantly more dry matter per unit area of ground cover than any legume species in pure or mixture form, other than the alfalfa in mixture 2, and trefoil alone.

The following were not significantly different in their yields: pure trefoil, pure red clover, red clover in mixtures (1), 3, 4, 5, 6, 7, alfalfa in mixtures 1 and 8. Birdsfoot trefoil in mixture 9, was significantly different from any of the above, except from its pure stand. It was not significantly different either from red clover in mixture 2, pure Ladino, pure alsike and alsike in mixture 3. However red clover in mixture 1, Ladino in 2 and 4, trefoil in 5, 6 and 7 yielded significantly less than all other species in the various mixtures, but not less than pure Ladino, pure alsike, alsike in mixture 3 and red clover in mixture 2.

If the comparison is made within a species only it was found that red clover in pure stand yielded significantly more than red clover in mixture 1 and 2 only, that alfalfa yielded significantly more, when in pure stand than alfalfa in mixture 1 and 8, that pure Ladino did not yield significantly more than Ladino in mixtures, neither did alsike, and that the yields per unit area of ground cover of the pure trefoil was significantly greater than any of the yields of trefoil in mixtures.

IV. A Study of Relationships Existing in Ground Cover Density $Y./_{U.A.}$ in Different Cuts and at Different Angles of P. Q. Inclinations. Pasture Mixtures and Pure Stands

Correlation coefficients were calculated for ground cover, density and $Y./_{U.A.}$ between cuts, blocks (i) and angles of inclination of the point quadrat. This was done for the pasture mixtures and their pure stands only. The objective was to evaluate the relationships that could exist among these variables, between cuts, blocks and angles of inclination. All correlation coefficients obtained are reported in table 28.

1. Between Cuts. a) Ground Cover. In this study pure stands, grasses and legumes were compared individually. Significant correlations were obtained in all three cases when comparing the[(i)] fall cut of 1960 and the first cut of 1961. When this fall cut was correlated with the fall cut of 1961 no real correlation was obtained. Cuts 1 and 2 and cuts 1 and 3 gave significant correlations for grasses and legumes, Only legumes showed significance between cut 1 and cut 5. The relationship of cut 2 and cut 3 was significant for grasses and legumes, and of cut 2 and cut 5 for pure stands and legumes. A significant coefficient was obtained for pure stands, grasses and legumes when cut 3 and cut 5 at an angle of inclination of 45° were correlated.

The inferences that could be made from these correlation

(i) differences in soil types existed between blocks.

Table 28. Correlations in Pasture Mixtures. (Reps. E, F, C and D)

1. Between Cuts

(i) Ground Cover

		P.S.		Gr.		Leg.
Fall 1960 vs Spring 1961	n:8	.79*	n:20	.56*	n:26	.50**
Fall 1960 vs Fall 1961	"	.64	n:13	.03	n:16	.47
Cut 1 vs Cut 2	"	.56	n:20	.65**	n:26	.81**
Cut 1 vs Cut 3	"	.54	n:18	.53*	n:26	.72**
Cut 1 vs Cut 5	"	.56	n:13	.50	n:16	.67**
Cut 2 vs Cut 3	"	.45	n:18	.70**	n:26	.90**
Cut 2 vs Cut 5	"	.72*	n:13	.49	n:16	.65**
Cut 3 (45°) vs Cut 5 45°	"	.94**	n:13	.84**	n:16	.88**

(ii) Density

Cut 2 vs Cut 3	n:8	.70	n:18	.45	n:26	.72*
Cut 2 vs Cut 5	"	.75*	n:13	.47	n:16	.52*
Cut 3 (45°) vs Cut 5(45°)	n:6	.71	n:13	.80*	n:16	.82*

(iii) Yield per Unit Area of Ground Cover

Fall 1960 vs Spring 1961	n:8	-.44	n:20	.53*	n:26	.79**
Fall 1960 vs Fall 1961	"	.55	n:13	.16	n:16	.87**
Cut 1 vs Cut 2	"	.23	n:20	.24	n:26	.42*
Cut 1 vs Cut 3	"	.07	n:18	-.08	n:26	.72**
Cut 1 vs Cut 5	"	.16	n:13	.10	n:16	.87**
Cut 2 vs Cut 3	"	.07	n:18	.28	n:26	.84**
Cut 2 vs Cut 5	"	.40	n:13	.31	n:16	.38
Cut 3(45°) vs Cut 5(45°)	n:6	.97*	n:13	.26	n:16	.87**

(iv) Competition Index of Mixtures

Fall 1960 vs Spring 1961	.72**	n:16
Fall 1960 vs Cut 2 1961	-.19	"
Fall 1960 vs Cut 3 1961	.35	"
Cut 1 vs Cut 2	.004	"
Cut 1 vs Cut 3	.07	"
Cut 2 vs Cut 3	.68**	"

One and 2 asterisks mean significant at the 5% and 1% level.

continued/

coefficients obtained are, that recording the first hit on each species to obtain a ground cover value by the point quadrat method was fairly reliable, for legumes especially since a large amount of variability was accounted for in many instances, that ground cover from cut to cut was very consistent for legumes and less so for grasses and therefore that other factors such as soil differences, differences in establishment, changes in, and low populations etc. played a more important role in grasses than in legumes.

b) Density. As mentioned some time prior to this density was not recorded in all cuts and of every block. For this reason correlation coefficients were only obtained in cuts 2, 3, and 5. Significant correlations were obtained in all 3 cases. of the legumes. The pure stands gave a statistically real correlation in comparing cuts 2 and 5 and also the grasses, (as for ground cover, in cut 3, 5 at 45°.) This latter correlation may imply that a 45° angle is much more appropriate for grasses since significant correlations that account for more than 64% of the variability can be obtained. Since good correlations were again obtained for legumes, density may be considered a reliable measurement for legumes.

c) Yield per Unit Area of Ground Cover. In the 3rd part of this first study the relationship that existed between cuts in $Y./_{U.A.}$ was determined. All legume cuts gave significant correlations except the comparison cut 2 and 5.

Only the fall 1960 cut related to the spring cut of 1961 was significant in grasses, and cut 3 and 5 at 45^{o} for pure stands.

Since there exists a good relationship in the $Y./_{U.A.}$ between cuts in legumes, the implication would be that the $Y./_{U.A.}$ method may be used with a certain amount of confidence for the legume species. As for the grasses the same inference cannot be made, but it could be that the variability observed may be due to other factors, than the inadequacy of the methods used to evaluate the grass species.

The basis for this statement being that significant correlations were obtained in some instances.

d) Competition index of mixtures. The relationship existing between mixture competition indices of different cuts was tested with 16 mixtures. Significant correlations were obtained between fall '60 cut and the spring '61 cut, and cut 2 vs cut 3.

These results exclude variabilities due to soil, environment, establishment etc. since they existed in both pure stands and mixtures and both of these gave the competition indices (see materials and methods). On this basis then, no correlations between cuts may imply that different trends of competition acted in different cuts, that inherent variability existed either for mixtures or pure stands alone and did not appear in all cuts.

A significant relationship may indicate that the competition varied in the same manner in every mixture from cut to cut.

2. <u>Between Blocks</u>

<u>Cut 1</u>. A significant correlation was obtained in comparing the ground cover of legumes in blocks C vs D. The dry matter the grasses contributed to the sward was also significant, which seems to exclude variation due to soil, microclimate etc. as being the reason of not obtaining a significant correlation of ground cover in block C vs D, in grasses. However the variability accounted for by this correlation is too small to be really confident in this statement.

<u>Cut 2.</u> In this cut the same results as above were obtained, which may confirm the suspicions that were aroused previously, namely about the adequacy of the ground cover measurement obtained for grasses.

3. <u>Between Angles</u>

This study was mostly done in pure stands and from the correlation coefficients that have been obtained, table 28, it appears that in taking ground cover measurements the angles 29°, 32.5° and 45° are all equally satisfactory. That for density and yield per unit area the inclinations of 29° and 32.5° were especially suitable, for legumes. It seems that these results can be considered with confidence since in most cases 64% of the variability was accounted for.

This study indicated that grasses gave the least consistent measurements of ground cover, density and yield per unit area, that density and ground cover were more instrumental in showing

Table 28. continued

2. Between Blocks

(i) Cut 1

Ground Cover	Cut 1	C vs D	n:14 .15	n:21 $.80^{**}$
DM of Components	"	"	n:14 $.56^{*}$	
Total DM	"	"	n:14 .42	

(ii) Cut 2

Ground Cover	Cut 2	"	n:14 .30	n:21 $.86^{**}$
DM of Components	"	"	n:14 $.55^{*}$	
Total DM	"	"	n:14 .17	

3. Between Angles

(i) Ground Cover	29^{o} vs 45^{o}	n:6 $.85^{*}$		
	29^{o} vs 32.5^{o}	n:6 $.88^{*}$	n:11 .55	n:16 $.94^{*}$
	32.5^{o} vs 45^{o}	n:6 $.84^{*}$		
(ii) Density	29^{o} vs 45^{o}	n:6 .44		
	29^{o} vs 32.5^{o}	n:6 $.82^{*}$	n:11 .51	n:16 $.94^{**}$
	32.5^{o} vs 45^{o}	n:6 .64		
(iii) Y./U.A.	29^{o} vs 45^{o}	n:6 .73		
	29^{o} vs 32.5^{o}	n:6 $.85^{*}$	n:11 .58	n:16 $.69^{**}$
	32.5^{o} vs 45^{o}	n:6 .49		

The correlations 29^{o} vs 32.5^{o} could also read: "point quadrat readings taken between 2 cuts vs at cutting time". (in Cut 3)

"n" refers to the number of pairs used in calculating the coefficient of correlation.

One and 2 asterisks mean significant at the 5% and 1% level respectively.

this inconsistency, but that significant correlations can be obtained with ease in legumes for all 3 types of evaluations of the swards (stands) and also in the grasses, in some instances.

V. Relationships Existing Between Grasses and Legumes in Ground Cover, Density and $Y./_{U.A.}$ of Ground Cover Hay and Pasture Mixtures

The correlation coefficient obtained from the relationships existing in density, ground cover and $Y./_{U.A.}$ between grasses and legumes are shown in table 29.

Only one significant correlation was obtained under the hay management, and that was in comparing the ground cover of the grasses versus the legumes in cut 1.

In the pasture mixtures significant correlations were obtained in density and ground cover of cut 1, in ground cover of cut 3, in density of cut 5 and in ground cover of the fall 1960 cut.

It is apparent from these correlations that there exists a negative relationship between the grasses and legumes, under both hay and pasture management, in density and ground cover. This would indicate then that a dense stand of legume resulted into a thin stand of grass and that a dense grass stand may be due only to a poor establishment of the legume species.

No definite trend was apparent from the correlations obtained of the $Y./_{U.A.}$. A negative correlation may suggest that as the yield of the legume species goes up that of the grasses

Table 29. Correlations of Timothy and Other Grasses (C and D Ave.) in Hay and Pasture Mixtures.

	Ave. Density	Ave. Ground Cover	Ave. Y./V.A. of G.C.	No. of Pairs in "r"
Hay Cut 1	-	-.80*	-.10(A83,A84)	10
Cut 2	-.430	-.30	.02(A85-A88)	10
Pasture				
Cut 1	-.843**	-.75**	.31(A51,A52)	12
Cut 2	-.312	-.50	-.38(A54,56)	12
Cut 3	-.525	-.60*	-.51(A58,A60)	12
(Grasses)				
Cut 4	-.321	-.22	-.19(A62,A63)	11
" Cut 5	-.777**	-.30	.02(A64,A65)	13
Fall 1960	-	-.58*	.28(A49,A50)	13

Figures in brackets refer to the appendix table from which the correlation coefficients were calculated.

One and 2 asterisks mean significant at the 5% and 1% level respectively.

Table 30. Correlations of Number of Components in the Mixtures vs Competition Indices of the Hay and Pasture Mixtures.

		"r"	No. of pairs in "r"
Hay	Cut 1	-.51	10
	Cut 2	.12	10
Pasture	Cut 1	-.14	16
	Cut 2	-.06	16
	Cut 3	-.12	16
	Cut 4	-.10	12
	Cut 5	.01	12
	Fall 1960	-.22	12

goes down, the reverse being not necessarily true. Also that an increase in the yield per unit area of ground cover in the legumes, may result in an increase of the competition effects on the grasses.

Whether a positive correlation was a result of a beneficial effect of the legumes on the grasses cannot be implied. However it may indicate that the ability to compete of the grasses was enhanced by some factors not related to their inherent competitiveness.

VI. Relationships Existing Between the Number of Components in a Mixture and the Respective Competition Index.

Hay and Pasture Mixtures

The object of this study was to determine whether the number of components in a mixture had any effect on the competition index of that mixture. Table 30 shows the correlation coefficients that were obtained.

There were no significant correlations in either the hay or the pasture mixtures. This would indicate that the number of components in a mixture did not affect the competition index to any great extent. However there appeared to be a trend, suggesting that an increase in the number of components would have the effect of decreasing the compatibility of the species involved, since the competition indices of the mixtures would decrease. This trend was indicated by the fact that most coefficients were negative.

VII. Results on Photosynthetic Area Index and Net Assimilation Rate

A. Pasture Mixtures. Point Quadrat Method

a) Cut 3. Just before the 3rd cut was harvested some point quadrat readings were obtained on certain pasture mixtures with the improved PQ apparatus. This analysis was done at an angle of inclination of 32.5^{o} and every hit was recorded. This permitted the calculation of a photosynthetic area index, which is similar to the leaf area index obtained by Warren Wilson (1959). However the correction factor 1·1 proposed by Warren Wilson was not applied. (Table A102).

It should be mentioned that the PA in this instance was equal to the density as used previously and that the PAI was equal to the density/$_{100}$.

From the PA thus calculated and the yield of a species in pure stand or in mixture, a value for NAR was evaluated. The data and results are reported in table A10.2 In table 31 appears the summary of the PAI and NAR values, together with the respective Y./$_{U.A.}$ of G.C. values obtained in cut 3, table 11. Although a restricted number of results were secured for this little study, table 31 shows certain trends in the different ways of measuring competition. It may be noted that in the three methods the grasses in the mixtures gave relatively low values as compared to their respective pure stands. Also the red clover in mixture 1 had competition indices that were

Table 31 (i) Average Values. Y/U.A., PAI, NAR.
Pasture Mixtures Cut 3

Mixt. No.	Yield/Unit Area G.C.				PAI (ii)				NAR (ii)			
	Tim.	Br.	R.C.	B.T.	Tim.	Br.	R.C.	B.T.	Tim.	Br.	R.C.	B.T.
1	1.9		12.5		0.41		2.14		.143		.550	
6	2.4		9.3	2.8	0.40		2.34	0.68	.230		.478	.178
13		3.4		9.9		0.55		3.28		.176		.415
Pure Stands	5.6	6.6	14.3	8.8	2.30	2.24	2.61	3.50	.255	.304	.616	.344
Competition Indices												
1	.34		.87		.18		.82		.56		.89	
6	.43		.65	.32	.17		.90	.19	.90		.78	.52
13		.52		1.12		.25		.94		.58		1.21

(i) Averages of blocks C and D.
(ii) Values obtained from table A 102

much alike and that trefoil in mixture 13 had a competition index of close to or more than 1.0 in the methods used.

b) Cut 3. A similar but more extensive study was done on the regrowth of the 3rd cut. Photosynthetic area values were obtained from PQ readings taken on the uncut borders of the plots; The net assimilation rates were calculated for each species in the mixtures. (Table A103.)

In table 32 appear the averages of two blocks of the PAI and NAR values. It will be noted that of the two methods used, in none of the mixtures did the grasses reach a competition index of 1.0, neither did red clover or alfalfa. Ladino in mixtures 8, 12, (vii) and (viii) had a PAI greater than the pure stands, whereas the NAR in mixtures 4, 3, 12 and (viii) was greater than the NAR of the pure stand. The PAI of trefoil in mixture 9 was greater than that of the pure stand, but this was not so for the NAR. The NAR of trefoil in mixture 13 was greater than that of the pure stand.

When, as for study (a) the PAI and NAR methods of studying competition are compared to the values of $Y./_{U.A.}$ of G.C. of cut 3, table 11, then it is seen that there exist consistent trends. Thus in all three methods none of the grass species under study produced a competition of 1.0 or greater, neither did the red clover. Also that timothy in mixtures 6, 9, and 11 and red clover in mixture 1, gave the highest competition indices in all three methods.

Table 32 Average PAI and NAR of Species in Mixtures and Pure Stands and their Respective Competition Indices. Pasture Mixtures Cut 3 1961 (Obtained by PQ Method)

	PAI						NAR					
Mixture	Tim.	Brome	R.C.	Af.	Lad.	B.T.	Tim.	Brome	R.C.	Af.	Lad.	B.T.
1	0.50		2.35				.130		.508			
4	0.35		0.95		2.45		.074		.279		.584	
6	0.50		2.25			0.80	.208		.496			.190
8	.40			0.55	3.25		.068			.506	.500	
9	.65			0.40(i)		3.55	.228			.676(i)		.283
11	1.00					3.20	.172					.274
12	.40				3.30		.082				.534	
13		.40				3.15		.229				.426
vii	.30				3.60	0.30	.068				.480	.037
viii	.55	.25			3.30	0.50	.039	.015			.584	.072
Pure Stands	2.30	2.24	2.61	1.20(ii)	3.10	3.50	.255	.304	.616	.845(ii)	.492	.344
Competition Indices												
1	.22		.90				.51		.82			
4	.15		.36		.79		.29		.45		1.19	
6	.21		.86			.23	.82		.81			.55
8	.17			.46	1.05		.27			.60	1.02	
9	.28			.33		1.01	.89			.80		.82
11	.43					.91	.67					.80
12	.17				1.06		.32				1.09	
13		.18				.90		.75				1.24
vii	.13				1.16	.09	.27				.98	.11
viii	.24	.11			1.06	.14	.15	.05			1.19	.21

(i) Not averages. Obtained from D only.
(ii) " " " " F only.

Alfalfa in mixtures 8 and 9 did not follow such a consistent trend since it had obtained a competition index greater than 1.0 when measuring Y./$_{U.A.}$ of G.C. and not so when measuring PAI or NAR by PQ. Ladino except in mixture 4 and (vii) obtained competition indices greater than 1.0 by all three methods. The competition indices for birdsfoot were much the same when obtained by all three methods.

B. Pasture Mixtures. Disc Method

The "disc method" as used in the heading, refers to the way which was used to obtain the PAI in this study, so as to differentiate from the PQ method used above.

The results obtained for the 4th cut are shown in tables A104 - A106. A summary of these, is presented in the same manner as for Y./$_{U.A.}$ of G.C. in table 33. However in this series the competition indices are shown in the same table, which permits a better interpretation of the PAI and NAR values as obtained for the species in the mixtures in comparison to the values of the pure stands.

Analyses of variance of the grasses and legumes allowed the use of Duncan's multiple range test, (Robinson 1959), to compare the means. The results of these are found in tables A113 - A116, A121 and A123.

It might be stated here that this form of analysis was done on all data concerning PAI and NAR of hay and pasture mixtures as obtained by the "disc method". It permitted a direct statistical comparison of the values secured for the species

Table 33 Average PAI and NAR of Species in Mixtures and Pure Stands, and their Respective Competition Indices. Pasture Mixtures Cut 4 1961

	PAI								NAR							
Mixt.	Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.	Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.
1	.34				2.46				.283				.428			
4	.62				0.50$^-$		3.47		.142$^-$				.298$^-$		.454	
6	.50				2.36			.62$^-$	.302				.437			.354$^-$
8	.52					.60	4.61		.098$^-$					.350$^-$	.378	
9	.80					1.01		2.20	.354					.428		.490
11	.57							2.84	.468							.452
12	.08						5.14$^+$		.132$^-$						.408	
13		.42						2.38		.378						.526
14			.16					2.84			.130					.479
15				2.08				2.04$^-$				.324				.402$^-$
vii	.03						3.52	0.66$^-$	.068$^-$						.466	.154$^-$
viii	.10	.06					4.22	0.22$^-$	.133$^-$	.090$^-$					.453	.165$^-$
Pure Stands	.68	.89	2.7	1.8	2.17	1.22	3.61	3.34	.390	.447	.408	.526	.456	.494	.498	.538
Competition Indices																
1	.50				1.13				0.73				.94			
4	.91				.23		0.96		.36				.65		.91	
6	.74				1.09			.19	.77				.96			.66
8	.76					0.49	1.28		.25					.71	.76	
9	1.18					0.83		.66	.91					.87		.92
11	.84							.85	1.20							.84
12	.12						1.42		.34						.82	
13		.47						.71		.85						.98
14			.06					.85			.32					.89
15				1.16				.61				.62				.75
vii	.04						0.98	.20	.17						.94	.29
viii	.14	.07					1.17	.07	.34	.20					.91	.31

\+ indicates values significantly greater than those of the respective pure stands, Duncan's Test at the 5% level.

\- indicates values significantly smaller than those of the respective pure stands, Duncan's Test at the 5% level.

in mixtures with their respective pure stands. Thus photosynthetic area and net assimilation rate indices of species in mixtures followed by a (+) or (-) were significantly different from their pure stands and did not, therefore, occur in the same grouping. They were either significantly greater or smaller than their respective pure stands.

In table 33 it can be observed that the PAI of red clover in mixture 4, of trefoil in mixtures 6, 15, (vii) and (viii) were significantly smaller than PAI of their pure stands. Ladino in mixture 12 gave a PAI that was significantly greater than its pure stand which was not shown by the corresponding NAR. This would suggest that Ladino, in its association with timothy is favored in the production of photosynthetic area, but suppressed in its rate to produce dry matter, i.e., depressed in its efficiency.

None of the PAI's obtained for grasses differed significantly from their pure stands, but the net assimilation rates of timothy in mixtures 4, 8, 12, (vii) and (viii) were significantly smaller than the NAR of the pure stand. It is of interest to note that in all five cases, timothy was associated with Ladino alone or Ladino plus another species, and that this legume had a depressing effect on timothy in this experiment. It is probable that the high CV (72.3%) obtained in the analysis of variance of the PAI values for grasses, explains the absence of significance between the pure stands and the species in the mixture. The CV of the NAR values for grasses was only 23.5%.

Similarly the NAR of red clover in mixture 4, alfalfa in mixture 8, trefoil in (vii) and (viii) appears to have been suppressed by ladino, since it was significantly smaller than the NAR of the respective pure stands. However, trefoil in mixtures 6 and 15 had also an NAR that was significantly smaller than that of the pure stand. Red clover and Kentucky blue grass may have a similar depressing effect on the efficiency of trefoil.

The underscored values indicate competition indices greater than 1.0. Thus, by measuring the PA, timothy in mixture 9 had a competition index of 1.18, Kentucky blue grass in 15 of 1.16, red clover in 1 and 6 of 1.13 and 1.09 respectively, ladino in 8, 12 and (viii) of 1.28, 1.42, and 1.17 respectively. By measuring NAR, only timothy associated with trefoil gave a competition index greater than 1.0, namely 1.20.

Cut 5a. The data to obtain the PAI's and NAR's and the results of these for cut 5a are found in the appendix tables A103 to A105. The analyses of variance reported are in tables A113 to A116 and Duncan's test, as applied to the means of the PAI and NAR values of this cut are found in tables A121 for the grasses and A119 for the legumes.

The summary of these results is presented in table 34. A first glance on this table gives the impression that competition in this cut was quite severe for the grasses. Thus both PAI and NAR for timothy in mixtures, 1, 4, 6, 8, 12, (vii) and (viii) and brome in (viii) were significantly smaller than the

Table 34 Average PAI and NAR of Species in Mixtures and Pure Stands and their Respective Competition Indices. Pasture Mixtures Cut 5a 1961

	PAI								NAR							
Mixt.	Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.	Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.
1	.22$^-$				1.50				.374$^-$				.489			
4	.08$^-$				.32$^-$		3.14		.184$^-$				.298$^-$		.530	
6	.40$^-$				1.60			.25	.410$^-$				.530			.341$^-$
8	.04$^-$					.30	2.92		.128$^-$					.296$^-$	.528	
9	.57$^-$					.58		.54	.472$^-$					.447$^-$		.447
11	.52							.52	.585							.534
12	.06$^-$						4.12$^+$		.121$^-$						.541	
13		.51						.96		.514						.572
14			.04					.40			.135					.504
15				.67				.48				.454				.550
vii	.03$^-$						2.75		.072$^-$						.570	
viii	.06$^-$	.02$^-$					2.93	.03	.260$^-$	.180$^-$					.526	.072$^-$
Pure Stands	.69	.68	1.30	1.11	1.53	0.68	3.06	0.34	.600	.642	.498	.551	.500	.642	.558	.510
Competition Indices																
1	.32				.98				.62				.98			
4	.12				.21		1.03		.31				.60		.95	
6	.58				1.05			.74	.68				1.06		.95	.67
8	.06					.44	.95		.21					.46		
9	.83					.85		1.59	.79					.70		.88
11	.75							1.53	.98						.97	1.05
12	.09						1.35		.20							
13		.75						2.82		.80						1.12
14			.03					1.18			.27					.99
15				.60				1.41				.82				1.08
vii	0.04						.90		.12						1.02	
viii	0.09	.03					.96	.09	.43	.280					.94	.14

± Refer to table 33 for explanation.

PAI and NAR of the timothy and brome in pure stand.

Also red clover in mixture 4 had a PAI and a NAR that was significantly smaller than that of the pure stand. The efficiency of alfalfa in mixture 8 and 9 and of trefoil in mixture (viii) was significantly less than that of the respective pure stands.

Measuring competition with the PAI, red clover in mixture 6 had a competition index of 1.05, Ladino in 4 of 1.03 and in 12 of 1.35. In the latter the PAI was significantly greater than the PAI of the Ladino pure stand. Also trefoil in 9, 11, 13, 14, 15 gave indices that were greater than 1.0, when the PAI was used to measure competition.

When the NAR was used, red clover in mixture 6 gave an index of 1.06, ladino in 7 of 1.02, trefoil in 11, 13, and 15 of 1.05, 1.12, 1.08 respectively. Thus of the species mentioned, red clover in mixture 6, trefoil in mixture 11, 13 and 15 showed no competition effects of the associated species, by either method.

<u>Cut 5b</u>. In tables A110 to A112 appear the data and results of PAI's and NAR's of cut 5 (b and c).

As mentioned previously cut 5b represented the regrowth that had taken place from the 20th day to the 53rd day of the recovery period which gave cut 5 in the pasture mixtures. It was obtained by calculating the difference between the regrowth of the entire 53 day period and that of the first 20 days, which gave cut 5a. The 53 day recovery period was called cut 5c, and therefore represents the same type of study as cut 4.

The analyses of variance for grasses and legumes of 5b appear in tables A113 to A116. As regards the procedure used in computing negative values it should be mentioned that when these occurred rarely in any one table, they were considered as zero (0). However, in the PAI's of the legumes of cut 5b many negative values were obtained. These were made positive by increasing them and all the other PAI's of this cut by 0.5. This however did not change the results of the analysis of variance.

It should be explained that a negative PAI in this cut can be accounted for by the fact that there may have existed large variations between the halves of the sub-plots. And also that due to frost, a loss of green material, such as leaves, had occurred, towards the end of the season.

From what has been said, Duncan's test was only applied to the PAI means of the grasses in cut 5b. These and the other means from this cut appear in tables A121 and A123. The summary is shown in table 35. From this table it is seen that all the PAI means of the grasses in mixtures were significantly smaller than the pure stand PAI of timothy and brome.

Considering competition in this cut, it is observed that when measured by both PAI and NAR, red clover in mixture 6, Ladino in mixture 8 and (viii) gave an index greater than 1.0,

Table 35 Average PAI and NAR of Species in Mixtures and Pure Stands, and their Respective Competition Indices. Pasture Mixtures Cut 5b 1961

	PAI								NAR							
Mixt.	Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.	Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.
1	.15-				.80				.047				.032			
4	.04-				0		.40		.066				.003		.021	
6	.15-				1.08			.10	.045				.047			.026
8	.10-					.08	.96		.052					.050	.065	
9	.56-					.22		.30	.073					.048		.047
11	.16-							.42	.046							.066
12	.07-						.50		.054						.001	
13		.06-						.12		.038						.025
14			.13					.34			.116					.032
15				.48				.06				.050				0
vii	.05-						.47	.02	.126						.042	.046
viii	.04-	.11-					.70	.01	.030	.058					.033	.030
Pure Stands	1.17	0.92	.53	.52	.92	.28	.52	.92	.108	.042	.057	.044	.042	.052	.022	.128
Competition Indices																
1	.13				.87				.44				.76			
4	.03				0		.77		.61				.07		.95	
6	.13				1.17				.42				1.12			.20
8	.09					.29	1.85		.48					.96	2.95	
9	.48					.79			.68					.92		.37
11	.14								.43							.52
12	.06						.96		.50						.05	
13		.07								.90						.20
14			.25								2.04					.25
15				.92								1.14				0
vii	.04						.90		1.17						1.91	.36
viii	.03	.12					1.35		.28	1.38					1.50	.23

_ refer to table 33 for explanation.

i.e., red clover and Ladino in these mixtures behaved similarly to their pure stands.

Another observation that can be made from table 35 is that according to the PAI's obtained, there was very little growth in the last 33 days of this recovery period. Also that the efficiency of the plants had decreased considerably, with respect to dry matter production in the above-ground parts of the plants.

Cut 5c. The PAI means and the NAR means of 5c were compared with Duncan's test. This is shown in tables A123 and A124. A summary is presented in table 36. From it, it is noted that both the PAI and NAR of timothy in mixtures 1, 4, 8, 12, (vii) and (viii) and of brome in (viii) were significantly smaller than the PAI and NAR of the pure stand. This was so too of the PAI of timothy in mixtures 6, 9 and 11 and of brome in 13. Similarly red clover in mixture 4, trefoil in (vii) and (viii) gave PAI and NAR values that were significantly less than those of the pure stands. Also the NAR of trefoil in mixtures 6, 14, 15 were significantly smaller.

Looking at the competition indices, it is found that both methods the PAI and the NAR, showed an index greater than 1.0 for red clover in mixture 6, Ladino in 8, 12 and (viii). However by using the NAR, an index greater than 1.0 was also obtained for brome in 13, red clover in 1, alfalfa in 9, Ladino in 4, and (vii).

In comparing cut 4 and 5c, which are both representing a

Table 36 Average PAI and NAR of Species in Mixtures and Pure Stands and their Respective Competition Indices. Pasture Mixtures Cut 5c 1961

Mixt.	PAI Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.	NAR Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.
1	0.38$^-$				2.23				.183$^-$				$\underline{.246}$			
4	.08$^-$				.26$^-$		3.31		.098$^-$				.142$^-$		$\underline{.272}$	
6	.54$^-$				$\underline{2.66}$			.30	.226				$\underline{.262}$			.177
8	.14$^-$					.30	$\underline{3.88}$		.100$^-$					.214	$\underline{.271}$	
9	1.08$^-$					.72		.84	.280					$\underline{.270}$		.234
11	.68$^-$							.95	.292							.250
12	.11$^-$						$\underline{3.72}$		.094$^-$						$\underline{.272}$	
13		.56$^-$						1.08		$\underline{.280}$						.278
14			.17					.74			.122					.193$^-$
15				1.14				.39				.220				.181
vii	.08$^-$						3.22	.04$^-$	.116$^-$						$\underline{.316}^+$	.072$^-$
viii	.11$^-$	.14$^-$					$\underline{3.64}$	.04$^-$	.104$^-$	.101$^-$					$\underline{.280}$	.058$^-$
Pure Stands	1.86	1.60	1.84	1.63	2.44	0.95	3.57	1.26	.323	.238	.302	.275	.238	.240	.216	.284

Competition Indices

Mixt.	PAI Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.	NAR Tim.	Brome	R.can.	K.Blue	R.C.	Af.	Lad.	B.T.
1	.20				.91				.57				1.03			
4	.04				.11		.93		.30				.60		1.26	
6	.29				1.09			.24	.70				1.10			.62
8	.08					.32	1.09		.31					.89	1.25	
9	.58					.76		.67	.87					1.12		.82
11	.37							.75	.90							.88
12	.06						1.04		.29						1.26	
13		.35						.86		1.18						.98
14			.09					.59			.40					.68
15				.70				.31				.80				.64
vii	.04						.90	.03	.36						1.46	.25
viii	.06	.09					1.02	.03	.32	.42					1.89	.20

$\pm$ refer to table 33 for explanation.

complete regrowth period, it is seen that in cut 5c there were more PAI's and NAR values that were significantly smaller than the values of the pure stand. It is also seen that if the PAI of the species in pure stands had not changed very much between the two harvests, the NAR of cut 5c had decreased to nearly half of those of cut 4. This would explain the greater number of competition indices greater than 1.0 in cut 5c.

Totals of cut 4 and 5c. Following the analyses of each individual cut, the total of each species in mixture and pure stand for cut 4 and 5c was considered. The analyses of variance of this appear in table A117, and the means of the totals were compared with Duncan's test. The results of this test are shown in table A122 and A124. The summary of the mean is presented in table 37.

From this summary it is seen that as in cut 4, 5a and 5c, the PAI and the NAR of timothy in mixtures 4, 8, 12 and (vii) were significantly smaller than the PAI and NAR of the timothy pure stands. Also that red clover in mixture 4, trefoil in 6, 15, (vii) and (viii) gave PAI and NAR values that were significantly smaller than those of the respective pure stands.

From the competition indices it is noted that red clover in mixture 6, on an average of these 2 cuts was the only one to give an index greater than 1.0 by both methods. However red clover in mixture 1 had an index of 1.02 by the PAI method and 0.97 by the NAR method. Ladino in 4 had an index of 0.94 by the PAI and 0.95 by the NAR method. In mixture 8 this was

Table 37 Average PAI and NAR of Species in Mixtures and Pure Stands and their Respective Competition Indices. Pasture Mixtures Cut 4 and 5c 1961

Mixt.	PAI Tim.	PAI Brome	PAI R.can.	PAI K.Blue	PAI R.C.	PAI Af.	PAI Lad.	PAI B.T.	NAR Tim.	NAR Brome	NAR R.can.	NAR K.Blue	NAR R.C.	NAR Af.	NAR Lad.	NAR B.T.
1	0.72-				4.70				.237				.673			
4	0.70-				0.76-		6.78		.128-				.439-		.726	
6	1.04-				5.02			0.92-	.287				.699			.532-
8	0.66-					0.90	8.48		.110-					.564	.648	
9	1.88					1.74		3.03	.352					.698		.724
11	1.24-							3.79	.423							.702
12	0.20-						8.85		.082-						.680	
13		0.98-						3.46		.329						.804
14			.32					3.58			.162					.672
15				3.22				2.43-				.291				.582-
vii	0.10-						6.73	0.69-	.099-						.783	.226-
viii	0.22-	.20-					7.86	0.26-	.206	.174					.733	.222-
Pure Stands	2.51	2.52	(4.55)	(3.43)(i)	4.62	2.16	7.18	4.60	.373	.348	(.710)	(.801)	.694	.734	.765	.822
Competition Indices																
1	.29				1.02				.64				.97			
4	.28				.16		.94		.34				.63		.95	
6	.41				1.09			.20	.77				1.01			.65
8	.26					.42	1.18		.29					.77	.85	
9	.75					.81		.66	.94					.95		.88
11	.49							.82	1.13							.85
12	.08						1.23		.22						.89	
13		.39						.75		.95						.98
14			.07					.78			.23					.82
15				.94				.53				.36				.71
vii	.04						.94	.15	.27						1.02	.27
viii	.09	.08					1.09	.06	.55	.50					.96	.27

(i) Figures in ( ) are totals, since these grasses were not replicated.
\- Refer to table 33 for explanation.

for Ladino, 1.18 and 0.85 respectively; in mixture 12, 1.23 and 0.89, in (vii) 0.94 and 1.02 and in (viii) 1.09 and 0.96.

C. Hay Mixtures. Disc Method

The same procedure to evaluate competition by the PAI and NAR methods was used in cut 3 of the hay mixtures as in the pasture mixtures just reported.

The data for this study appear in the table A118. Analyses of variance of each of the grasses, legumes and pure stands were obtained and also with the pure stands incorporated into the grasses and legumes. It may be noted here that the analyses of variance of the grasses and legumes without the pure stands was done on the basis of four replications and that when these pure stands were incorporated into the grasses and legumes two replications only could be used for the analyses of variance since the pure stands were seeded in two blocks. Blocks A and D were picked randomly for these latter analyses of variance.

From the various analyses of variance, tables A119 and A120, the NAR values of the grasses and legumes alone were significant at the 5 and 1% level respectively. The PAI values of the pure stands and legumes were also significant at the 5 and 1% level respectively. Duncan's test was not applied to the means of these. When the pure stands were analyzed together with the grasses and legumes, the PAI's and the NAR values of the grasses were both significant at the 5% level. The PAI's of the legumes were significant at 1% and the NAR values showed no significance.

The comparisons of the various means are shown in table A125. A summary of this cut 3 is presented in table 38.

At first glance on this table it is striking to note the high PAI's of the legumes and their respective low NAR. The PAI of brome and red clover was the only one to be significantly smaller than the PAI of the pure stands, and that when they were in mixtures 8 and 1 respectively. Timothy in mixtures 1, 4, 5, and brome in 8 gave an NAR value that was significantly smaller than that of the timothy and brome pure stand.

Looking at the competition indices it is seen that red clover in mixture 5, alfalfa in mixture 8 and trefoil in mixture 9 gave an index of, 1.14, 1.10 and 1.40 respectively by the PAI method and 1.05, 1.05 and 1.27 respectively by the NAR method. Red clover in 4 and alfalfa in 1 also gave an index greater than 1.0 by the PAI method, and close to 1.0 by the NAR method.

Table 38 [i] Average PAI and NAR of Species in Mixtures and Pure Stands and their Respective Competition Indices

Hay Mixtures Cut 3 1961

Mixt.	PAI Tim.	PAI Brome	PAI R.C.	PAI Af.	PAI Lad.	PAI B.T.	NAR Tim.	NAR Brome	NAR R.C.	NAR Af.	NAR Lad.	NAR B.T.
i	1.64		3.33				.176		.152			
1	0.29		0.16$^-$	6.40			.088$^-$		.063$^-$	.176		
4	0.72		5.17		1.16		.147$^-$		.174		.131	
5	0.96		5.18			0.50	.124$^-$		.184			.160
8		1.00$^-$		5.04			.170			.219		
9	1.12					3.16		.096$^-$				.235
Pure Stands	2.28	3.91	4.54	4.59	1.38	2.26	.239	.220	.176	.208	.141	.185
Competition Indices												
i	.72		.73				.74		.86			
1	.13		.04	1.39			.37		.36	.85		
4	.32		1.14		.84		.62		.99		.93	
5	.42		1.14			.22	.52		1.05			.86
8	.49			1.10			.71			1.05		
9		.26				1.40		.44				1.27

(i) Averages have been obtained of the 2 blocks, A, D for mixtures and E,F for pure stands.

$^-$ Refer to table 33 for explanation.

DISCUSSION AND CONCLUSIONS

The results obtained for experiment I during the year of 1960 reflected the unfavorable, dry conditions that prevailed during the summer, the weed problem encountered in certain pure stands, and the lack of relation between the pure stands selected and the pasture mixtures studied.

In the second cut which were the first data available, for 1960, the yieldsper unit area of ground cover of timothy, brome and alfalfa pure stands were relatively large. Under competition conditions, the yields of brome and timothy, when associated with other species, were considerably lower than the yields of the pure stands. This was especially the case in the mixture in which the legume species were still present, as for example, alfalfa, trefoil and Ladino. However birds-foot trefoil in some mixtures appeared to have had a beneficial effect on timothy and brome.

It was rather difficult from table 3 to find any trends from the yields per unit area obtained during this first year of work. Whether certain species in certain mixtures yielded least or most, none did consistently so in the various cuts obtained. Except brome, which however occurred in only 2 mixtures. When it was associated with trefoil it consistently produced a larger amount of dry matter per unit area, than when it was associated with alfalfa.

The results of the small study pertaining to the time of doing the point quadrat analysis, in cut 5, were not sufficiently conclusive. Although the correlation coefficient obtained for timothy was significant at the 5% level, the coefficient was not large enough to formulate recommendations in the sense that PQ readings taken before cutting were no different from PQ readings taken after cutting. The variability accounted for was only 33%. Alfalfa gave a correlation coefficient which suggested that there was no relation between the two times of taking PQ readings.

Thus in 1961 the time of performing the analysis of the sward by PQ was chosen on the basis of the stage of growth that would give the best estimate of ground cover, which ground cover would then give the best estimate of the yield per unit area. Thus for 1961 it was decided that the PQ readings taken after a week or ten days of regrowth would give the best estimate of ground cover for the cut following the analysis.

A. Experiment II. Pasture Mixtures and Pure Stands

a) DM. Botanical Composition and PQ Analysis. In this experiment the pure stands of timothy and brome gave the largest yields (table 4). For the second half of the season, that is in cuts 3, 4, 5 for timothy and 4, 5 for brome, these 2 grasses were the lowest in yields. The explanation of such a behaviour, may be sought in the combined adverse effects of the weather and the weedicide used on these plots.

Among the legume pure stands the largest amount of dry matter was produced by Ladino clover, however red clover was not very different in its dry matter production. A poor establishment of the alfalfa stand was the reason for the low yields of this species at the beginning of the season. An improved stand, i.e., greater ground cover due to further germination during this season, permitted the alfalfa to yield as much as red clover, Ladino or birdsfoot trefoil in cuts 4 and 5.

Of the mixtures that occurred in blocks E and F, number (vii) and (viii) were yielding very much alike throughout the season. The only difference existing in these mixtures was the presence or absence of brome, which contributed very little to the sward.

Among the pasture mixtures, table 5, mixture 2, 4, 5 and 8 consistently produced some of the highest yields. Of these number 2, 4, 8 plus 9 produced the highest total yield of DM for the entire season. It may be of interest to note that all of these were made up of at least three species, i.e., one grass (timothy) and two legumes.

On a statistical basis, however, they were not significantly different from mixtures 3, 6, 7 and 12. The last two, being simple mixtures, were the only simple mixtures, out of 8 which were as productive per plot as the more complex associations.

The large apparent differences that existed between blocks were attributed to unfavorable soil moisture conditions in the year of establishment, differences in soil types and the volunteer Ladino clover problem.

The data obtained from hand separations and PQ analyses, which in turn gave the results of botanical composition and ground cover of each species were merely a means to an end in view of studying methods to measure competition. For this reason the results were presented in the form of a summary in tables 6 and 7. It was considered that a detailed discussion on these was unnecessary and it was judged to be sufficient to elaborate only on the more salient points of these data.

In the first cut the species in pure stands contributed the major portion of the stand, but as the season progressed, the weeds took relatively more importance in most swards except in trefoil and Ladino. However this never became a problem since the undesirable species were controlled rather effectively.

Timothy, alfalfa, brome and trefoil had a relatively high bare ground at the first cut, which however decreased considerably in following cuts of the trefoil and alfalfa stands. Red clover had a uniform stand during the season, but increased its bare ground in the second and third cut. During the end of the first growing period and through the recovery period of the first aftermath, the red clover stand was greatly thinned by disease which explains this increase in bare ground.

Ladino had a very uniform stand with little bare ground and low population of undesirable species at all times of the 1961 season. The non-replicated Kentucky blue and reed canary grass behaved quite similar, except that the former had a more uniform stand and obtained a higher yield.

In the mixtures, the grasses made only a small contribution to the final yield, especially timothy in the more complex mixtures. From table 7 it may be noted that timothy made its largest contribution, when it was associated with alfalfa and trefoil, with either of these two species alone or with Ladino alone. However in mixture 10, in association with alsike, timothy produced in cut 2 and 5, 32 and 35% of the dry matter respectively, but from table 15 it can be seen that the total production was much less than when it was found in other mixtures. On a dry matter basis timothy produced least when it was associated with red clover alone, red clover and Ladino, alfalfa and Ladino. It was surprising to find that it produced close to one seventh of the total dry matter of mixtures (vii) and (viii).

Brome did not establish well in the complex mixtures, (viii) and (ix) which is reflected in both the ground cover and botanical composition. In association with trefoil, it behaved much better, but did not reach as high dry matter yields as when timothy was in mixture with thisspecies. Reed canary grass contributed very little to the total sward, on a percentage composition basis. Kentucky blue gave a low botanical composition too, but was distributed very uniformly throughout the stand.

Among the legumes, the highest botanical composition was obtained from red clover when it was associated with timothy alone. The next highest percentage of red clover was achieved when it was in mixture with alsike and timothy. It yielded least, like alfalfa and Ladino, in the complex mixture 5. In cut 1 and 3 alfalfa contributed 80% to the total DM of mixture 7, when its only associated species was timothy. Ladino made its greatest contribution when it was with timothy alone, and trefoil when it was in mixture with reed canary only.

The highest total ground cover values for timothy were obtained when this species was associated with alfalfa in mixtures 7, (ix) and 9 and with Ladino in mixture 12. Red clover achieved its greatest ground cover when it was with timothy either alone or plus alfalfa or trefoil. Alfalfa had most ground cover when it was with timothy alone and so did Ladino. However Ladino had also a large ground cover when it was associated with both timothy and alfalfa. Trefoil had most ground cover when it was associated with any of the grasses alone and also in mixture 9.

b) Hay Mixtures and Pure Stands. The ranks achieved by the pure stands under a hay management were relatively consistent throughout the season. As would be expected alfalfa yielded most. Birdsfoot trefoil which produced little in the first cut gave a similar total yield as red clover. Ladino and alsike were the same. Timothy and brome were average in their dry matter production.

The dry matter per plot of the mixtures did not vary greatly from stand to stand or from cut to cut. However from table 21 it is seen that existing differences were shown in the season's total. Thus the highest yield was obtained from the simple mixture timothy-alfalfa, which was outstanding. This was followed by other mixtures containing alfalfa. The association of timothy with red clover and Ladino cannot be recommended, on the basis that it gave the lowest yield of dry matter per plot.

A conclusion that may be drawn from the dry matter yields per plot of mixtures and pure stands, under both hay and pasture management is that the hay management gives the highest yields and that alfalfa appears to be the deciding component to achieve this.

The botanical composition of the hay species in pure stand was high throughout the season, as there was little or no weed problem. The one exception to this was alsike which after the first cut contributed only 12% to the sward in the second cut and practically nothing in the third cut.

The ground cover of the pure stands was relatively high in the first cut, but less so in the second. No data were obtained on the regrowth of the third cut.

The percentage composition of the legumes in the mixtures was greatest, with grasses producing only little except in mixture 8 and 9. It should also be outlined that the trefoil varieties used in mixtures 5, 6 and 7 contributed so little that the differences were insignificant.

There was no consistent trend in ground cover in cut 1 and 2 of the hay mixtures. The values of cut 2 were smaller than these of cut 1 which would be mainly due to the fact that the PQ analysis was obtained at an earlier stage of growth of the aftermath. Also disease, slower recovery for certain species could have been other factors for this.

In conclusion to this part of the discussion, some considerations on botanical composition, and PQ use are in order. Thus hand separations are only of value if the sampling in the field is done with great care, and with a sufficient number of pickings from the cut material, so as to have a representative sample of the whole plot.

It is realized that this cannot always be achieved, and is often neglected. Thus it is proposed that hand separations be replaced by a botanical analysis obtained by PQ. It has been shown by workers in the past (see literature review) and by this author in a study not reported, that good estimates can be obtained by the PQ method, and this with greater ease and less time. However it appears that one of the main requirements is that a sufficient number of points be analyzed, especially in stands where one of the species occurs only in small proportions.

During the 1961 season, large variations were observed in ground cover values obtained from the PQ analysis. As was shown in the results, some of these were due to variations that were inherent to the mixtures in individual plots. However it is suspected that the number of points analyzed and the stages of growth at which the anslyses were obtained were also factors contributing to these variations.

Thus it is proposed that for those species occurring in small proportions, the number of points analyzed should be increased to such an extent to obtain at least 5 hits. The 5 here is just an arbitrary number, which would exclude personnal and chance factors.

Also that the PQ readings should be obtained either immediately after cutting in which case it would apply to the cut just obtained, or not more than 3-5 days after cutting in which case it would apply to the cut following the analysis. The second method is favored by this author in view of the fact, that in May and June regrowth is so fast, that the new shoots will bias the analysis as applied to the cut just obtained.

B. Yield per Unit Area of Ground Cover Study

Before proceeding with the discussion it was judged appropriate to re-state briefly the hypothesis used in this study and theory supporting the hypothesis. From the mathematical concept of the homogeneity of a unit area as represented by a point, it was assumed that a unit area of ground covered by a species in pure stands would produce the same amount of dry matter as a unit area of ground covered by the same species in mixtures. Therefore the hypothesis, that if this were true there would be no competition.

In table 8, it can be seen that the yield per unit area of the pure stands, "unit area" referring at all times in the discussion to follow, to "unit area of ground cover", were considerably smaller than these of the species in the mixtures. Thus of the 45 values obtained, 8 only were smaller yields per unit area than those of the pure stands. This may suggest that either the competition from the nurse crop or the weeds is greater in pure stands than in mixtures or that these have a beneficial effect on the mixtures. It may also be thought that intraspecific competition in pure stands was greater than interspecific competition in mixtures.

In table 9, representing the first cut of 1961, the situation was almost completely reversed with respect to the 1960 cut. Especially so for grasses which appeared to have been greatly affected by competition. In 11 mixtures, the legumes had yields that were greater than those of the respective pure stands. The yields per unit area of alfalfa were especially large, as for example when it was associated with timothy alone. There it produced 45.4 gm. of dry matter per unit area as compared to 23.4 gm. in pure stand. The competition index obtained was 1.94 or just about 2.0. This would certainly suggest that in this instance that intraspecific competition was actively operating in the pure stand and even that alfalfa must have benefitted from its association with timothy. The other legume species yielded very much alike, and most were evolving around a competition index of 1.0.

In this cut 1, then, the grasses appeared to have greatly suffered from interspecific competition and the legumes except in a few instances, less so.

In cut 2, table 10, interspecific competition was even more apparent than in cut 1. Yet the yields per unit area of both, species in mixtures and in pure stands were greater and at a few occasions had more than doubled from the previous cut. Only in 5 mixtures did legume species reach a competition index of 1.0 and the grasses in none. It is of interest to note that each time a legume species gave a yield per unit area that was greater when it was in mixture than as a pure stand, it was associated with a species that did not offer any competition. Thus it was for Ladino in mixtures (vii) and (viii) and alfalfa in mixture (ix). For example, alfalfa in the latter mixture produced a yield per unit area of 162.3 gm. or almost three times that of the pure stand. It is suspected due to the nature of the stand throughout the season, that alfalfa behaved as a single, sufficiently spaced, plant. Under such condition it has the ability to produce a large amount of dry matter per unit area.

In cut 3, table 11, only the values under (a) were an integral part of this study. The values under (b) were merely of a passing interest, to determine if the yields per unit area obtained from the PQ analysis taken at cutting time compared favorably with the yields per unit area.

In this cut 3 more species in mixtures yielded more than the pure stands, than in the previous 2 cuts. However there was an overall decrease in yield per unit area. This may be explained on the general observation, that the yields per plot, therefore the yields per plant decrease as the season progresses, due to a number of factors. Although, as mentioned previously, the stage of growth at which ground cover was obtained has also its effects on the yields per unit area.

In this cut the competition on the grasses appeared to be less severe for certain mixtures in which timothy occurred. Thus in association with alsike this species had a competition index greater than 1.0, and with trefoil it came close to 1.0.

In 15 different associations the legume species yielded more than their pure stands and among these was Ladino, which did so in every mixture in which it occurred. Red clover achieved this characteristic in none, but came close to an index of 1.0 in mixture 1. It should also be noted that trefoil gave a competition index greater than 1.0 in every simple mixture.

Thus in the second aftermath, a decline in interspecific competition was observed or conversely an increase in intra - specific competition. However it should be remembered that the adverse effect of the weedicide on the timothy and brome grass could have been the cause of a low production in these pure stands.

The discussion on the 4th cut, table 12, will only be brief, since this cut is not comparable to the previous cuts.

Yet it is of interest to note, as under (b) in cut 3, that in most instances the same species yielded more per unit area than the respective pure stands or yielded close to the values obtained in pure stands, as in previous cuts. Due to the fact that the PQ readings were taken at cutting time, the yields per unit area were considerably smaller; this was also shown in cut 3. Also unlike in cut 1, 2, 3, timothy in mixtures 4, 6 and (viii) yielded more than the pure stand. Upon looking at table 13, it is seen that this also happened in cut 5. Therefore this may indicate that towards the end of the season there is a declining competitive effect among the grasses in mixtures. Had this only occurred in cut 4, it may have been attributed simply to the method or manner by which ground cover was obtained. In cut 5 also Kentucky blue grass and reed canary yielded more than their pure stands.

Among the legumes of cut 5, there was no great change from the trend obtained in previous cuts, i.e., red clover in mixture 1 and 6, alfalfa in 8 and 9, Ladino in 4, 12 and (viii), trefoil in 13 still revolved around a competition index of 1.0. The amount of dry matter per unit area had decreased again, which may be attributed to the slow growth which took place after the 20th September, as shown by the PAI and NAR values obtained in another part of this dissertation. This slow growth was not necessarily accompanied by a decrease in ground cover, since the plants, especially the legume species have a tendency to form a rosette in the late season.

In conclusion, a comparison of cuts 1, 2, 3 permitted, the evaluation of the method used to measure yield per unit area and therefore competition. The means of cuts 1, 2 and 3 subjected to Duncan's test, allow one to assess to what extent the yield per unit area of a species in a mixture differed from that of the same species in pure stand. Consequently the extent of competition as measured by the index could be judged.

Looking at tables 9, 10, 11, it is seen that the grasses behaved in a like manner, i.e., none could produce as much as the pure stands. The exception occurred only in cut 4 and 5. Yet the order of importance of the yields per unit area, judged quantitatively, did not follow a definite trend from cut to cut. This characteristic was most likely governed by the variations due to the point quadrat and probably also by the associated species. Thus, e.g., timothy with alsike increased its yield per unit area from cut to cut, whereas timothy with alfalfa increased, then decreased it. The only consistent trend was shown by the small yields per unit area of brome in mixtures (viii) and (ix).

The legume species permitted a more favorable evaluation of the method. Alfalfa in mixture (ix) gave consistently a high competition index, in mixture 5 it never gave a high yield per unit area, i.e., it was never able to achieve the productivity level of the pure stand. Ladino in mixture 12, yielded more than its pure stand in all 3 cuts. Trefoil was again more like the grasses, in that it did not show any clear trend, except that in mixtures 6, and (viii) it was consistently low yielding.

From this, it is this worker's conviction, that this method has merit, and can be used with some confidence to evaluate the productivity of pasture species both in mixtures and pure stands.

The average of the species at cuts 1, 2, 3 in table 18, or the means of these in table 17, permitted one to test the validity of the hypothesis put forth.

It was shown that none of the grasses in mixtures were able to yield as much per unit area as the pure stands, on an average of three cuts. More outstanding yet, was the fact that all the grasses in mixtures yielded significantly less than the grasses in pure stands, thus showing that there was an adverse effect on the grasses in mixture which was not found when these were in pure stand. In the legumes the evaluation of competition was not as clear as in grasses. Eight mixtures had legume species that yielded more than the pure stands, but of these only alfalfa in mixture 7 and (ix) were significantly greater than the pure stand. Trefoil in mixture 7 and 8 yielded significantly less than the pure stand, which tends to invalidate the original assumption in four instances. However all other results do not necessarily credit the hypothesis with truth.

It is this author's conviction that the differences in yield per unit area between a pure stand and mixture are real, that a more sensitive experiment may prove this.

The yields per unit area of the hay mixtures were considerably greater than those of the pasture mixtures. This follows from the fact that the yields per plot and therefore the ability of the species to produce dry matter is greater under a hay management than a pasture management.

It is also of interest to note that the ground cover appears to change little whether a hay or a pasture management is used. From table 23, it is seen that timothy performs much better in hay mixtures than in pasture mixtures. Thus in 2 mixtures out of 8 it yielded more than the pure stand in the first cut, and in the second cut this occurred in 3 mixtures. In a fourth mixture, i.e., number 5, its yield per unit area was only a little less than that of the pure stands.

Among the legumes only red clover in mixture 6 yielded more than the pure, in cut 1. However in cut 2, its yield per unit area was greater than that of the pure stand in mixtures 1, 3, 6 and 7. For alfalfa this happened when it was in mixture 2. It should be noted that the discrepancy between cut 1 and cut 2 is not as great as it appears. For example the competition index of red clover in mixture 1 cut 1 was only 0.97 and that in cut 2 was slightly more than 1.0. The same relation can also be shown for red clover in mixture 7.

The magnitude of the differences and the extent of competition, that existed between species in mixtures and pure stands, are shown in tables 25 and 26 respectively. Thus the grass species have not shown any real differences between mixtures and pure stands. Therefore in the light of what has been said above for pasture mixtures, the hypothesis under test has not been disproven statistically. In legumes, competition between species in mixtures that appears to be real has occurred in some instances, but also instances have been shown where this was not so. Thus red clover yielded significantly less than the pure stand in mixtures 1 and 2, alfalfa in mixtures 1 and 8, and trefoil in all mixtures in which it occurred. It is of interest to note that alfalfa and trefoil yielded significantly less than the pure stand when they were associated with a grass alone and yet mixture 8 was the highest yielding mixture on a per plot basis for the entire season. This would suggest that the ability to compete of these two legumes is no greater than that of the grasses with which they were associated.

From this whole study the following considerations are worth investigating:

a) Would part of the variations obtained, be eliminated, if a yield per point were measured on the basis of obtaining the PQ analysis by the second alternative suggested earlier and record only these hits that promise to be contributing to the yield of the point, no matter how much or how little?

b) On the basis of the high yields obtained by alfalfa in mixture (ix) under a pasture management, use a method of planting that would either eliminate or permit the estimation of intraspecific competition. If alfalfa as in this mixture (ix) is capable of obtaining such high yields per unit area, then it is reasonable to suspect that considerable intraspecific competition occured in the pure stand used in this study.

c) The competition indices obtained for certain species have indicated that very unfavorable conditions for the production of dry matter per unit area prevailed for these species. In the light of this it is suspected that optimum rates of seeding were not employed, resulting in ill-balanced forage mixtures.

C. PAI and NAR Studies

The objective of this part of the dissertation was to evaluate the feasibility of measuring competition by other means than the yield per unit area of ground cover. If the point quadrat is used to obtain the PA, as in cut 3 of the pasture mixtures, then the assumption that a point hit in pure stand represents a point hit in mixture is valid on the basis that, mathematically, a unit area as represented by a point is homogeneous. Thus the assumption that the PAI of a species in mixture is the same as that of the same species in pure stand is the hypothesis to be tested.

Justification in the use of the total photosynthetic area to measure NAR, might be obtained in view of the fact that if NAR measures the net amount of dry matter accumulated per unit area of photosynthesizing material per unit time once respiration has taken place then the total PA should be used to measure this NAR since respiration takes place throughout the plant at any time.

Comparing the results of the third cut of the pasture mixtures as obtained by PQ, the $Y/_{U.A.}$ of G.C., the PAI and the NAR gave competition indices which evaluated the ability of the species to compete, with relatively good consistency. That is, high as well as low indices were obtained for the same species, in the same mixtures. However since the PQ was used to obtain the three measurements, this could have been expected.

In the following study of cut 4, 5a, 5b, and 5c, the "disc method" was used to obtain the total PA, and therefore the NAR of each species, in every mixture considered. For this reason it is suspected that the hypothesis to be tested, i.e., the one used in every previous investigation, is not directly applicable to the discussion following. However, if an assumption is made, stating that whatever factor governing the growth and development of a plant in pure stand is also governing that of a plant in mixtures, then it could be hypothesized that a species in mixture can reach the same PAI as in a pure stand and similarly for the NAR.

Pasture Mixtures. In cut 4 the range of PAI values obtained in mixtures, was from a low of 0.03 for timothy when it was associated with ladino and trefoil to a high of 5.14 for Ladino in mixture 12. (Table 33). The net assimilation rates ranged from 0.068 grams per dm^2 per week for this same timothy to 0.526 $gm/dm^2/week$ for trefoil in mixture 13. In this cut red clover in mixture 1 and 6, Ladino in 8, 12 and (viii) appeared to be unaffected by interspecific competition as measured by the PAI method and only relatively little as measured by the NAR method.

In cut 5a, table 34, the differences that existed between the species in the mixtures and those in pure stands were much more apparent, since many more of the former were significantly different from the latter in both PAI and NAR. The values obtained for PAI in mixtures ranged from 0.02 for brome in mixture (viii) to 4.12 for Ladino in 12. The range of the NAR values was from 0.072 $gm/dm^2/week$ for both timothy in mixture (vii) and trefoil in mixture (viii) to 0.572 $gm/dm^2/week$ for trefoil in mixture 13. In this cut the grasses continued to show little ability to compete. This was obtained through both the PAI and NAR measurements. Likewise red clover in mixture 1 and 4, Ladino in 4, 8, 12, (vii) and (viii) and trefoil in 9, 11, 13, 14 and 15, follow the trend taken in cut 4, i.e., the competition indices obtained from the PAI and NAR measurements show the ability these species have to compete for water, nutrient and light when found in the mixtures mentioned. The results of cut 4 and 5a also show that red clover and alfalfa tend to be suppressed when they are associated with Ladino.

The results of cut 5b, table 35, indicate that the growth of plants decreased conspicuously after the 20th of September. The analyses of variance performed on this cut showed only significance for the PAI values of the grasses. This indicated that the grasses were also suppressed in this part of the recovery period.

The range of the PAI's was from 0.01 for trefoil in mixture (viii) to 1.08 for red clover in mixture 6, i.e., a drop of approximately 3.0 from the previous cuts. The range of NAR was from 0 gm of DM/dm^2/week in trefoil in mixture 15 to 0.126 gm/dm^2/week for timothy in mixture (vii). This was completely the reverse situation to cut 5a where trefoil had the highest NAR and timothy the lowest, however trefoil was not in the same mixture. This may indicate that timothy in mixture (vii) accumulated its dry matter only towards the end of the 4th aftermath regrowth.

The trend taken by the competition indices reappeared in this cut 5b, even though the NAR method gave greater competition indices for grasses, than the PAI. For example brome in mixture 13 had an index of 0.07 as measured by the PAI and 0.90 as obtained by the NAR. Explanations for such discrepancies might be sought on a physiological basis, but also from the variations that existed in the plant population between half sub-plots. Thus no increment may be shown in PA, yet the net assimilation rate may still be measured.

The results obtained from cut 5c, table 36, show the PAI and the NAR values obtained from the entire regrowth period. Thus cut 5c represents the trends taken by the different species in each mixture, during the 53 day recovery period.

As shown in cut 5a, the results of the entire period were mostly governed by the first 20 days of recovery. Most of the PAI's and NAR's of species in mixtures that were significantly different from the pure stands in cut 5a, were also significantly different in cut 5c. Thus most of the highest competition indices of cut 5a were also recurring in cut 5c. This would indicate that to measure competition one set of measurements, obtained at the end of the recovery period, are sufficient.

The averages of the results of cut 4, and 5c indicated the trend competition has taken in pasture mixtures, for the species evaluated. Thus from an average of the last three months of the growing season, it is observed that by measuring both the PA and NAR the same extent of competition was measured for species in certain mixtures. Thus timothy in mixtures 4, 8, 12 and (vii), red clover in mixture 4, trefoil in mixtures 6, 15, (vii) and (viii) had PAI's and NAR's that were significantly smaller than these of their respective pure stands .

Upon comparing the yields per unit area of ground cover of cut 5, the PAI's and the NAR's of cut 5c, it was found that common high and low competition indices were found with the three methods. For example, common high competition indices were obtained for timothy in mixtures 6, 9, 11, for red clover in mixtures 1 and 6, alfalfa in 9, for Ladino in all mixtures analyzed, and for trefoil in mixture 13. Common low competition indices were obtained for timothy in mixtures 4, 12 and (viii), for brome in mixture (viii), for red clover in 4 and for trefoil in mixtures 6, (vii) and (viii).

These results then indicate that competition can be measured, and that similar effects of competition may be obtained by three methods used in this study, of species under a pasture management. However it may be pointed out that the extent of competition was not evaluated by the three methods and compared. This could be the objective of a future investigation. Also the magnitude of the competition index was not absolute for the three methods. Yet relative to each other, within a method, the competition indices showed the same trend for species in different mixtures, from cut to cut, and from one method to another, under a pasture management practice.

Hay Mixtures. Table 36 shows the results of PAI's and NAR's of the third cut obtained from the hay mixtures. Very high PAI's and low NAR's were obtained. The PAI's ranged from 0.16 for red clover in mixture 1 to 6.40 for alfalfa in the same mixture. The range of the NAR's was from 0.063 gm. of DM/dm^2/week, for red clover in mixture 1 to 0.235 gm/dm^2/week, for trefoil in mixture 9, and 0.235 gm/dm^2/week for timothy in pure stand.

According to the measurments of PAI and NAR obtained in this cut, competition was severe for timothy, brome and red clover when these were associated with alfalfa. It was not present for red clover, alfalfa , and trefoil, when these were in mixtures 4 and 5, 1 and 8, and 9 respectively.

In conclusion to the PAI and NAR study, it may be indicated that these methods have merit insofar as giving a measure of competition in forage mixtures. They appear to give the same sort of results as the yield per unit area. However the latter is easily applicable, more so than the other two methods when these are based on the disc method. Yet if a study is undertaken to measure competition, and has also as objective to investigate the recovery pattern of every species in different mixtures, than the PAI and the NAR is most likely to be of more value.

This whole study has made an attempt to show the feasibility of measuring competition. Trends of a competition pattern, have been demonstrated for various forage species as they exist in hay and pasture mixtures. The reliability of the point quadrat, to give a yield per unit area of ground cover, and a total photosynthetic area index which measures competition satisfactorily, has been shown. Total photosynthetic area index and net assimilation rate as obtained by the "disc method" was found to be equally satisfactory, but more time consuming, to give a measure of competition.

It is realized that either of these methods, have yet to be proven thoroughly by sensitive statistical means. But it is my firm conviction that future assessment of forage mixtures may only be reliable if a well established measure of competition is used.

S U M M A R Y

A study undertaken at Macdonald College in 1960 and 1961 on hay and pasture mixtures and the respective species in pure stands gave the following findings:

1) There appeared to be little or no relationship in the measurements of yield per unit area of ground cover, when the PQ analyses were taken either before or immediately after a harvest had been obtained, in pasture mixtures.

2) PQ recordings obtained 10 to 15 days after cutting of the plots proved to be satisfactory, but not ideal, for the measurement of yield per unit area of ground cover.

3) The PQ appears to be a reliable method to measure ground cover, but more so for legumes than for grasses.

4) The 3 angles of inclination of the PQ, i.e., 29^{o}, 32.5^{o} and 45^{o} appear to be equally satisfactory to give estimations of ground cover, density, and indirectly yield per unit area of ground cover, in legumes.

5) The angle of inclination of 45^{o} appears to be more appropriate to study grasses, as shown by the high correlation coefficients obtained between cut 3 and cut 5 for ground cover and density.

6) In mixtures with low population of certain species such as the grasses, large variations were obtained for yield per unit area, PAI and NAR. CV's in the order of 70-80% were obtained.

7) Competition indices for mixtures did not appear to be related between cuts.

8) The legumes had a depressing effect on the grasses, as measured by ground cover, density and yield per unit area of ground cover.

9) A trend was obtained, indicating an inverse relation between the number of components in a mixture and the competition index of these mixtures.

10) There was relatively good consistency in the competition indices obtained by $Y./_{U.A.}$ of G.C., PAI and NAR in pasture mixtures.

11) In both hay and pasture mixtures, the grasses in general and trefoil in some instances obtained very low competition indices. These species have been considered as having little ability to compete under the conditions of this study.

12) Ladino and alfalfa in general obtained high competition indices, red clover in some instances too, and trefoil was only average.

13) Good evidence was obtained that the hypothesis formulated may not be true for forage species in hay and pasture mixtures, and their respective pure stands.

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APPENDIX

Table A 1

Yields of Dry Matter per Plot of Pure Stands (gm/plot)
Experiment I 1960

Species	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5
Timothy	1967	238	146	-	3
Brome	2487	-	-	216	69
Alfalfa	1982	-	-	424	188

Table Al$_a$

Percentage Composition and Point Quadrat Analysis of the Pure Stands
Experiment I 1960

Species	Cut 2 % Comp.	Cut 2 Hits	Cut 2 G.C.	Cut 3 % Comp.	Cut 3 Hits	Cut 3 G.C.	Cut 4 % Comp.	Cut 4 Hits	Cut 4 G.C.	Cut 5 % Comp.	Cut 5 Hits	Cut 5 G.C.	Cuts (after cutting) Hits	Cuts (after cutting) G.C.
Tim.	42.8[i]	12	24	15.6	12	24	25.0[i]	6	12	23.2	-		4	8
Oth.	57.2[i]	16	32	84.4	17	34	75.0[i]	18	36	76.8			17	34
B.G.		25	50		26	52		27	54				30	60
Br.	70.6[i]	12	30.0				60.0			91.4	7	14	10	20
Oth.	29.4[i]	5	12.5				40.0			8.6	2	4	13	26
B.G.		24	60.0								41	82	27	54
Af.	33.3[i]	10	25.0				94.9			96.0	7	14	5	10
Oth.	66.7[i]	20	50.0				5.1			4.0	12	24	15	30
B.G.		11	27.5								31	62	38	76

Only 4 stations per plot were taken of the Alfalfa and Brome pure stands of Cut 1.
5 " " " " " at all other times.
% Comp. = Percentage by hand separation.
Ground Cover = G.C. = as described in materials and methods.
Bare Ground, abbreviated as B.G.
(i) These values have been obtained from the point quadrat readings, since Cut 1 & 2 were not hand separated.

Percentage Composition Cut 1 May 26, 1960.
(Experiment I)

Table A 2

Mixtures	A	B	C	D
1 Tim.	85.7	81.8	71.0	88.1
R.C.	3.4	0.8	2.4	2.9
Oth.	10.9	17.4	26.6	9.0
2 Tim.	89.1	79.7	82.1	86.8
R.C.	2.0	5.9	1.1	4.4
As.	-	-	0.6	-
Oth.	8.9	14.4	16.2	8.8
3 Tim.	92.6	76.4	83.1	84.5
R.C.	0.6	0.8	1.1	tr
Lad.	2.5	10.2	1.8	4.3
Oth.	4.3	12.6	14.0	11.2
4 Tim.	31.5	15.0	18.3	25.8
R.C.	- tr	tr	tr	tr
Af.	65.4	82.7	80.2	73.4
Oth.	3.1	2.3	1.5	0.8
5 Tim.	63.3	52.8	55.0	48.4
R.C.	1.7	6.6	0.8	1.6
B.T.	31.7	34.9	36.6	46.8
Oth.	3.3	5.7	7.6	3.2
6 Tim.	47.2	27.2	29.2	27.1
R.C.	0.8	tr	tr	tr
Af.	47.2	71.4	67.4	72.0
Lad.	3.2	0,7	1.1	-
Oth.	1.6	0.7	2.3	0.9
7 Tim.	19.9	17.4	8.8	20.0
Af.	78.8	81.7	89.5	78.7
Oth.	1.3	0.9	1.7	1.3
8 Tim.	15.2	14.2	17.4	16.4
Af.	81.3	84.9	78.0	81.0
B.T.	2.8	0.9	2.3	2.6
Oth.	0.7	tr	2.3	tr

Mixtures	A	B	C	D
9 Tim.	27.7	21.7	13.8	18.3
Af.	70.9	75.5	85.4	81.7
As.	0.7	-tr	tr	tr
Oth.	0.7	2.8	0.8	tr
10 Tim.	39.2	29.8	26.4	22.8
Af.	56.8	64.5	72.9	74.3
Lad.	2.0	1.4	0.7	-
Oth.	2.0	4.3	4.	2.9
11 Tim.	90.8	84.4	68.4	84.8
Lad.	6.4	8.2	9.4	1.9
Oth.	2.8	7.4	22.2	13.3
12 Tim.	50.0	49.0	47.3	44.8
B.T.	37.7	44.8	42.8	55.2
Oth.	12.3	6.2	9.9	
13 Br.	78.6	82.8	64.3	67.3
B.T.	20.3	15.8	30.4	29.9
Oth.	1.1	1.4	5.3	2.8
14 R.Can	30.7	50.4	31.6	47.6
B.T.	47.4	32.2	46.9	42.9
Oth.	21.9	17.4	21.5	9.5
15 O.G.	97.0	97.3	98.4	98.1
Lad.	0.5	1.5	0.8	tr
Oth.	2.5	1.2	0.8	1.9
16 T.Fe.	46.9	64.8	47.8	65.1
B.T.	26.2	22.9	34.5	27.1
Oth.	26.9	12.3	17.7	7.8
17 Br.	19.6	36.1	19.7	29.7
Af.	79.7	63.1	79.6	69.7
Oth.	0.7	0.8	0.7	0.6

No point quadrat analysis was taken before Cut 1

Percentage Composition and Point Quadrat Analysis
(P.Q. Analysis taken June 4,1960) (Experiment I)

Cut 2
June 22,1960

Table A 3

		Blocks											
Reps.		A			B			C			D		
	Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1	Tim.	94.4	21	52.5	94.4	15	37.5	88.9	15	37.5	94.2	21	52.5
	R.C.	1.4	-	-	0.9	-	-	2.6	2	5.0	2.9	-	-
	Oth.	4.2	8	20.0	4.7	7	17.5	8.5	9	22.5	2.9	6	15.0
	B.G.		18	45.0		18	45.0		16	40.0		16	40.0
2	Tim.	84.6i	22	55.0	89.4	18	45.0	88.2	15	37.5	93.3	28	70.5
	R.C.	-	-		6.5	5	12.5	3.4	1	2.5	2.5	1	2.5
	As	-	-		0.8	-	-	-	-		tr	-	-
	Oth.	15.4i	4	10.0	3.3	2	5.0	8.4	9	22.5	4.2	4	10.0
	B.G.		14	35.0		18	45.0		16	40.0		10	25.0
3	Tim.	96.2	16	40.0	79.2	22	55.0	93.7	23	57.5	85.5	21	52.5
	R.C.	0.8	-	-	tr	1	2.5	0.8	1	2.5	4.0	-	-
	Lad.	1.5	4	10.00	16.6	12	30.0	5.5	11	27.5	6.5	11	27.5
	Oth.	1.5	1	2.5	4.2	1	2.5	-	7	17.5	4.0	2	5.0
	B.G.		19	47.5		10	25.0		6	15.0		11	27.5
4	Tim.	15.1	9	22.5	11.9	12	30.0	11.1	13	32.5	10.4	10	25.0
	R.C.	tr	3	7.5	0.8	-	-	tr	1	2.5	0.4	-	-
	Af.	82.6	11	27.5	87.3	13	32.5	88.9	20	50.0	88.4	14	35.0
	Oth.	2.3	5	12.5	-	-	-	-	-	-	0.8	4	10.0
	B.G.		8	20.0		17	42.5		13	32.5		18	45.0
5	Tim.	52.9	14	35.0	47.3	25	62.5	41.7	19	47.5	52.1	17	42.5
	R.C.	2.4	-	-	6.4	2	5.0	tr	3	7.5	1.4	-	-
	B.T.	42.3	9	22.5	44.5	11	27.5	56.9	16	40.0	45.1	21.	52.5
	Oth.	2.4	2	5.0	1.8	-	-	0.4	-	-	1.4	7	17.5
	B.G.		14	35.0		8	20.0		9	22.5		7	17.5

Percentage Composition and Point Quadrat Analysis Cut 2
(P.Q. Analysis taken June 4,1960) (Experiment I) June 22,1960

Table A 3

Reps.	Mixtures	A % Comp.	A Hits	A % G.C.	B % Comp.	B Hits	B % G.C.	C % Comp.	C Hits	C % G.C.	D % Comp.	D Hits	D % G.C.
6	Tim.	17.2	22	55.0	21.2	17	42.5	15.2	12	30.0	13.8	18	45.0
	R.C.	1.0	-	-	tr	1	2.5	tr	-	-	tr	-	-
	Af.	76.8	6	15.0	76.3	14	35.0	83.9	13	32.5	85.4	8	20.0
	Lad.	4.0	8	20.0	0.8	1	2.5	0.9	-	-	tr	7	17.5
	Oth.	1.0	-	-	1.7	-		tr	3	7.5	0.8	2	5.0
	B.G.		13	32.5		10	25.0		16	40.0		9	22.5
7	Tim.	5.6	9	22.5	11.0	10	25.0	8.7	15	37.5	9.4	5	12.5
	Af.	94.4	14	35.0	89.0	15	37.5	89.6	16	40.0	90.6	23	57.5
	Oth.	tr	1	2.5	tr	4	10.0	1.7	3	7.5	tr	2	5.0
	B.G.		18	45.0		12	30.0		11	27.5		12	30.0
8	Tim.	10.6	16	40.0	9.3	12	30.0	11.5	19	47.5	13.5	15	37.5
	Af.	82.3	7	17.5	86.7	13	32.5	85.4	17	42.5	81.2	10	25.0
	B.T.	6.2	2	5.0	3.3	6	15.0	3.1	2	5.0	4.5	7	17.5
	Oth.	0.9	4	10.0	0.7	-	-	tr	2	5.0	0.8	4	10.0
	B.G.		16	40.0		16	40.0		10	25.0		11	12.5
9	Tim.	12.9	17	42.5	8.9	10	25.0	15.8	11	27.5	11.8	14	35.0
	Af.	87.1	11	27.5	89.3	14	35.0	83.3	22	55.0	89.0	18	45.0
	As.	-	-	-	-	1	2.5	-	-	-	-	1	2.5
	Oth.	tr	2	5.0	1.8	1	2.5	0.9	13	32.5	-	7	17.5
	B.G.		13	32.5		17	42.5		16	40.0		8	20.0
10	Tim	22.4	11	27.5	4.7	11	27.5	11.9	8	20.0	6.0	10	25.0
	Af.	74.8	7	17.5	94.0	16	40.0	85.7	2	52.5	94.0	19	47.5
	Lad.	2.8	5	12.5	tr	1	2.5	1.6	10	25.0	tr	9	22.5
	Oth.	tr	5	12.5	1.3	-	-	0.8	3	7.5	tr	1	2.5
	B.G.		17	42.5		11	27.5		15	37.5		8	20.0

Percentage Composition and Point Quadrat Analysis
(P.Q. Analysis taken June 4,1960) (Experiment I)

Cut 2
June 22,1960

Table A 3

Reps.		A			B			C			D		
		Blocks											
Mixtures		% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11	Tim.	82.0	18	45.0	82.7	19	47.5	79.3	15	37.5	93.0	17	42.5
	Lad.	13.5	11.	27.5	12.2	17	42.5	14.9	21.	52.5	2.6	10	25.0
	Oth.	4.5	12	30.0	5.1	1	2.5	5.8	-	-	4.4	6	15.0
	B.G.		-	-		6	15.0		18	45.0		7	17.5
12	Tim.	36.2	10	25.0	42.7	15	37.5	32.1	17	42.5	60.8[i]	25	62.5
	B.T.	63.8	23	57.5	56.4	17	42.5	63.1	23	57.5	29.2[i]	16	40.0
	Oth.	tr	5	12.5	0.9	3	7.5	4.8	2	5.0	tr	-	-
	B.G.		6	15.0		13	32.5		7	17.5		6	15.0
13	Br.	40.0	9	22.5	38.5	23	57.5	27.3	13	32.5	32.3[i]	10	25.0
	B.T.	56.0	7	17.5	58.9	23	57.5	67.5	25	62.5	54.8[i]	17	42.5
	Oth.	4	4	10.0	2.6	4	10.0	5.2	4	10.0	12.9[i]	4	10.0
	B.G.		18	45.0		10	25.0		8	20.0		15	37.5
14	R.Can.	25.0	14	35.0	23.7	15	37.5	20.6	22	55.0	31.8	17	42.5
	B.T.	69.3	10	25.0	69.5	14	35.0	72.9	15	37.5	66.7	22	55.0
	Oth.	5.7	5	12.5	6.8	4	10.0	6.5	8	20.0	1.5	3	7.5
	B.G.		17	42.5		10	25.0		7	17.5		10	25.0
15	O.Gr.	92.5	21	52.5	90.2	24	60.0	92.6	20	50.0	96.4	29	72.5
	Lad.	3.3	2	5.0	8.1	2	5.0	6.2	12	30.0	1.2	2	5.0
	Oth.	4.2	1	2.5	1.7		-	1.2	-	-	2.4	2	5.0
	B.G.		16	40.0		15	37.5		-	-		2	5.0

Percentage Composition and Point Quadrat Analysis Cut 2
(P.Q. Analysis taken June 4,1960) (Experiment I) June 22,1960

Table A 3

Blocks

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
16 T.Fe.	47.0	27	67.5	54.4	24	60.0	45.1	22	55.0	45.3	26	65.0
B.T.	47.9	14	35.0	43.0	11	27.5	48.0	17	42.5	47.2	15	37.5
Oth.	5.1	2	5.0	2.6	3	7.5	6.9	5	12.5	7.5	3	7.5
B.G.		4	10.0		7	17.5		3	7.5		8	20.0
17 Br.	3.2	8	20.0	4.3	8	20.0	3.8	9	22.5	11.7	4	10.0
Af.	96.8	16	40.0	94.0	16	40.0	95.4	21	52.5	86.4	26	65.0
Oth.		1	2.5	1.7	1	2.5	0.8	3	7.5	1.9	6	15.0
B.G.		17	42.5		11	27.5		12	30.0		9	22.5

(1) Obtained from point quadrat analysis

Percentage Composition and Point Quadrat Analysis — Cut 3
(P.Q. Analysis taken July 7, 1960) (Experiment I) — July 22,1960.

Table A 4

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	55.8	11	22	25.9	10	20	22.0	18	36	15.6	14	28
R.C.	1.9	-	-	3.7	-	-	1.7	1	2	4.4	3	6
Oth.	42.3	11	22	70.4	15	30	76.3	13	26	80.0	14	28
B.G.		29	58		25	50		23	46		24	48
2 Tim.	76.6	13	26	29.0	11	22	37.8	19	38	28.2	16	32
R.C.	4.4	2	4	35.5	6	12	4.4	1	2	10.3	1	2
As.	-	-	-	-	-	-	-	-	-	-	-	-
Oth.	20.0	8	16	37.1	8	16	57.8	19	38	61.5	11	22
B.G.		27	54		25	50		18	36		24	48
3 Tim.	85.0	16	32	33.3	21	42	21.7	19	38	41.2	15	30
R.C.	tr	1	2	3.3	-	-	2.2	-	-	-	1	2
Lad.	5.0	13	26	45.0	6	12	13.0	4	8	23.5	14	28
Oth.	10.0	6	12	18.3	3	6	63.1	12	24	35.3	8	16
B.G.		20	40		20	40		10	20		16	32
4 Tim.	3.7	7	14	3.0	12	24	2.9	7	14	5.4	12	24
R.C.	1.2	2	4	0.9	1	2	1.0	-	-	tr	1	2
Af.	95.1	24	48	95.0	19	38	94.2	25	50	92.4	21	42
Oth.	tr	4	8	1.1	1	2	1.9	11	22	2.2	10	20
B.G.		16	32		19	38		15	30		19	38
5 Tim.	9.9	13	26	15.1	10	20	15.1	17	34	11.5	6	12
R.C.	4.2	5	10	8.6	1	2	0.9	-	-	3.3	1	2
B.T.	80.3	30	60	73.1	31	62	77.8	32	64	80.3	34	68
Oth.	5.6	3	6	3.2	7	14	6.2	5	10	4.9	5	10
B.G.		9	18		8	16		7	14		9	18

Table 4A

Percentage Composition and Point Quadrat Analysis (P.Q. Analysis taken July 7,1960) (Experiment I)

Cut 3
July 22,1960.

Reps.	A			B			C			D		
Mix- tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6. Tim.	5.2	13	26	6.6	10	20	12.3	16	32	5.8	11	22
R.C.	tr	1	2	1.6	-	-	-	-	-	tr	1	2
Af.	89.6	11	22	89.0	13	26	85.2	14	28	89.6	24	48
Lad.	3.9	7	14	0.6	-	-	tr	3	6	2.3	2	4
Oth.	1.3	4	8	2.2	8	16	1.5	8	16	2.3	5	10
B.G.		21	42		23	46		16	32		13	26
7 Tim.	2.7	11	22	1.1	9	18	1.1	16	32	2.0	10	20
Af.	97.3	33	66	98.6	30	60	77.8	29	58	98.0	26	52
Oth.	-	4	8	.2	5	10	21.1	7	14	tr	3	6
B.G.		8	16		11	22		9	18		15	30
8 Tim.	3.7	2	4	2.0	6	12	4.1	9	18	1.9	7	14
Af.	90.4	17	34	93.9	26	52	93.1	21	42	93.3	28	56
B.T.	4.8	17	34	3.1	6	12	2.4	2	4	2.9	13	26
Oth.	1.6	8	16	1.0	3	6	0.4	7	14	1.9	4	8
B.G.		13	26		17	34		16	32		9	18
9 Tim.	1.7	9	18	3.3	7	14	3.1	14	28	1.1	8	16
Af.	98.3	23	46	96.1	17	34	96.3	27	54	97.8	28	56
As.	tr	-	-	-	-	-	-	tr	-	-	-	-
Oth.	tr	1	2	.6	9	18	.6	5	10	1.1	6	12
B.G.		17	34		20	40		10	20		12	24
10 Tim.	3.6	9	18	3.9	7	14	6.5	4	8	2.5	8	16
Af.	91.7	10	20	93.8	21	42	88.0	25	50	95.0	24	48
Lad.	4.7	8	16	1.9	1	2	3.3	8	16	1.3	8	16
Oth.	tr	5	10	.4	6	12	2.2	6	12	1.2	14	28
B.G.		25	50		12	24		13	26		10	20

Table A 4

Percentage Composition and Point Quadrat Analysis Cut 3
(P.Q. Analysis taken July 7, 1960) (Experiment I) July 22,1960.

Reps.		A			B			C			D		
	Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11	Tim.	31.9	6	12	67.9	12	24	20.3	15	30	36.1	10	20
	Lad.	38.3	14	28	23.2	15	30	48.4	19	38	13.9	8	16
	Oth.	29.8	5	10	8.9	3	6	31.3	9	18	50.0	13	26
	B.G.		25	50		23	46		16	32		20	40
12	Tim.	12.2	13	26	17.2	8	16	16.1	12	24	11.1	9	18
	B.T.	81.7	29	58	75.9	28	56	77.4	31	62	82.2	39	78
	Oth.	6.1	11	22	6.9	5	10	6.5	6	12	6.7	5	10
	B.G.		9	18		15	30		10	20		5	10
13	Br.	23.5	15	30	23.4	13	26	14.3	10	20	20.6	12	24
	B.T.	58.8	21	42	71.9	33	66	81.6	42	84	63.2	43	86
	Oth.	17.7	16	32	4.7	4	8	4.1	8	16	16.2	10	20
	B.G.		12	24		10	20		3	6		3	6
14	R.Can.	15.7	12	24	14.0	13	26	14.3	22	44	15.8	21	42
	B.T.	78.6	31	62	76.7	34	68	71.4	44	88	72.4	39	78
	Oth.	5.7	9	18	9.3	7	14	14.3	12	24	11.8	4	8
	B.G.		10	20		7	14		1	2		5	10
15	O.G.	75.0	20	40	90.6	25	50	80.7	21	22	73.5	18	36
	Lad.	1.8	4	8	8.2	6	12	7.9	5	10	2.0	7	14
	Oth.	23.2	2	4	1.2	-	-	11.4	4	8	24.5	8	16
	B.G.		31	62		20	40		21	22		20	40

Percentage Composition and Point Quadrat Analysis Cut 3
(P.Q. Analysis taken July 7, 1960) (Experiment I) July 22, 1960.

Table A 4

	Blocks												
Reps.		A			B			C			D		
Mix-tures		% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
16	T.Fe.	38.2	18	36	36.6	18	36	30.5	22	44	27.6	33	66
	B.T.	54.6	17	34	54.9	15	30	63.0	34	68	65.8	25	50
	Oth.	7.2	4	8	8.5	6	12	6.5	3	6	6.6	7	14
	B.G.		15	30		13	26		6	12		5	10
17	Br.	3.3	7	14	7.4	12	14	8.7	10	20	5.6	10	20
	Af.	95.6	29	58	92.6	21	22	89.4	29	58	92.2	25	50
	Oth.	1.1	4	8		7	14	1.9	11	22	2.2	19	38
	B.G.		14	28		14	28		6	12		6	12

Percentage Composition and Point Quadrat Analysis Cut 4
(P.Q. Analysis taken Aug. 5, 1960) (Experiment I) August 25, 1960.

Table A 5

		Blocks											
Reps.		A			B			C			D		
	Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1	Tim.	57.1	18	36		11	22	22.2	13	26		12	24
	R.C.	8.6	1	2		-	-	5.6	-	-		1	2
	Oth.	34.2	12	24		12	24	72.2	13	26		21	42
	B.G.		33	66		29	58		25	50		18	36
2	Tim.	65.7	13	26		11	22	26.3	11	22		11	22
	R.C.	3.0	2	4		1	2	10.5	1	2		-	-
	As.	1.5	1	2		-	-	10.5	-	-		1	2
	Oth.	29.8	14	28		18	36	52.6	16	32		21	42
	B.G.		20	40		22	24		25	50		18	36
3	Tim.	70.0	13	26		6	12	13.8	10	20		7	14
	R.C.	5.0	1	2		-	-	3.4	2	4		-	-
	Lad.	10.0	13	26		13	26	20.7	1	2		17	34
	Oth.	15.0	7	14		11	22	62.1	19	38		8	16
	B.G.		18	36		23	46		18	36		20	40
4	Tim.	-	10	20		6	12	2.7	4	8		5	10
	R.C.	2.5	2	4		1	2	tr	-	-		-	-
	Af.	95.0	18	36		12	24	97.3	19	38		19	38
	Oth.	2.5	6	12		15	30	tr	11	22		8	16
	B.G.		21	42		24	48		20	40		22	44
5	Tim.	9.4	7	14		8	16	10.8	7	14		4	8
	R.C.	3.9	tr			-	-	10.8	tr	-		-	-
	B.T.	77.2	40	80		32	64	62.2	36	72		30	60
	Oth.	9.4	4	8		4	8	16.2	7	14		7	14
	B.G.		8	16		9	18		9	18		13	26

Table A 5

Percentage Composition and Point Quadrat Analysis (P.Q. Analysis taken Aug. 5, 1960) (Experiment I)

Cut 4
August 25, 1960.

Reps.	Mixtures	A % Comp.	A Hits	A G.C.	B % Comp.	B Hits	B G.C.	C % Comp.	C Hits	C G.C.	D % Comp.	D Hits	D G.C.
6	Tim.	6.8	9	18		5	10	2.6	6	12		3	6
	R.C.	tr	1	2		2	4	tr	-	-		1	2
	Af.	86.4	11	22		13	26	92.3	17	34		11	22
	Lad.	3.8	12	24		3	6	-	1	2		6	12
	Oth.	3.0	6	12		12	24	5.1	11	22		7	14
	B.G.		19	38		19	38		17	34		24	48
7	Tim.	3.2	10	20		8	16	0.8	4	8		2	4
	Af.	95.2	22	44		24	48	95.9	27	54		23	46
	Oth.	1.6	8	16		7	14	3.2	11	22		10	20
	B.G.		16	32		14	28		14	28		16	32
8	Tim.	3.2	5	10		6	12	3.0	7	14		4	8
	Af.	87.0	17	34		18	36	90.9	17	34		21	42
	B.T.	1.1	15	30		12	24	3.0	5	10		13	26
	Oth.	8.7	8	16		3	6	3.0	10	20		5	10
	B.G.		13	26		14	28		21	42		15	30
9	Tim.	2.6	11	22		8	16	3.2	2	4		4	8
	Af.	96.1	19	38		20	40	92.5	26	52		25	50
	As.	tr	1	2		-	-	-	-	-		-	-
	Oth.	1.3	6	12		9	18	4.3	8	16		8	16
	B.G.		17	34		15	30		17	34		17	34
10	Tim.	3.1	9	18		8	16	1.9	2	4		9	18
	Af.	92.3	12	24		10	20	88.3	22	44		14	28
	Lad.	1.5	5	10		4	8	4.9	2	4		9	18
	Oth.	3.1	8	16		8	16	4.9	8	16		6	12
	B.G.		18	36		23	46		18	36		18	36

Percentage Composition and Point Quadrat Analysis
(P.Q. Analysis taken Aug. 5, 1960) (Experiment I)

Cut 4
August 25,1960.

Table A 5

Reps.		A			B			C			D		
	Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11	Tim.	21.0	13	26		8	16	5.3	10	20		13	26
	Lad.	63.2	14	28		14	28	52.6	25	50		7	14
	Oth.	15.8	2	4		8	16	42.1	2	4		13	26
	B.G.		25	50		22	44		15	30		21	42
12	Tim.	10.7	8	16		6	12	7.8	5	10		9	18
	B.T.	85.7	40	80		36	72	80.4	36	72		40	80
	Oth.	3.6	8	16		6	12	11.8	12	24		1	2
	B.G.		4	8		6	12		7	14		5	10
13	Br.	27.3	6	12		7	14	14.7	1	2		5	10
	B.T.	63.6	20	40		18	36	61.8	28	56		27	54
	Oth.	9.0	8	16		3	6	23.5	11	22		9	18
	B.G.		17	34		25	50		7	14		11	22
14	R.Can.	23.9	7	14		7	14	23.5	11	22		4	8
	B.T.	71.6	33	66		32	64	64.2	35	70		33	66
	Oth.	4.5	7	14		8	16	11.8	12	24		3	6
	B.G.		9	18		10	20		12	24		6	12
15	O.G.	78.6	20	40		24	48	79.0	16	32		19	38
	Lad.	3.5	3	6		10	20	10.5	6	12		2	4
	Oth.	17.9	5	10		1	2	10.5	5	10		6	12
	B.G.		24	48		17	34		26	52		27	54

Table A 5

Percentage Composition and Point Quadrat Analysis (P.Q. Analysis taken Aug. 5, 1960) (Experiment I)

Cut 4
August 25, 1960.

Reps.		Blocks A			B			C			D		
	Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
16	T.F.	37.9	17	34		15	30	53.8	13	26		16	32
	B.T.	51.7	23	46		26	52	38.5	24	48		30	60
	Oth.	10.4	7	14		2	4	7.7	3	6		3	6
	B.G.		10	20		13	26		15	30		13	26
17	Br.	3.0	5	10		3	6	13.2	3	6		6	12
	Af.	94.0	20	40		24	48	83.5	26	52		25	50
	Oth.	3.0	14	28		8	16	3.3	7	14		13	26
	B.G.		16	32		18	36		19	28		11	22

Blocks B and D were not hand separated.

Percentage Composition and Point Quadrat Analysis Cut 5
(P.Q. Analysis taken Sept. 8, 1960) (Experiment I) Oct. 1960.

Table A 6

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	68.5	10	20	75.0			36.0	6	12	57.6		
R.C.	-	3	6	7.7				tr	tr			
Oth.	31.5	11	22	17.3			64.0	11	22	42.4		
B.G.		26	52					33	66			
2 Tim.	75.6	7	14	30.1			24.4	8	16	30.8		
R.C.	-	1	2	-			-	-	-			
As.	-	tr	tr	-				tr	tr			
Oth.	24.4	16	36	69.9			75.6	17	34	69.2		
B.G.		27	54					25	50			
3 Tim.	42.0	10	20	25.0			32.2	4	8	18.7		
R.C.	1.0	tr	tr					-	-			
Lad.	56.0	5	10	75.0			67.8	3	6	81.3		
Oth.	1.0	6	12					7	14			
B.G.		31	62					36	72			
4 Tim.	5.0	6	12	2.6			2.6	2	4	3.7		
R.C.	0.5	tr	tr	-			-	1	2	-		
Af.	93.8	8	16	96.8			96.8	8	16	95.8		
Oth.	0.7	7	14	0.6			0.6	8	16	0.5		
B.G.		30	60					31	62			
5 Tim.	42.9	2	4	32.1			29.4	tr	tr	25.0		
R.C.	3.9	1	2	3.6				tr	tr	-		
B.T.	39.1	24	48	41.4			70.6	27	54	57.6		
Oth.	14.1	tr	tr	22.9				3	6	17.4		
B.G.		24	48					21	42			

Table A 6

Percentage Composition and Point Quadrat Analysis (P.Q. Analysis taken Sept. 8, 1960) (Experiment I)

Cut 5 Oct. 1960.

Reps.		A			B			C			D		
	Mix- tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6	Tim.	7.0	8	16	4.0			5.5	5	10	2.3		
	R.C.	3.5	tr	tr	-			-	-	-	-		
	Af.	73.9	5	10	95.5			93.4	13	26	96.0		
	Lad.	14.8	6	12	0.5			1.1	-	-	1.7		
	Oth.	0.8	2	4	-				8	16			
	B.G.		29	58					28	56			
7	Tim.	3.1	2	4	4.3			3.6	4	8	3.5		
	Af.	96.9	13	26	95.7			96.4	11	22	96.5		
	Oth.	-	4	8	-			-	2	4	-		
	B.G.		31	62					33	66			
8	Tim.	5.9	5	10	3.3			7.7	4	8	2.1		
	Af.	91.1	7	14	94.2			91.6	8	16	97.9		
	B.T.	3.0	8	16	2.5			0.7	5	10	tr		
	Oth.	-	2	4							tr		
	B.G.		29	58									
9	Tim.	5.2	8	16	2.4			4.3	5	10	2.4		
	Af.	94.8	5	10	96.9			94.5	10	20	97.6		
	As.	-	-	-	-			1.2	-	-	-		
	Oth.	-	1	2	0.7				8	16	-		
	B.G.		36	72					27	54			
10	Tim.	9.3	4	8	2.7			4.6	8	16	2.4		
	Af.	74.8	11	22	90.3			93.7	9	18	95.7		
	Lad.	14.8	3	6	6.7			1.8	1	2	-		
	Oth.	1.1	6	12	0.3				4	8	1.9		
	B.G.		30	60					29	58			

Table A 6

Percentage Composition and Point Quadrat Analysis (P.Q. Analysis taken Sept. 8, 1960) (Experiment I)

Cut 5 Oct. 1960.

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11 Tim.	15.1	9	18	35.0			8.7	3	6	23.1		
Lad.	81.0	7	14	61.5			91.3	11	22)	76.9		
Oth.	3.9	6	12	3.5			-	5	10)			
B.G.		28	56					33	66			
12 Tim.	29.1	4	8	42.0			44.4	2	4	38.3		
B.T.	60.6	23	46	52.3			55.6	22	44)	61.7		
Oth.	10.3	1	2	5.7				1	2)			
B.G.		24	48					25	50			
13 Br.	59.6	8	16	71.6			52.7	3	6	56.7		
B.T.	29.8	18	36	22.9				28	56)	43.3		
Oth.	10.8	6	12	5.5			47.3	2	4)			
B.G.		18	36					18	36			
14 R.Can.		1	2					6	12			
B.T.		24	48					23	46			
Oth.		4	8					3	6			
B.G.		23	46					20	40			
15 O.G.		11	22					10	20			
Lad.		1	2					7	14			
Oth.		4	8					2	4			
B.G.		34	68					33	66			

Table A 6

<u>Percentage Composition and Point Quadrat Analysis</u>
<u>(P.Q. Analysis taken Sept. 8, 1960) (Experiment I)</u>

Cut 5
Oct. 1960.

			Blocks									
Reps.		A			B			C			D	
Mix-tures		% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
16	T.F.		6	12					8	16			
	B.T.		13	26					14	28			
	Oth.		4	8					1	2			
	B.G.		30	60					27	54			
17	Br.	8.2	3	6	9.8			9.7	1	2	6.7		
	Af.	91.1	11	22	90.2			90.3	12	24	93.3		
	Oth.	0.7	5	10	-			-	6	12	-		
	B.G.		32	64					31	62			

No point quadrat analysis of B or D

Table A 7

Percentage Composition and Point Quadrat Analysis (P.Q. Analysis taken Oct. 22,1960) (Experiment I)

Cut 5
Oct. 1960.

Reps.		Blocks A			B		3 stations	C			D		3 stations
	Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1	Tim.	68.5	21	42	75.0	8	26.7	36.0	12	24	57.6	8	26.7
	R.C.	-	tr	tr	7.7	1	3.3		1	2		1	3.3
	Oth.	31.5	9	18	17.3	10	33.3	64.0	5	10	42.4	10	33.3
	B.G.		20	40		13	43.3		32	64		12	40.0
2	Tim.	75.6	12	24	30.1	9	30.0	24.4	14	28	30.8	12	40.0
	R.C.	-	1	2	-	1	3.3		5	10		2	6.7
	As.	-	-	-	-	-	-	75.6	4	8	69.2	-	-
	Oth.	24.4	10	20	69.9	5	16.7		6	12		7	23.3
	B.G.		27	54		15	50.0		21	42		10	33.3
3	Tim.	42.0	24	48	25.0	12	40.0	32.2	16	32	18.7	9	30.0
	R.C.	1.0	tr	tr		-	-		-	-		-	-
	Lad.	56.0	1	2	75.0	8	26.7	67.8	7	14	81.3	2	6.7
	Oth.	1.0	7	14		3	10.0		10	20		2	6.7
	B.G.		20	40		11	36.7		21	42		17	56.7
4	Tim.	5.0	14	28	2.6	9	30.0	2.6	9	18	3.7	6	20.0
	R.C.	0.5	-	-	-	-	-	-	-	-	-	-	-
	Af.	93.8	16	32	96.8	7	23.3	96.8	17	34	95.8	5	16.7
	Oth.	0.7	8	16	0.6	1	3.3	0.6	8	16	0.5	4	13.3
	B.G.		16	32		14	46.7		20	40		16	53.3
5	Tim.	42.9	10	20	32.1	18	60.0	29.4	9	18	25.0	4	13.3
	R.C.	3.9	1	2	3.6	-	-		2	4	-	1	3.3
	B.T.	39.1	14	28	41.4	12	40.0	70.6	14	28	57.6	16	53.3
	Oth.	14.1	7	14	22.9	3	10.0		14	28	17.4	4	13.3
	B.G.		20	40		9	30.0		19	38		9	30.0

Percentage Composition and Point Quadrat Analysis   Cut 5

(P.Q. Analysis taken Oct. 22, 1960) (Experiment I)   Oct. 1960.

Table A 7

Reps.	A			B 3 stations			C			D 3 stations		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	7.0	10	20	4.0	8	26.7	5.5	10	20	2.3	5	16.7
R.C.	3.5	tr	tr	-	1	3.3	-	-	-	-	-	-
Af.	73.9	9	18	95.5	4	13.3	93.4	5	10	96.0	3	10.0
Lad.	14.8	4	8	0.5	-	-)	1.1	3	6)	1.7	4	13.3
Oth.	0.8	7	14	-	1	3.3)		8	16)		2	6.7
B.G.		23	46		16	53.3		27	54		16	53.3
7 Tim.	3.1	13	26	4.3	4	13.3	3.6	8	16	3.5	4	13.3
Af.	96.9	16	32	95.7	9	30.0	96.4	17	34	96.5	10	33.3
Oth.	-	10	20	-	1	3.3	-	3	6	-	1	3.3
B.G.		23	46		17	56.7		22	44		16	53.3
8 Tim.	5.9	9	18	3.3	2	6.7	7.7	8	16	2.1	5	16.7
Af.	91.1	8	16	94.2	4	13.3	91.6	10	20	97.9	9	30.0
B.T.	3.0	11	22	2.5	6	20.0	0.7	7	14	tr	2	6.7
Oth.	-	9	18	-	3	10.0		4	8		2	6.7
B.G.		14	28		17	56.7		24	48		15	50.0
9 Tim.	5.2	12	24	2.4	7	23.3	4.3	9	18	2.4	4	13.3
Af.	94.8	10	20	96.9	8	26.7	94.5	10	20	97.6	11	36.7
As.	-	-	-	-	-	-	-	-	-	-	-	-
Oth.	-	6	12	0.7	2	6.7	1.2	4	8	-	10	33.3
B.G.		25	50		14	46.7		27	54		8	26.7
10 Tim.	9.3	12	24	2.7	6	20.0	4.6	8	16	2.4	4	13.3
Af.	74.8	6	12	90.3	4	13.3	93.7	8	16	95.7	2	6.7
Lad.	14.8	8	16	6.7	4	13.3		1	2	-	4	13.3
Oth.	1.1	3	6	0.3	9	30.0	1.8	7	14	1.9	3	10.0
B.G.		24.	48		10	33.3		29	58		18	60.0

Percentage Composition and Point Quadrat Analysis
(P.Q. Analysis taken Oct. 22, 1960) (Experiment I)

Cut 5
Oct. 1960.

Table A 7

Reps.	A			B	3 stations		C			D	3 stations	
Mix-tures	Comp.	Hits	G.C.	Comp.	Hits	G.C.	Comp.	Hits	G.C.	Comp.	Hits	G.C.
11 Tim.	15.1	17	34	35.0	13	43.3	8.7	11	22	23.1	10	33.3
Lad.	81.0	9	18	61.5	4	13.3	91.3	17	34		4	13.3
Oth.	3.9	8	16	3.5	2	6.7	-	6.	12	76.9	-	-
B.G.		20	40		14	46.7		20	40		17	56.7
12 Tim.	29.1	5	10	42.0	9	30.0	44.4	7	14	38.3	6	20.0
B.T.	60.6	18	36	52.3	15	50.0		13	26		10	33.0
Oth.	10.3	12	24	5.7	-	-	55.6	9	18	61.7	8	26.7
B.G.		17	34		9	30.0		23	46		9	30.0
13 Br.	59.6	11	22	71.6	6	20.0	52.7	9	18	56.7	2	6.7
B.T.	29.8	15	30	22.9	13	43.3		15	30		9	30.0
Oth.	10.3	13	26	5.5	3	10.0	47.3	11	22		7	23.3
B.G.		16	32		10	33.3		22	44		13	43.3
14 R.Can.												
B.T.		No										
Oth.												
B.G.				Record								
15 O.G.						Kept						
Lad.												
Oth.							of					
B.G.									This.			

Percentage Composition and Point Quadrat Analysis   Cut 5
(P.Q. Analysis taken Oct. 22, 1960) (Experiment I)   Oct. 1960.

Table A 7

Reps.	A			B 3 stations			C			D 3 stations		
Mixtures	Comp.	Hits	G.C.	Comp.	Hits	G.C.	Comp.	Hits	G.C.	Comp.	Hits	G.C.
16 T.Fes.		No										
B.T.				Record								
Oth.						Kept						
B.G.							of		This			
17 Br.	8.2	9	18	9.8	4	13.3	9.7	10	20	6.7	7	23.3
Af.	91.1	8	16	90.2	10	33.3	90.3	4	8	93.3	9	30.0
Oth.	0.7	13	26	-	2	6.7	-	7	14	-	5	16.7
B.G.		21	42		17	56.7		28	58		9	30.0

Only 30 points recorded on B or D

Yield per Unit Area of Ground Cover of the Pure Stands 1960
(Pasture Mixtures - Experiment I) (in gms)

Table A 8

Species	Cut 2			Cut 3			Cut 4			Cut 5			Cut 5 '		
	D.M. per Plot	G.C.	Yield per Unit Area	D.M. per Plot	G.C.	Yield per Unit Area	D.M. per Plot	G.C.	Yield per Unit Area	D.M. per Plot	G.C.	Yield per Unit Area	D.M. per Plot	G.C.	Yield per Unit Area
Tim.	842[i]	24	37.1	23	24	0.96	-	12	-	0.7	-	-	0.7	8	0.09
Br.	1755[i]	30	58.5	-	-	-	130	-	-	63	14	4.5	63	20	3.2
Af.	661[i]	25	26.4	-	-	-	402	-	-	180	14	12.9	180	30	6.0

(i)- represents yields of Cut I and the percentage composition as determined from Point quadrat analysis of Cut 2.
D.M./Plot is the total plot yield minus the others.
Cut 3 & 4 Brome and Alfalfa were discarded by error
Cut 4 discarded due to drought conditions.
Cut 5 ' Yield per Unit Area obtained with Ground Cover being calculated from a point quadrat analysis taken after cutting.

Yields of Timothy per Unit Area of Ground Cover in a Mixture Stand (in gms)

Cut 2 June 22, 1960 (Experiment I)

Table A 9

	Blocks													
	A			B			C			D			Ave.
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Yield / Unit Area
1	608	52.5	11.6	672	37.5	17.9	536	37.5	14.3	477	52.5	9.1	12.7
2	572[i]	55.0	10.4	795	45.0	17.7	535	37.5	14.3	734	70.5	10.4	12.7
3	710	40.0	17.8	735	55.0	13.4	621	57.5	10.8	639	52.5	12.2	13.2
4	243	22.5	10.8	168	30.0	5.6	146	32.5	4.5	122	25.0	4.9	6.2
5	503	35.0	14.4	422	62.5	6.8	332	47.5	7.0	504	42.5	11.9	9.4
6	182	55.0	3.3	242	42.5	5.7	156	30.0	5.2	156	45.0	3.5	4.3
7	84	22.5	3.7	180	25.0	7.2	151	37.5	4.0	134	12.5	10.7	5.6
8	181	40.0	4.5	158	30.0	5.3	177	47.5	3.7	182	37.5	4.9	4.5
9	181	42.5	4.3	146	25.0	5.8	225	27.5	8.2	130	35.0	3.7	5.2
10	253	27.5	9.2	87	27.5	3.2	203	20.0	10.2	71	25.0	2.8	6.1
11	657	45.0	14.6	616	47.5	13.0	579	37.5	15.4	668	42.5	15.7	14.6
12	368	25.0	14.7	400	37.5	10.7	264	42.5	6.2	517[i]	62.5	8.3	9.3

i Values obtained by using % composition with point quadrat.

Yields of Timothy per Unit Area of Ground Cover in a Mixture Stand
(in gms)

Cut 3 July 22, 1960 (Experiment I)

Table A 10

	Blocks												
	A			B			C			D			
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Y ield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Ave. Yield / Unit Area
1	118	22.0	5.4	33	20.0	1.6	38	36.0	1.1	23	28.0	0.8	2.0
2	111	26	4.3	54	22	2.5	50	38	1.3	50	32	1.6	2.2
3	92	32	2.9	60	42	1.4	44	38	1.2	71	30	2.4	1.9
4	28	14	2.0	26	24	1.1	25	14	1.8	47	24	2.0	1.7
5	38	26	1.5	99	20	5.0	102	34	3.0	52	12	4.3	3.2
6	31	26	1.2	51	20	2.6	98	32	3.1	52	22	2.4	2.3
7	27	22	1.2	11	18	0.6	11	32	0.3	21	20	1.0	0.8
8	28	4	7.0	19	12	1.6	41	18	2.3	20	14	1.4	2.2
9	16	18	0.9	33	14	2.4	34	28	1.2	10	16	0.6	1.2
10	27	18	1.5	30	14	2.1	66	8	8.2	25	16	1.6	2.6
11	48	12	4.0	219	24	9.1	36	30	1.2	46	20	2.3	4.1
12	72	26	2.8	107	16	6.7	118	24	4.9	78	18	4.3	4.5

Yields of Timothy per Unit Area of Ground Cover in a Mixture Stand

(in gms)

Cut 5 October, 1960 (Experiment I)

Table A 11

	Blocks												
	A			B			C			D			
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Ave. Yield / Unit Area
1	24	20	1.2	32			9	12	0.8	16			1.03
2	22	14	1.6	10			10	16	0.6	14			1.07
3	23	20	1.2	20			24	8	3.0	17			2.94
4	19	12	1.6	8			7	4	1.8	11			1.62
5	29	4	7.2	22			22	2[i]	11.0	9			8.50
6	21	16	1.3	14			13	10	1.3	12			1.31
7	9	4	2.2	22			12	8	1.5	13			1.75
8	18	10	1.8	11			17	8	2.1	5			1.94
9	16	16	1.0	9			11	10	1.1	6			1.04
10	32	8	4.0	7			14	16	0.9	10			1.92
11	30	18	1.7	37			14	6	2.3	15			1.83
12	28	8	3.5	37			24	4	6.0	24			4.33

(i) Assumed 1 hit in the place of o per plot as recorded

Yields of Timothy per Unit Area of Ground Cover in a Mixture Stand
(in gms)

Table A 12 Cut 5' October, 1960 (Experiment I)

	Blocks												
	A			B			C			D			
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Ave. Yield / Unit Area
1	24	42.	0.6	32	26.7	1.2	9	24.	0.4	16	26.7	0.6	0.50
2	22	24.	0.9	10	30.0	0.3	10	28.	0.4	14	40.0	0.4	0.62
3	23	48.	0.5	20	40.0	0.5	24	32.	0.8	17	30.0	0.6	0.59
4	19	28.	0.7	8	30.0	0.3	7	18	0.4	11	20.0	0.6	0.57
5	29	20.	1.4	22	60.0	0.4	22	18	1.2	9	13.3	0.7	1.34
6	21	20.	1.0	14	26.7	0.5	13	20	0.6	12	16.7	0.7	0.85
7	9	26	0.3	22	13.3	1.7	12	16	0.8	13	13.3	1.0	0.50
8	18	18	1.0	11	6.7	1.6	17	16	1.1	5	16.7	0.3	1.03
9	16	24	0.7	9	23.3	0.4	11	18	0.6	6	13.3	0.5	0.84
10	32	24	1.3	7	20.0	0.4	14	16	0.9	10	13.3	0.8	1.15
11	30	34	0.9	37	43.3	0.9	14	22	0.6	15	33.3	0.5	0.79
12	28	10	2.8	37	30.0	1.2	24	14	1.7	24	20.0	1.2	2.17

Cut 5' obtained with ground cover being calculated of point quadrat analysis taken after cutting.
Rep. B & D Ground cover obtained from 30 point only per plot

Yield of Brome per Unit Area of Ground Cover in a Mixture Stand
(in gms/plot)

Table A 13 1960 (Experiment I)

	Blocks												
	A			B			C			D			
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Ave. Yield / Unit Area
CUT 2													
13	222	22.5	9.9	204	57.5	3.5	141	32.5	4.3	162	25.	6.5	5.3
17	47	20.0	2.4	51	20.0	2.6	51	22.5	2.3	135	10.	13.5	3.9
CUT 5													
13	72	16.	4.5	57			44	6.	7.4	40			5.3
17	21	6.	3.5	25			21	2.	10.5	17			5.2
CUT 5'													
13	72	22	3.3	57	20.	28.5	44	18.	2.4	40	6.7	6.0	2.9
17	21	18	1.2	25	13.3	1.9	21	20.	1.0	17	26.7	0.6	1.1

Cut 5' obtained with Ground Cover being calculated from a point quadrat analysis taken after cutting.
Cut 5 Rep. B & D Ground Cover obtained from 30 points only per plot.

Yield of Alfalfa per Unit Area of Ground Cover in a Mixture Stand

1960 (Experiment I) (in gms)

Table A 14

	Blocks												
	A			B			C			D			
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Ave. Yield / Unit Area
CUT 2													
4	1151	27.5	41.9	1229	32.5	37.8	1166	50.0	23.3	959	35.0	27.4	31.1
6	766	15.0	51.1	807	35.0	23.1	863	32.5	26.6	914	20.0	45.7	32.7
7	1412	35.0	40.3	1457	37.5	38.9	1299	40.0	32.5	1287	57.5	22.4	32.1
8	1294	17.5	73.9	1366	32.5	42.0	1313	42.5	30.9	1034	25.0	41.4	42.6
9	1225	27.5	44.5	1220	35.0	34.9	1122	55.0	20.4	1053	45.0	23.4	28.4
10	844	17.5	48.2	1362	40.0	34.0	1368	52.5	26.1	1117	47.5	23.5	29.8
17	1413	40.0	35.3	1120	40.0	28.0	1278	52.5	24.3	998	65.0	15.4	24.3
CUT 5													
4	353	16.0	22.1	298			248	16.0	15.5	282			18.8
6	221	10.	22.1	338			226	26.	8.7	496			12.4
7	296	26.	11.4	476			314	22.	14.3	360			12.7
8	276	14.	19.7	314			206	16.	12.9	225			16.1
9	298	10.	29.8	386			245	20.	12.2	255			18.1
10	255	22.	11.6	251			290	18.	16.1	385			13.6
17	238	22.	10.8	234			192	24.	8.0	238			9.3

Yield of Alfalfa per Unit Area of Ground Cover in a Mixture Stand
1960 (Experiment I) (in gms)

Table A 14

	Blocks												
	A			B			C			D			
Mixt. No.	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	D.M. / Plot	G.C. %	Yield / Unit Area	Ave. Yield / Unit Area
CUT 5'													
4	353	32.0	11.0	298	23.3	12.8	248	34.0	7.3	282	16.7	16.9	9.1
6	221	18.	12.2	338	13.3	25.4	226	10.	22.6	496	10.0	49.6	16.0
7	296	32.	9.2	476	30.0	15.9	314	34.	9.2	360	33.3	10.8	9.2
8	276	16.	17.2	314	13.3	23.6	206	20.	10.3	225	30.0	7.5	13.4
9	298	20.	14.9	386	26.7	14.5	245	20.	12.2	255	36.7	6.9	13.6
10	255	12.	21.2	251	13.3	18.9	290	16.	18.1	385	6.7	57.5	19.6
17	238	16.	14.9	234	33.3	7.0	192	28.	6.9	238	30.0	7.9	9.8

Cut 5' obtained with Ground Cover being calculated of point quadrat analysis taken after cutting.
Rep. B & D Ground Cover obtained with 30 points only per plot.

Yield of D.M./Plot of Pure Stands and 3 Mixtures
Pasture Mixtures 1960-61 (gm/plot)

Table A 15 Cut 1960

	Blocks						
	E			F			Ave.
Mixt. No.	Green Weight	% D.M.	Dry Weight	Green Weight	% D.M.	Dry Weight	D.Wt.
i	500	62.8	314	450	63.6	286	300
ii	1500	37.7	566	950	37.8	359	462
iii	550	61.0	336	600	63.0	378	357
iv	600	64.8	389	400	71.1	284	336
v	1100	39.6	436	1150	40.0	460	448
vi	850	49.6	422	750	49.6	372	397
vii	850	45.0	382	650	42.7	278	330
viii	900	42.4	382	1300	37.0	481	432
ix	400	50.7	203	450	55.0	248	226
K.B.	1100	38.0	418				418
R.Can.	1000	40.1	401				401

Table A 16 Cut 1 1961

i	9450	15.9	1502	9500	15.3	1440	1471
ii	8800	14.3	1258	6400	16.4	1050	1154
iii	1700	18.4	313	3300	17.6	581	447
iv	7500	16.6	1245	7700	16.8	1294	1270
v	9000	12.0	1080	10650	11.2	1193	1136
vi	4000	15.0	600	5000	14.3	715	658
vii	8000	13.6	1088	7400	14.0	1036	1062
viii	8200	13.6	1115	9100	13.7	1247	1181
ix	3700	18.5	684	2400	19.2	461	572
K.B.	3900	21.0	820				
R.Can.	5600	15.7	879				

Table A 17 Cut 2

i	17800	19.1	3400	18500	19.2	3552	3476
ii	13700	13.1	1795	10800	15.1	1631	1713
iii	2750	19.8	544	4500	18.1	814	679
iv	11800	15.6	1841	17500	14.4	2520	2180
v	17000	12.3	2091	15500	12.1	1876	1984
vi	18900	12.8	2419	18400	12.2	2245	2332
vii	18800	12.2	2294	17500	13.7	2398	2346
viii	16600	13.5	2241	17800	12.4	2207	2224
ix	5400	20.3	1096	2400	20.8	499	798
K.B.	20600	20.2	4161				
R.Can.	18000	15.3	2754				

Yield of D.M./Plot of Pure Stands and 3 Mixtures (gm/plot)
Pasture Mixtures

Table A18 — Blocks

Mixt. No.	E Green Weight	E % D.M.	E Dry Weight	F Green Weight	F % D.M.	F Dry Weight	D.Wt.
Table A 18 Cut 3							
i	2800	20.5	573	4100	20.1	823	698
ii	7800	16.4	1272	8700	15.9	1382	1327
iii	4750	19.9	946	5300	20.4	1080	1013
iv	7650	16.6	1272	5900	17.9	1058	1165
v	9200	16.0	1469	6400	19.2	1228	1348
vi	7900	15.1	1196	5300	15.0	793	994
vii	7100	18.2	1293	7500	16.9	1268	1280
viii	7800	17.6	1376	8700	17.3	1509	1442
ix	4000	20.5	820	2800	20.8	583	702
Table A 19 Cut 4							
i	750	25.4	219	900	24.3	251	235
ii	3950	19.3	871	3600	17.4	615	743
iii	4700	21.8	1159	4600	21.9	1102	1130
iv	500	24.0	212	900	27.8	295	254
v	5000	16.0	940	4000	16.2	751	846
vi	3800	17.6	835	4100	17.4	869	852
vii	4300	15.2	778	4250	15.7	774	776
viii	4750	14.9	847	5200	15.8	962	904
ix	4650	21.6	1004	4000	21.5	860	932
K.B.	3300	23.8	867				867
R.Can.	3100	20.6	724				724
Table A 20 Cut 5							
i	550	32.5	266	725	34.0	341	304
ii	1625	26.4	513	2350	24.4	681	597
iii	2525	25.2	713	2350	25.5	678	696
iv	725	31.5	325	400	34.0	244	284
v	2700	24.3	786	2600	24.9	760	773
vi	1600	23.6	470	1650	23.1	439	454
vii	2425	24.6	750	2100	24.7	639	694
viii	2900	24.1	851	2300	25.0	707	779
ix	2600	25.8	671	2100	27.1	569	620
K.B.	500	35.5	504				
R.Can.	2000	28.7	662				

In cut 4 and 5 the sub-plot dry weights have been added!

Yields as Grammes of D.M./Plot Pasture Mixtures 1960
(Experiment II) Cut Nov. 2, 1960

Table A 21

Mixture No.		Blocks A	B	C	D	Mean	
1.	T. R.C.	715	699	451	739	651	abc
2.	T. R.C. Af.	993	954	663.	549	790	a
3.	T. R.C. As.	750	690	395	609	611	abc
4.	T. R.C. L.	743	628	542	704	654	abc
5.	T. R.C. Af. L.	819	947	652	689	777	a
6.	T. R.C. B.T.	642	642	413	524	555	bc
7.	T. Af.	875	939	253	774	710	ab
8.	T. Af. L.	874	1032	426	759	773	a
9.	T. Af. B.T.	835	926	343	473	644	abc
10.	T. As.	589	525	439	363	479	c
11.	T. B.T.	514	642	388	503	512	c
12.	T. L.	569	756	498	651	619	abc
13.	Br. B.T.	488	785	394	339	502	c
14.	R.Can. B.T.	491	458	407	513	467	c
15.	K.B. B.T.	463	631	350	500	486	c

$\bar{x} = 615$

S.D. = 113.3

C.V. = 18.41

gm of D.M./plot x fact. 1.1034 = 16/acre. F Treat. = 3.98**

Yield of D.M./Plot of Pasture Mixtures Cut I 1961
(in gms)

May 23, 1961.

Table A 22

	Blocks												
	A			B			C			D			
Mixt. No.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	Total D.M.
1	8600	13.3	1144	10700	13.3	1423	10700	14.0	1498	10150	14.7	1492	5557
2	20200	12.3	2485	14800	13.4	1983	12500	13.5	1688	11250	14.3	1609	7765
3	18400	11.3	2079	14600	11.8	1723	11100	14.9	1654	15650	13.0	2034	7490
4	17200	11.5	1978	17850	11.6	2071	10800	13.5	1458	13700	12.6	1726	7233
5	20800	11.6	2413	20400	12.5	2550	12100	12.6	1525	15500	12.5	1938	8426
6	19050	11.6	2210	14800	14.0	2072	9950	13.9	1383	11600	14.0	1624	7289
7	7600	15.6	1186	18200	13.7	2493	2350	18.6	437	11650	15.5	1806	5922
8	20500	11.5	2358	21500	12.1	2602	12550	13.2	1657	14700	12.4	1823	8440
9	12400	14.5	1798	14850	14.9	2213	4650	16.2	753	6450	15.5	1000	5764
10	19100	11.2	2139	15650	13.0	2034	12600	14.0	1764	12600	14.1	1777	7714
11	11800	12.2	1440	4450	15.1	672	3400	16.5	561	5350	15.2	813	3486
12	15300	11.4	1744	18550	11.1	2059	9700	12.7	1232	14400	12.0	1728	6763
13	4000	16.0	640	16550	12.4	2052	4850	16.0	776	4600	15.9	731	4199
14	12200	11.3	1379	3800	14.4	547	2100	14.8	311	5500	14.3	786	3023
15	1300	15.8	205	12900	12.0	1548	4150	15.6	647	2900	15.3	444	2844

1. T. R.C.
2. T. R.C. Af.
3. T. R.C. As.
4. T. R.C. L.
5. T. R.C. Af. L.
6. T. R.C. B.T.
7. T. Af.
8. T. Af. L.
9. T. Af. B.T.
10. T. As.
11. T. B.T.
12. T. L.
13. Brome B.T.
14. R.Can. B.T.
15. K.Blue B.T.

Yield of D.M./Plot of Pasture Mixtures   Cut 2 1961
(in gms)

June 27, 1961.

Table A 23

Mixt. No.	A G.Wt.	A % D.M.	A D.M.	B G.Wt.	B % D.M.	B D.M.	C G.Wt.	C % D.M.	C D.M.	D G.Wt.	D % D.M.	D D.M.	Total D.M.
1	6500	15.9	1033	12900	15.2	1961	13800	14.8	2042	13800	14.4	1987	7023
2	15600	14.3	2231	14800	14.8	2190	14500	14.3	2074	11800	14.7	1735	8230
3	13300	13.7	1822	14600	13.0	1898	12400	14.3	1773	10300	14.9	1535	7028
4	15000	13.5	2025	15000	12.9	1935	16000	13.1	2096	14500	13.0	1885	7941
5	15900	13.0	2067	15700	13.3	2088	17400	13.3	2314	13300	13.4	1782	8251
6	16100	12.9	2077	14800	14.4	2131	14700	14.2	2087	12700	15.1	1918	8213
7	12300	16.6	2042	15800	14.4	2275	6400	19.8	1267	12400	16.2	2009	7593
8	17400	12.2	2123	18300	11.5	2104	15300	13.8	2111	16900	12.4	2096	8434
9	16000	15.1	2416	14900	15.1	2250	16500	14.3	2360	14350	14.2	2038	9064
10	9700	14.9	1445	8000	15.9	1272	13200	13.3	1756	7300	15.9	1161	5634
11	20400	13.0	2652	16700	14.3	2388	16300	14.4	2347	15100	13.7	2069	9456
12	16500	12.5	2062	14600	12.5	1825	16100	13.7	2206	16500	12.6	2079	8172
13	17000	14.9	2533	17900	11.8	2112	15900	13.0	2067	13000	13.4	1742	8454
14	17500	11.8	2065	22400	12.0	2688	21600	13.4	2894	17700	12.5	2212	9859
15	18700	13.8	2581	17350	12.0	2142	16300	13.2	2152	7300	13.2	963	7838

Yield of D.M./Plot of Pasture Mixtures Cut 3 1961
(in gms)

July 26, 1961.

Table A 24

Mixt. No.	A G.Wt.	A % D.M.	A D.M.	B G.Wt.	B % D.M.	B D.M.	C G.Wt.	C % D.M.	C D.M.	D G.Wt.	D % D.M.	D D.M.	Total D.M.
1	6800	16.5	1123	6800	17.4	1184	5900	17.8	1048	6300	16.7	1055	4410
2	12900	13.8	1784	10200	16.9	1722	7700	16.2	1248	6200	18.0	1118	5872
3	10500	14.3	1505	10800	14.0	1515	5700	17.9	1022	5700	17.2	981	5023
4	10500	14.2	1486	10750	14.9	1601	7600	17.3	1315	8900	16.0	1425	5827
5	11950	14.0	1679	12000	14.8	1774	7800	16.6	1296	7900	16.3	1289	6038
6	11500	14.1	1618	7500	16.6	1241	7350	16.7	1230	5900	17.8	1049	5138
7	10600	16.7	1767	11750	16.1	1886	4650	19.6	910	10000	18.2	1820	6383
8	12600	13.8	1739	12750	14.3	1828	7650	17.6	1344	10000	16.8	1677	6588
9	11700	16.5	1930	11200	17.3	1937	6000	17.8	1068	6400	17.2	1101	6036
10	7600	16.7	1269	4300	19.1	821	5500	18.5	1020	2600	20.9	544	3654
11	9350	16.0	1496	7000	15.7	1098	6200	16.4	1019	3900	18.0	700	4313
12	9400	15.5	1455	9200	15.3	1409	6750	17.8	1203	9450	15.4	1460	5527
13	9200	14.9	1371	12500	14.3	1786	8000	15.9	1274	6800	16.8	1143	5574
14	8000	17.9	1432	7300	14.7	1071	6600	15.2	1000	5800	16.8	974	4477
15	7700	16.0	1229	11700	16.0	1870	6900	18.6	1285	5650	16.4	925	5309

Yield of D.M./Plot of Pasture Mixtures Cut 4 1961
(in gms)

Sept. 1, 1961.

Table A 25

	Blocks												
	A			B			C			D			
Mixt. No.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	Total
1	7200	17.3	1246	6850	18.8	1289	4000	19.6	898	5300	19.1	1158	4591
2	10600	15.3	1622	10700	17.3	1851	7100	18.0	1278	5350	19.0	1016	5767
3	8900	15.2	1353	8500	16.1	1368	5000	18.5	925	5500	19.1	1050	4696
4	8800	14.6	1285	9050	15.7	1421	5200	15.4	918	7500	14.5	1223	4847
5	10100	15.5	1566	11800	15.5	1829	6500	15.7	1020	5750	15.3	880	5295
6	8900	15.2	1353	7150	17.6	1258	4550	17.7	925	4350	18.1	920	4456
7	10400	17.7	1841	9000	16.0	1440	4700	20.4	959	9750	18.8	1833	6073
8	10100	15.2	1535	9900	16.1	1594	6000	15.7	1082	7200	15.7	1265	5476
9	10800	18.0	1944	10700	17.5	1873	5100	18.1	1079	5700	18.6	1228	6124
10	7600	17.1	1300	5550	19.3	1071	4800	16.3	782	2600	21.1	549	3702
11	7200	16.4	1181	8300	17.0	1411	4100	17.6	857	4700	19.3	1040	4489
12	7700	15.5	1194	7950	15.3	1216	4600	20.4	1075	7500	15.0	1262	4747
13	7900	16.6	1311	9000	15.1	1359	3950	17.9	838	3000	18.7	693	4201
14	5900	16.1	1139	7700	16.1	1437	5100	16.0	1005	5700	20.2	1151	4732
15	7100	17.0	1207	7150	16.5	1180	3200	19.9	778	7800	16.9	1487	4652

Yield of D.M./Plot of Pasture Mixtures Cut 5 1961
(in gms)

Oct. 25, 1961.

Table A 26

	Blocks												
	A			B			C			D			
Mixt. No.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	G.Wt.	% D.M.	D.M.	Total D.M.
1	3000	25.9	885	2250	26.5	596	2150	26.2	629	1700	25.8	487	2597
2	3400	25.6	870	4150	24.7	1025	4300	24.1	1036	2950	25.6	755	3686
3	2100	26.2	550	1000	28.2	282	2350	26.0	611	2550	25.7	655	2048
4	1300	26.9	350	750	28.5	214	3150	23.3	801	3250	23.3	818	2183
5	1850	27.8	514	3950	24.6	972	3900	24.1	940	4200	23.5	927	3413
6	2000	27.2	544	2775	24.8	688	2850	25.3	792	3000	25.1	813	2837
7	3650	25.8	942	2500	25.6	640	2700	27.9	753	4650	23.7	1102	3437
8	1800	27.2	490	1375	27.7	381	3600	20.8	826	3625	22.8	901	2598
9	3900	25.3	987	4450	24.9	1108	2250	26.4	667	2600	26.3	735	3497
10	2900	27.1	786	1850	29.8	253	3550	24.9	884	1000	31.2	312	2235
11	2500	26.0	650	2650	28.6	758	1850	25.6	521	1600	27.4	474	2403
12	2500	24.7	618	675	27.8	188	2450	25.1	689	3000	24.7	799	2294
13	3600	26.2	943	950	28.2	268	1600	25.6	459	1900	25.6	525	2195
14	2700	26.0	702	1150	25.4	329	3000	24.1	781	1500	26.3	394	2206
15	3500	25.8	903	2775	33.6	932	2500	29.0	780	3200	26.7	901	3466

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1960
(Experiment II)

Date Recorded Nov. 4   Angle 45°   Cut Nov. 2, 1960

Table A 27

	Blocks					
	E			F		
Components	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
i Tim.	10.5	10	20	11.1	7	14
Oth.	89.5	3	6	88.9	-	-
B.G.		37	74		43	86
ii R.C.	57.8	17	34	54.0	25	50
Oth.	42.2	1	1	46.0	1	2
B.G.		32	64		24	48
iii Af.	11.4	6	12	37.5	9	18
Oth.	88.6	3	6	62.5	2	4
B.G.		41	82		39	78
iv Br.	6.2	6	12	5.1	10	20
Oth.	93.8	2	4	94.9	1	2
B.G.		42	84		39	78
v Lad.	37.5	19	38	22.6	18	36
Oth.	62.5	-	-	77.4	-	-
B.G.		31	62		33	66
vi B.T.	34.7	18	38	36.7	17	34
Oth.	65.3	3	6	63.3	1	2
B.G.		29	58		32	64
vii Tim.	3.3	3	6	2.4	4	8
Lad.	16.7	12	24	26.2	18	36
B.T.	20.0	4	8	11.9	9	18
Oth.	60.0	-	-	59.5	-	-
B.G.		32	64		20	40

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1960
(Experiment II)

Date Recorded Nov. 4   Angle 45°   Cut Nov. 2,1960

Table A 27

Components		Blocks E % Comp.	E Hits	E G.C.	Blocks F % Comp.	F Hits	F G.C.
viii	Tim.	3.3	1	2	2.8	4	8
	Br.	3.3	5	10	7.1	5	10
	Lad.	20.0	8	16	19.0	6	12
	B.T.	23.4	4	8	11.8	9	18
	Oth.	50.0	-	-	59.2	-	-
	B.G.		34	64		28	56
ix	Tim.	8.2	8	16	8.1	5	10
	Br.	3.4	4	8	2.7	4	8
	Af.	24.9	2	4	13.5	3	6
	Oth.	63.5	4	8	75.7	-	-
	B.G.		32	64		38	76
	R.Can.	2.6	4	8			
	Oth.	97.4	17	34			
	B.G.		30	60			
	K.Bl.	3.7	8	16			
	Oth.	96.3	19	38			
	B.G.		24	48			

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961
(Experiment II)

Date Recorded May 9 Angle 29^{o} Cut 1
May 23, 1961

Table A 28

	Blocks						
	E			F			
Components	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	Density
i Tim.	100.0	35	70	100.0	24	48	68
Oth.	0	-	-	0.	2	4	4
B.G.		15	30		27	54	54
ii R.C.	100.0	35	70	100.0	40	80	162
Oth.	0	-	-	0	-	-	-
B.G.		15	30		10	20	20
iii Af.	99.0	6	12	100.0	13	26	36
Oth.	1.0	-	-	0	-	-	-
B.G.		44	88		37	74	74
iv Br.	100.0	32	64	100.0	15	30	46
Oth.	0	-	-	0	-	-	-
B.G.		18	36		35	70	70
v Lad.	98.9	34	68	97.4	35	70	124
Oth.	1.1	-	-	2.6	-	-	-
B.G.		16	32		15	30	34
vi B.T.	100.0	34	68	98.7	19	38	52
Oth.	0	3	6	1.3	-	-	-
B.G.		13	26		31	62	62
vii Tim.	17.0	17	34	8.5	8	16	20
Lad.	57.4	27	54	52.3	27	54	92
B.T.	21.3	9	18	38.1	12	24	28
Oth.	4.3	-	-	1.1	-	-	-
B.G.		14	28		11	22	22

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961

Recording Date: May 9 Angle 29^{o} Cut I
May 23, 1961

Table A 28 (Experiment II)

		Blocks						
Reps.		E			F			
Compo- nents		% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	Den- sity
viii	Tim.	25.9	13	26	12.2	11	22	30
	Br.	0.9	5	10	2.1	5	10	12
	Lad.	43.1	25	50	55.1	24	48	74
	B.T.	25.8	26	52	30.6	16	32	40
	Oth.	4.3	-	-	-	-	-	4
	B.G.		4	8		13	26	26
ix	Tim.	20.0	18	36	25.3	15	30	36
	Br.	5.7	9	18	8.1	7	14	14
	Af.	72.9	6	12	65.8	4	8	10
	Oth.	1.4	-	-	0.8	-	-	-
	B.G.		27	54		31	62	62
	R.Can.	100.0	12	24	-	-	-	-
	Oth.	0	-	-				
	B.G.		38	76				
	K.Bl.	98.3	26	52				
	Oth.	1.7	-	-				
	B.G.		24	48				

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961.

Recording Date: June 7 Angle 29° Cut 2
June 27,1961

Table A 29 (Experiment II)

Reps.		E				F			
	Compo-nents	% Comp.	Hits	G.C.	Dens-ity	% Comp.	Hits	G.C.	Dens-ity
i	Tim.	99.3	28	56	94	100.0	39	78	136
	Oth.	0.7	-	-	-	0	-	-	-
	B.G.		22	44	44		11	22	22
ii	R.C.	99.1	29	58	92	99.4	31	62	90
	Oth.	0.9	-	-	-	0.6	-	-	-
	B.G.		21	42	44		19	38	38
iii	Af.	97.5	6	12	22	98.8	6	12	4
	Oth.	2.5	-	-	-	1.2	-	-	-
	B.G.		44	88	88		44	88	88
iv	Br.	90.3	31	62	84	95.8	25	50	72
	Oth.	9.7	12	24	30	4.2	-	-	-
	B.G.		12	24	24		25	50	50
v	Lad.	100.0	44	88	164	100.0	42	84	156
	Oth.	0	-	-	-	0	-	-	-
	B.G.		6	12	12		8	16	16
vi	B.T.	97.9	40	80	158	99.1	33	66	102
	Oth.	2.1	1	2	2	0.9	-	-	-
	B.G.		10	20	20		17	34	34
vii	Tim.	21.7	9	18	34	19.4	16	32	44
	Lad.	72.6	38	76	126	71.3	24	48	64
	B.T.	5.7	15	30	46	8.5	14	28	36
	Oth.		-	-	-	0.8	-	-	-
	B.G.		8	16	16		11	22	22

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961.

Recording Date: June 7 Angle 29° Cut 2
June 27, 1961

Table A 29 (Experiment II)

Reps.		Blocks E				Blocks F			
Components		% Comp.	Hits	G.C.	Density	% Comp.	Hits	G.C.	Density
viii	Tim.	10.6	8	16	18	14.4	7	14	18
	Br.	0.2	2	4	4	1.0	7	14	14
	Lad.	77.7	33	66	102	76.3	35	70	98
	B.T.	10.6	23	46	62	8.3	12	24	34
	Oth.	0.9	-	-	-	-	-	-	-
	B.G.		8	16	16		9	18	18
ix	Tim.	32.1	23	46	60	45.1	22	44	46
	Br.	1.5	4	8	14	12.0	5	10	14
	Af.	65.6	2	4	6	51.6	1	2	2
	Oth.	0.8	-	-	-	1.3	-	-	-
	B.G.		25	50	50		18	36	36
	R.Can.	85.2	36	72	110				
	Oth.	14.8	-	-	-				
	B.G.		14	28	28				
	K.Bl.	99.0	46	72					
	Oth.	1.0	-	-					
	B.G.		4	8					

Percentage Composition and Point Quadrat Analysis Pasture Pure Stands and Mixtures 1961
(Experiment II)

Date Recorded July 10 Angle 45° Cut 3 July 26, 1961.

Table A 30

	Blocks								G.C. July 14 Angle 45°			
	E				F				E		F	
Components	% Comp.	Hits	G.C.	Density	% Comp.	Hits	G.C.	Density	G.C.	Density	G.C.	Density
i Tim.	56.7	19	38	46	70.5	17	34	44	28	46	44	54
Oth.	43.3	4	8	8	29.5	6	12	12	20	20	26	8
B.G.		28	56	56		29	58	58	58	58	52	52
ii R.C.	91.2	18	36	42	94.7	23	46	64	74	122	76	124
Oth.	8.8	10	20	20	5.3	9	18	22	4	6	16	18
B.G.		25	50	50		22	44	44	26	26	14	14
iii Af.	85.2	11	22	30	84.5	18	36	58	22	22	22	26
Oth.	14.8	21	42	56	15.5	23	46	58	42	52	48	58
B.G.		23	46	46		16	32	32	46	46	40	40
iv Br.	41.5	24	48	62	54.2	9	18	24	34	44	36	46
Oth.	58.5	17	34	42	45.8	5	10	12	36	54	12	12
B.G.		16	32	32		36	72	72	42	42	54	54
v Lad.	100.0	35	70	102	100.0	36	72	118	88	141	78	158
Oth.		-	-	-		-	-	-	-	-	-	-
B.G.		15	30	30		14	28	28	12	12	22	22
vi B.T.	90.1	37	74	168	86.1	28	56	84	76	154	68	114
Oth.	9.9	2	4	4	13.9	7	14	16	10	10	4	4
B.G.		12	24	24		19	38	38	20	20	32	32

Percentage Composition and Point Quadrat Analysis Pasture Pure Stands and Mixtures 1961

Date Recorded July 10 Angle 45^{o} Cut 3 July 26, 1961. (Experiment II)

Table A 30

Components		Blocks E: % Comp.	E: Hits	E: G.C.	E: Density	F: % Comp.	F: Hits	F: G.C.	F: Density
vii	Tim.	0.9	6	12	14	2.5	3	6	6
	Lad.	97.8	26	52	76	96.6	38	76	112
	B.T.	1.3	17	34	34	0.9	1	2	4
	Oth.		-	-	-		-	-	-
	B.G.		18	36	36		9	18	18
viii	Tim.	2.1	(1)	(2)	(2)	1.1	3	6	6
	Br.	0.1	1	2	2	0.3	3	6	6
	Lad.	95.8	25	50	86	97.3	33	66	90
	B.T.	2.0	4	8	10	1.4	6	12	16
	Oth.		-	-	-		-	-	-
	B.G.		21	42	42		11	22	22
ix	Tim.)	9.9	14	28	36	14.4	9	18	26
	Br.)		6	12	16		10	20	24
	Af.	87.3	3	6	6	76.0	1	2	2
	Oth.	2.8	4	8	8	9.6	6	12	14
	B.G.		28	56	56		29	58	58
	R.C.)	Dis-	33	66	146				
	Oth.)	carded	17	34	42				
	B.G.)		11	22	22				
	K.Bl.)	Dis-	33	66	126				
	Oth.)	carded	3	6	6				
	B.G.)		16	32	32				

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961
(Experiment II)

Date Recorded Aug. 30 Angle 45° (Improved)
Cut 4 Sept. 1, 1961

Table A 31

Components		Blocks E % Comp.	E Hits	E G.C.	E Density	Blocks F % Comp.	F Hits	F G.C.	F Density
i	Tim.	77.3	6	60	80	83.6	5	50	90
	Oth.	22.7	-	-	-	16.4	3	30	30
	B.G.		4	40	40		3	30	30
ii	R.C.	66.9	8	80	160	87.3	7	70	210
	Oth.	33.1	6	60	60	12.7	-	-	-
	B.G.		1	10	10		3	30	20
iii	Af.	61.0	6	60	140	71.4	7	70	130
	Oth.	39.0	10	100	100	28.6	9	90	90
	B.G.		-	-	-		-	-	-
iv	Br.	23.1	9	90	120	77.3	7	70	130
	Oth.	76.9	6	60	60	22.7	2	20	20
	B.G.		1	10	10		2	20	20
v	Lad.	100.0	9	90	320	92.3	9	90	170
	Oth.	0	-	-	-	7.7	-	-	-
	B.G.		1	10	10		1	10	10
vi	B.T.	57.1	10	100	350	64.9	8	80	180
	Oth.	42.9	2	20	20	31.1	5	50	50
	B.G.		-	-	-		1	10	10
vii	Tim.	1.0	(.2)	(2)	(2)	0.6	(.2)	(2)	(2)
	Lad.	97.9	10	100	280	97.3	10	100	270
	B.T.	1.1	2	(2)	20	1.9	(.2)	(2)	(2)
	Oth.		-	-	-	0.2	-	-	-
	B.G.		-	-	-		-	-	-

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961
(Experiment II)

Date Recorded Aug. 30 Angle 45° (Improved)
Cut 4 Sept. 1, 1961

Table A 31

		Blocks							
		E				F			
Components		% Comp.	Hits	G.C.	Density	% Comp.	Hits	G.C.	Density
viii	Tim.	4.3	(.2)	(2)	(2)	1.4	1	10	10
	Br.	0.9	(.2)	(2)	(2)	0.6	1	10	10
	Lad.	87.2	9	90	330	97.1	10	100	250
	B.T.	7.7	(.2)	(2)	(2)	0.9	1	10	10
	Oth.		-	-	-		-	-	-
	B.G.		1		10				-
ix	Tim.	5.6				7.9			
	Br.								
	Af.	84.9				48.3			
	Oth.	9.5				43.8			
	B.G.		-	-	-		-	-	
	R.Can.	93.2	7	70	180				
	Oth.	6.8	2	20	20				
	B.G.		1	10	10				
	K.Bl.	82.4	7	70	120				
	Oth.	17.6	-	-	-				
	B.G.		3	30	30				

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961
(Experiment II)

Date Recorded Sept. 20   Angle 45^{o} Cut 5
Oct. 25,1961

Table A 32

Components		E % Comp.	E Hits	E G.C.	E Density	F % Comp.	F Hits	F G.C.	F Density
i	Tim.	84.4	23	46	52	94.1	30	60	90
	Oth.	15.6	6	12	12	5.9	6	12	12
	B.G.		24	48	48		18	36	36
ii	R.C.	90.9	31	62	104	99.5	40	80	160
	Oth.	9.1	14	28	28	0.5	-	-	-
	B.G.		11	22	22		10	20	20
iii	Af.	88.9	16	32	46	89.1	24	48	76
	Oth.	11.1	26	52	66	10.9	19	38	42
	B.G.		16	32	32		15	30	30
iv	Br.	61.1	23	46	62	79.4	16	32	40
	Oth.	38.9	11	22	32	20.6	10	20	20
	B.G.		19	38	38		27	54	54
v	Lad.	99.0	50	100	250	99.7	45	90	190
	Oth.	1.0	-	-	-	0.3	-	-	-
	B.G.		-	-	-		5	10	10
vi	B.T.	77.4	35	70	140	82.1	39	78	150
	Oth.	22.6	15	30	38	17.9	9	18	22
	B.G.		7	14	14		7	14	14
vii	Tim.	2.0	2	4	4	4.9	2	4	6
	Lad.	97.5	44	88	160	93.7	49	98	170
	B.T.	0.5	(.2)	(.4)	(.4)	0.9	(.2)	(.4)	(.4)
	Oth.		-	-	-	0.4	-	-	-
	B.G.		4	8	8		1	2	2

Percentage Composition and Point Quadrat Analysis
Pasture Pure Stands and Mixtures 1961
(Experiment II)

Date Recorded Sept. 20 Angle 45° Cut 5
Oct. 25, 1961

Table A 32

Components		E % Comp.	E Hits	E G.C.	E Density	F % Comp.	F Hits	F G.C.	F Density
viii	Tim.	0.9	3	6	8	2.1	2	4	4
	Br.	2.1	2	4	8	1.9	3	6	6
	Lad.	96.0	48	96	230	95.2	44	88	150
	B.T.	1.0	3	6	6	0.8	(.2)	(.4)	(.4)
	Oth.		-	-	-		-	-	-
	B.G.		1	2	2		6	12	12
ix	Tim.) Br.)	8.3				12.6			
	Af.	80.3				65.9			
	Oth.	11.4				21.6			
	B.G.		-	-	-		-	-	-
	R.Can.	91.7	34	68	96				
	Oth.	8.3	9	18	18				
	B.G.		14	28	28				
	K.Bl.	98.5	34	68	110				
	Oth.	1.5	-	-	-				
	B.G.		15	30	30				

Percentage Composition and Point Quadrat Analysis Pasture Mixture 1960

Recorded: Nov. 4 Angle 45° Cut Nov. 2, 1960.

Table A 33

(Experiment II)

Reps.	Block A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	6.8	8	a) 13	5.9	2	4	4.5	4	8	4.6	3	6
R.C.	45.5	22	37	52.9	18	36	45.5	21	42	41.9	20	40
Oth.	47.7	9	15	41.2	1	2	50.0	-	-	53.5	3	6
B.G.		25	42		30	60		26	52		25	50
2 Tim.	3.5	3	6	5.9	6	12	4.6	3	6	5.1	4	8
R.C.	24.6	9	18	29.4	6	12	41.9	13	26	40.5	13	26
Af.	29.8	3	6	35.3	7	14	4.6	3	6	2.2	1	2
Oth.	42.1	6	12	29.4	1	2	48.8	2	4	52.3	-	-
B.G.		31	62		31	62		30	60		33	66
3 Tim.	2.4	2	4	7.1	3	6	2.8	3	6	2.8	1	2
R.C.	24.4	16	32	31.0	12	24	11.1	10	20	33.3	13	26
As.	34.2	6	12	28.6	6	12	44.4	12	24	16.7	9	18
Oth.	39.0	8	16	33.3	2	4	41.7	-	-	47.2	-	-
B.G.		21	42		27	54		26	52		27	54
4 Tim.	6.0	4	8	8.3	4	8	3.8	5	10	4.6	3	6
R.C.	30.0	6	12	20.8	13	26	30.8	17	34	32.6	12	24
Lad.	32.0	20	40	41.7	14	28	15.4	7	14	18.6	13	26
Oth.	32.0	1	2	29.2	2	4	50.0	-	-	44.2	-	-
B.G.		19	38		19	38		22	44		25	50
5 Tim.	5.7	3	6	3.0	1	2	4.3	3	6	3.8	b) 2	2
R.C.	22.9	10	20	24.2	10	20	27.7	14	14	34.6	23	26
Af.	17.1	2	4	42.4	3	6	8.5	3	3	3.8	1	1
Lad.	25.7	2	4	15.2	6	12	12.8	7	7	15.4	16	18
Oth.	28.6	1	2	15.2	-	-	46.8	-	-	42.3	-	-
B.G.		25	50		31	62		26	52		50	56

Percentage Composition and Point Quadrat Analysis Pasture Mixture 1960
Recorded: Nov. 4 Angle 45° Cut Nov. 2, 1960.
(Experiment II)

Table A 33

Reps.		Blocks A			B			C			D		
Mixtures		% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6.	Tim.	7.5	3	6	4.5	3	6	3.8	3	6	3.4	2	4
	R.C.	37.5	15	30	31.8	15	30	32.1	13	26	33.9	16	32
	B.T.	5.0	7	14	9.1	4	8	7.6	8	16	8.5	4	8
	Oth.	50.0	6	12	54.6	4	8	56.6	-	-	54.2	-	-
	B.G.		23	46		26	52		27	54		28	56
7.	Tim.	9.6	5	10	9.0	6	12	11.1	7	14	6.7	5	10
	Af.	34.6	3	6	39.3	4	8	11.1	1	2	48.9	5	10
	Oth.	55.8	18	36	51.7	7	14	77.8	7	14	44.4	-	-
	B.G.		34	68		33	66		36	72		40	80
8.	Tim.	13.8	9	18	10.0	4	8	8.0	4	8	7.8	7	14
	Af.	24.1	2	4	27.5	1	2	16.0	2	4	28.1	1	2
	Lad.	34.5	14	28	35.0	20	40	26.0	17	34	23.4	12	24
	Oth.	27.6	-	-	27.5	-	-	50.0	-	-	40.6	-	-
	B.G.		25	50		26	52		28	56		30	60
9.	Tim.	13.3	5	10	4.4	1	2	8.1	5	10	5.7	3	6
	Af.	26.7	5	10	51.1	6	12	2.7	2	4	14.3	1	2
	B.T.	16.7	4	8	8.9	3	6	21.6	7	14	28.6	8	16
	Oth.	43.3	3	6	35.6	1	2	67.6	-	-	51.4	-	-
	B.G.		32	64		39	78		38	76		35	70
10.	Tim.	8.0	3	6	6.8	1	2	2.3	1	2	4.4	4	8
	As.	40.2	12	24	36.4	17	34	46.5	17	34	39.1	17	34
	Oth.	51.7	6	12	56.8	-	-	51.2	5	10	56.5	-	-
	B.G.		31	62		31	62		28	56		39	78

Percentage Composition and Point Quadrat Analysis Pasture Mixture 1960
Recorded: Nov. 4   Angle 45°   Cut Nov. 2, 1960.

Table A 33
(Experiment II)

Reps.	Blocks A			B			C			D		
Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11.Tim.	10.0	2	4	8.3	4	8	8.2	5	10	4.7	3	6
B.T.	17.5	13	26	29.2	9	18	24.5	9	18	41.1	5	10
Oth.	72.5	5	10	72.5	3	6	67.3	1	2	54.2	3	6
B.G.		32	64		34	64		36	72		38	76
12.Tim.	10.3	4	8	10.3	4	8	7.1	6	12	4.1	4	8
Lad.	35.9	14	28	65.5	6	12	38.1	13	26	51.0	21	42
Oth.	53.8	-	-	24.1	15	30	54.8	-	-	44.9	-	-
B.G.		31	62		26	52		33	66		25	50
13.Br.	3.7	4	8	6.9	4	8	2.6	7	14	3.5	3	6
B.T.	14.8	8	16	17.2	6	12	29.0	9	18	33.3	7	14
Oth.	81.5	11	22	75.9	15	30	68.4	1	2	63.2	1	2
B.G.		27	54		26	52		34	68		37	74
14.R.Can.	1.2	2	4	1.6	1	2	3.3	1	2	2.0	1	2
B.T.	20.0	6	12	39.1	13	26	26.7	6	12	42.0	17	34
Oth.	78.8	19	38	59.4	1	2	70.0	7	14	56.0	2	4
B.G.		24	48		36	72		36	72		31	62
15.K.Bl.	1.8	1	2	2.0	4	8	2.4	3	6	2.0	2	4
B.T.	21.8	9	18	21.6	13	26	26.2	9	18	32.0	16	32
Oth.	76.4	10	20	76.5	5	10	71.4	1	2	66.0	6	12
B.G.		31	62		29	58		37	74		28	56

a) 6 stations/plot
b) 9 " "
Others in this fall cut include all stubles of the companion crop.

Percentage Composition and Point Quadrat Analysis Pastures Mixtures 1961
Recorded: May 8 Angle 29° Cut 1 May 23, 1961.
(Experiment II)

Table A 34

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	16.3			10.3			7.1	10	20	7.1	12	24
R.C.	83.7			89.7			92.9	37	74	91.1	38	76
Oth.	tr			tr			-	-	-	1.8	-	-
B.G.								10	20		8	16
2 Tim.	3.5			8.8			6.2	11	22	9.2	5	10
R.C.	22.8			52.9			77.1	37	74	84.6	42	84
Af.	54.3			38.3			16.7	4	8	6.2	9	18
Oth.	19.3			tr			-	-	-	0	-	-
B.G.								7	14		6	12
3 Tim.	8.6			9.3			8.9	6	12	11.1	16	32
R.C.	46.6			37.0			28.6	26	32	33.3	18	36
As.	24.1			35.2			62.5	35	70	53.3	28	56
Oth.	20.7			18.5			0	-	-	2.3	-	-
B.G.								3	6		4	8
4 Tim.	21.3			17.8			11.3	24	48	11.9	8	16
R.C.	42.6			40.0			53.0	21	42	59.3	38	76
Lad.	36.1			42.2			35.7	25	50	27.1	29	58
Oth.	tr			tr			tr	-	-	1.7	-	-
B.G.								9	18		3	6
5 Tim.	9.0			3.1			10.3	13	26	10.3	12	24
R.C.	21.0			23.2			41.4	20	40	58.6	32	64
Af.	37.6			57.4			20.7	5	10	10.3	6	12
Lad.	31.6			15.5			27.6	25	50	19.0	18	36
Oth.	0.8			0.8			tr	-	-	1.8	2	4
B.G.								4	8		5	10

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961

Recorded: May 8 Angle 29° Cut I May 23, 1961.

Table A 34

(Experiment II)

Reps.	Blocks A			B			C			D		
Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	9.1			11.9			10.5	19	38	8.3	13	26
R.C.	65.9			78.0			73.7	34	68	81.7	39	78
B.T.	2.3			10.1			15.8	12	24	10.0	10	20
Oth.	22.7			tr			tr	-	-	tr	-	-
B.G.								4	8		2	4
7 Tim.	13.6			11.0			27.6	20	40	10.0	26	52
Af.	85.7			73.0			71.7	2	4	88.3	19	38
Oth.	0.7			16.0			0.7	-	-	1.7	-	-
B.G.								20	40		15	30
8 Tim.	15.6			10.3			15.2	15	30	12.4	15	30
Af.	53.1			53.8			19.6	3	6	37.2	9	18
Lad.	31.3			35.9			58.7	33	66	49.6	37	74
Oth.	-			-			6.5	-	-	0.8	-	-
B.G.								12	24		6	12
9 Tim.	10.3			10.7			19.6	23	46	13.6	26	52
Af.	84.6			85.7			23.5	3	6	29.5	11	22
B.T.	5.1			1.8			56.9	21	42	54.5	22	44
Oth.	-			1.8			tr	-	-	2.4	3	6
B.G.								16	32		8	16
10 Tim.	13.5			10.3			9.1	13	26	5.9	13	26
As.	78.4			84.6			70.9	42	84	94.1)	46	92
Oth.	8.1			5.1			20.0	3	6	)	-	-
B.G.								6	12		3	6

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: May 8 Angle 29° Cut I May 23, 1961.

Table A 34 (Experiment II)

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11 Tim.	25.0			25.3			28.6	18	36	17.7	20	40
B.T.	22.9			74.7			71.4	23	46	81.4	26	52
Oth.	52.1			-			0	-	-	0.9	-	-
B.G.								19	38		14	28
12 Tim.	22.9			25.3			20.4	24	48	11.1	8	16
Lad.	75.0			73.4			79.6	34	68	88.9	42	84
Oth.	2.1			1.7			tr	-	-	0	-	-
B.G.								7	14		6	12
13 Br.	37.7			23.7			25.0	10	20	28.6	19	38
B.T.	50.9			13.2			75.0	20	40	70.5	27	54
Oth.	11.4			63.1			0	-	-	0.9	-	-
B.G.								21	42		15	30
14 R.C.	0			1.7				1	2	10.9	2	4
B.T.	4.0			96.6				17	34	87.3	23	46
Oth.	6.0			1.7				-	-	1.8	-	-
B.G.								33	66		26	52
15 K.Bl.				6.9			14.8	16	32	32.4	10	20
B.T.				24.1			85.2	26	52	64.7	17	34
Oth.				69.0			tr	-	-	2.9	-	-
B.G.								16	32		30	60

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: June 7 Angle 29 Cut II June 27, 1961

Table A 35 (Experiment II)

Reps.	Blocks A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	58.0	12	24	29.0	19	38	11.6	11	22	18.8	15	30
R.C.	37.0	22	44	66.7	26	52	88.4	28	56	81.2	28	56
Oth.	5.0	10	20	4.3	6	12	-	-	-	-	3	6
B.G.		15	30		8	16		19	38		10	20
2 Tim.	11.5	4	8	15.6	14	28	18.8	11	22	17.1	10	20
R.C.	27.1	10	20	33.8	21	42	69.3	34	68	76.2	19	38
Af.	31.2	19	38	48.0	14	28	7.9	4	8	6.7	1	2
Oth.	30.2	20	40	2.6	-	-	4.0	1	2	-	-	-
B.G.		20	40		10	20		9	18		20	40
3 Tim.	9.8	6	12	12.5	9	18	16.0	11	22	17.2	8	16
R.C.	35.9	25	50	41.3	20	40	55.6	18	36	58.6	19	38
As.	2.2	8	16	1.2	7	14	25.7	29	58	23.4	16	32
Oth.	52.1	20	40	45.0	18	26	2.7	-	-	0.8	-	-
B.G.		6	12		9	18		7	14		17	34
4 Tim.	17.4	8	16	9.4	7	14	11.3	11	22	11.4	13	26
R.C.	14.7	12	24	18.7	15	30	38.7	29	58	40.0	22	44
Lad.	67.9	36	72	71.9	39	78	50.0	30	60	48.6	31	62
Oth.	0	-	-	-	-	-	-	-	-	-	1	2
B.G.		6	12		5	10		2	4		1	2
5. Tim.	17.3	6	12	7.2	6	12	7.6	13	26	11.5	7	14
R.C.	18.3	14	28	21.7	21	42	37.1	22	44	34.5	30	60
Af.	13.5	5	10	43.4	10	20	1.9	1	2	0.4	5	10
Lad.	50.9	24	48	27.7	23	46	53.3	27	54	53.6	29	58
Oth.	0	-	-	0	-	-		-	-		-	-
B.G.		11	22		10	20		8	16		6	12

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: June 7 Angle 29° Cut II June 27, 1961
(Experiment II)

Table A 35

Reps.	A			B			C			D		
	Blocks											
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	14.4	6	12	12.1	11	22	15.4	11	22	18.7	15	30
R.C.	49.5	24	48	77.3	28	56	71.4	31	62	69.2	26	52
B.T.	2.1	2	4	9.1	12	24	12.1	10	20	12.1	7	14
Oth.	34.0	20	40	1.5	2	4	1.1	2	4		-	-
B.G.		9	18		11	22		9	18		11	22
7 Tim.	32.9	20	40	25.0	19	38	44.3	23	46	14.0	16	32
Af.	59.1	15	30	66.7	24	48	32.1	6	12	83.0	21	42
Oth.	8.0	8	16	8.3	23	46	23.6	2	4	3.0	1	2
B.G.		14	28		12	24		25	50		23	46
8 Tim.	14.3	14	28	19.8	12	24	11.5	7	14	7.3	13	26
Af.	18.7	11	22	22.8	11	22	18.0	10	20	25.4	10	20
Lad.	67.0	38	76	57.4	33	66	70.5	42	84	66.4	34	68
Oth.	-	-	-	-	2	4	-	2	4	0.9	-	-
B.G.		5	10		7	14		7	14		8	16
9 Tim.	16.3	23	46	15.7	21	42	21.6	18	36	19.4	18	36
Af.	70.7	17	34	67.5	23	46	6.7	3	6	26.4	3	6
B.T.	5.4	6	12	8.4	8	16	70.2	31	62	52.8	29	58
Oth.	7.6	7	14	8.4	1	2	1.5	1	2	1.4	3	6
B.G.		12	24		11	22		8	16		11	22
10 Tim.	33.8	14	28	46.2	14	28	12.1	7	14	34.3	11	22
As.	7.0	17	34	43.1	29	58	24.1	24	48	62.7	25	50
Oth.	59.2	14	28	10.7	4	8	63.8	25	50	3.0	7	14
B.G.		15	30		13	26		7	14		16	32

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: June 7 Angle 29° Cut II June 27, 1961

Table A 35 (Experiment II)

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11 Tim.	25.0	14	28	22.2	16	32	16.1	12	24	23.4	17	34
B.T.	10.5	11	22	64.5	25	50	83.9	38	76	72.7	36	72
Oth.	64.5	34	68	13.3	8	16	-	-	-	3.9	-	-
B.G.		5	10		11	22		10	20		9	18
12 Tim.	23.3	16	32	13.9	5	10	17.2	17	34	25.0	8	16
Lad.	76.7	34	68	86.1	39	78	82.0	39	78	75.0	43	86
Oth.	-	-	-	-	-	-	0.8	-	-	-	-	-
B.G.		5	10		10	20		3	6		6	12
13 Br.	17.4	14	28	1.6	1	2	7.4	7	14	10.5	11	22
B.T.	57.4	34	68	6.5	6	12	88.2	32	64	86.0	41	82
Oth.	25.2	12	24	91.9	38	76	4.4	3	6	3.5	3	6
B.G.		14	28		8	16		13	26		7	14
14 R.C.	0.2	(1)	(2)	1.4	3	6	0.3	Not recorded		2.4	2	4
B.T.	9.4	17	34	90.4	37	74	92.0			67.0	29	58
Oth.	90.4	33	66	8.2	9	18	7.7			30.6	9	18
B.G.		11	22		10	20					14	28
15 K.Bl.	3.3	10	20	6.9	19	38	5.0	12	24	6.2	17	34
B.T.	90.2	35	70	13.8	22	44	93.3	31	62	90.7	35	70
Oth.	6.5	2	4	79.3	30	60	1.7	2	4	3.1	2	4
B.G.		9	18		4	8		9	18		7	14

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Date Recorded: A & B July 14, Angle 45°. C & D July 11, Angle 29°

Table A 36 (Experiment II) Cut 3, July 26, 1961.

Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	26.9	21	42	13.0	6	12	4.9	2	4	7.5	4	8
R.C.	56.4	14	28	81.3	18	36	94.4	16	32	84.2	16	32
Oth.	16.7	21	42	5.7	16	32	0.7	4	8	8.3	9	19
B.G.		8	16		18	36		29	58		24	48
2 Tim.	4.1	2	4	3.6	6	12	3.9	4	8	5.4	12	24
R.C.	8.2	13	26	24.7	25	50	66.7	25	50	79.8	18	36
Af.	45.4	7	14	65.1	13	26	20.9	3	6	13.4	(1)	
Oth.	42.3	35	70	6.7	6	12	8.5	9	18	1.4	8	16
B.G.		8	16		14	28		13	26		20	40
3 Tim.	7.4	2	4	6.1	3	6	7.9	5	10	8.1	8	16
R.C.	14.8	14	28	15.8	6	12	86.4	19	38	78.1	15	30
As.	-	-	-	-	(1)		2.9	13	26	6.7	8	16
Oth.	77.8	37	74	78.1	33	66	2.9	1	2	7.1	4	8
B.G.		11	22		13	26		18	36		24	48
4 Tim.	5.6	2	4	8.7	7	14	1.9	3	6	2.5	2	4
R.C.	6.7	41	82	12.7	33	66	26.8	22	44	9.3	11	22
Lad.	87.8	7	14	77.8	8	16	71.3	14	28	85.6	31	62
Oth.	-	1	2	0.8	3	6	-	-	-	2.5	-	-
B.G.		9	18		7	14		17	34		14	28
5 Tim.	3.0	6	12	1.5	5	10	2.2	2	4	1.5	3	6
R.C.	6.4	8	16	5.9	11	22	27.0	9	18	17.7	8	16
Af.	18.1	6	12	52.6	15	30	10.9	2	4	7.7	3	6
Lad.	72.4	34	68	39.2	25	50	59.9	15	30	73.1	29	58
Oth.	0.1	-	-	0.8	4	8	-	-	-		-	-
B.G.		8	16		8	16		26	52		13	26

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Date Recorded: A & B July 14, Angle 45°.C&D - July 11, Angle 29°
(Experiment II) Cut 3, July 26, 1961.

Table A 36

		Blocks										
Reps.	A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	2.0	4	8	4.6	7	14	6.7	7	14	12.7	8	16
R.C.	20.6	15	30	82.7	24	48	81.0	23	46	74.0	24	48
B.T.	0.8	3	6	6.0	16	32	10.0	9	18	11.8	8	16
Oth.	76.6	28	56	6.7	12	24	2.3	2	4	1.5	2	4
B.G.		11	22		9	18		15	30		15	30
7 Tim.	10.1	14	28	4.6	6	12	5.5	17	34	2.8	9	18
Af.	72.7	13	26	68.7	14	28	85.4	3	6	93.8	15	30
Oth.	17.3	23	46	26.7	25	50	9.1	15	30	3.4	10	20
B.G.		11	22		16	32		19	38		22	44
8 Tim.	2.0	10	20	2.0	4	8	2.5	1	2	0.7	3	6
Af.	16.8	6	12	28.8	13	26	17.8	2	4	20.9	3	6
Lad.	81.2	38	76	68.9	35	70	79.5	23	46	78.3	32	64
Oth.	-	-	-	0.3	1	2	0;2	-	-		-	-
B.G.		8	16		6	12		25	50		14	28
9 Tim.	4.4	4	8	5.6	8	16	10.8	3	6	13.6	12	24
Af.	79.4	14	28	79.9	25	50	26.2	(1)	(2)	28.7	4	8
B.T.	4.1	9	18	3.5	12	24	57.6	27	54	54.3	22	44
Oth.	12.0	14	28	11.1	13	26	5.4	5	10	3.4	2	4
B.G.		18	36		7	14		20	40		17	34
10 Tim.	18.7	6	12	32.1	13	26	4.4	4	8	36.6	5	10
As.	2.0	11	22	12.5	20	40	3.0	12	24	56.3	27	54
Oth.	79.3	27	54	55.4	9	18	92.6	33	66	7.1	7	14
B.G.		14	28		13	26		9	18		20	40

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Date Recorded: A & B July 14, Angle 45°. C & D July 11, Angle 29°
(Experiment II) Cut 3, July 26, 1961.

Table A 36

Reps.	Blocks A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11 Tim.	4.2	5	10	22.5	10	20	12.2	8	16	27.6	7	14
B.T.	1.3	2	4	41.6	23	46	85.0	24	48	67.6	14	28
Oth.	94.5	42	84	35.9	13	26	2.8	4	8	4.8	9	18
B.G.		5	10		13	26		18	36		27	54
12 Tim.	6.0	5	10	8.1	3	6	3.1	6	12	1.9	2	4
Lad.	91.8	40	80	90.7	36	72	96.8	24	48	98.0	32	64
Oth.	2.2	1	2	1.3	-	-	0.1	-	-	0.1	-	-
B.G.		1	2		13	26		23	46		15	30
13 Br.	11.1	3	6	No data obtained			8.3	10	20	8.9	5	10
B.T.	53.1	32	64				83.3	28	56	80.2	36	72
Oth.	35.8	18	36				8.3	14	28	10.9	8	16
B.G.		10	20					12	24		11	22
14 R.C.	No data obtained			2.9	2	4	0.2	(1)	(2)	4.1	3	6
B.T.				65.7	29	58	73.2	27	54	67.0	22	44
Oth.				31.4	7	14	26.6	17	34	28.9	10	20
B.G.					19	38		13	26		20	40
15 K.Bl.	9.1	7	14	No data obtained			21.6	15	30	18.3	13	26
B.T.	75.0	38	76				68.8	26	52	63.4	22	44
Oth.	15.9	7	14				9.6	9	18	18.3	8	16
B.G.		10	20					15	30		16	32

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Date Recorded: Aug. 30 Angle 45° (Improved P.Q.) Cut 4 Sept. 1, 1961.
(Experiment II)

Table A 37

Reps.	Blocks A			B			C			D		
Mixtures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
1 Tim.	17.1			6.1			8.3	3	30	6.1	5	50
R.C.	43.9			73.0			63.9	10	100	58.5	6	60
Oth.	39.0			20.9			27.8	2	20	35.5	9	90
B.G.								-	-		-	-
2 Tim.	1.0			1.1			3.2			10.0		
R.C.	8.5			12.8			39.9			46.7		
Af.	49.5			75.5			31.9			16.7		
Oth.	41.0			10.6			25.0			26.6		
B.G.												
3 Tim.	2.0			4.9			5.9			9.3		
R.C.	28.6			30.9			75.4			59.1		
As.	-			-			0.3			0.8		
Oth.	69.4			64.2			18.4			30.8		
B.G.												
4 Tim.	0.4			1.7			0.3	(.2)	(2)	2.0	(.2)	(2)
R.C.	8.1			9.5			32.6	5	50	11.7	3	30
Lad.	91.5			86.0			66.8	7	70	80.1	8	80
Oth.	-			2.8			0.3	-	-	6.2	2	20
B.G.								-	-		-	-
5 Tim.	0.1			0.1			2.4			3.5		
R.C.	13.6			9.3			11.9			10.7		
Af.	15.9			46.5			29.8			12.0		
Lad.	70.0			42.6			54.8			72.6		
Oth.	0.4			1.5			1.2			1.2		
B.G.												

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Date Recorded: Aug. 30 Angle 45° (Improved P.Q.) Cut 4 Sept. 1, 1961
(Experiment II)

Table A 37

Reps.	Blocks A			B			C			D		
Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	0.3			6.6			4.3	4	40	18.1	5	50
R.C.	27.0			50.3			76.1	5	50	61.7	8	80
B.T.	1.3			12.0			4.3	4	40	11.5	5	50
Oth.	71.4			31.1			15.2	3	30	8.8	3	30
B.G.								-	-		-	-
7 Tim.	9.0			1.2			8.3			0.9		
Af.	65.7			69.0			46.7			95.4		
Oth.	25.3			29.8			45.0			3.7		
B.G.												
8 Tim.	0.1			0.1			1.7	(.2)	(2)	0.3	1	10
Af.	37.5			36.5			31.7	2	20	45.9	5	50
Lad.	59.6			62.5			66.2	9	90	53.6	10	100
Oth.	2.8			0.9			0.4	-	-	0.3	-	-
B.G.								1	10		-	-
9 Tim.	1.4			4.0			14.9	3	30	14.8	10	100
Af.	68.7			88.9			37.6	7	70	57.2	3	30
B.T.	1.9			4.9			21.8	10	100	21.7	9	90
Oth.	28.0			2.2			25.7	-	-	6.3	2	20
B.G.								-	-		-	-
10 Tim.	11.9			21.2			20.9			40.0		
As.	-			0.1			63.8			12.7		
Oth.	88.1			78.7			15.3			47.3		
B.G.												

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Date Recorded: Aug. 30 Angle 45° (Improved P.Q.) Cut 4 Sept. 1, 1961
(Experiment II)

Table A 37

Reps. / Mixtures	A % Comp.	A Hits	A G.C.	B % Comp.	B Hits	B G.C.	C % Comp.	C Hits	C G.C.	D % Comp.	D Hits	D G.C.
11 Tim.	3.1			29.5			10.2	8	80	26.1	8	80
B.T.	1.8			45.9			-	9	90	52.2	9	90
Oth.	95.1			24.6			89.8	3	30	21.6	3	30
B.G.								1	10		1	10
12 Tim.	7.9			3.1			2.5	1	10	1.6	(.2)	(2)
Lad.	87.9			96.3			97.5	10	100	97.6	9	90
Oth.	4.2			0.6			-	-	-	0.8	-	-
B.G.								-	-		-	-
13 Br.	22.7			0.1			13.8	5	50	22.4	3	30
B.T.	36.1			0.2			51.7	8	80	53.5	7	70
Oth.	41.2			99.7			34.5	3	30	24.1	5	50
B.G.								2	20		1	10
14 R.Can.	-			1.9	(.2)	(2)	0.9	1	10	8.7		
B.T.	0.3			45.2	10	100	42.3	10	100	35.1		
Oth.	99.7			53.0	8	80	56.8	7	70	56.2		
B.G.					-	-		-	-		-	-
15 K.Bl.	11.4			10.2			49.1	7	70	41.5	9	90
B.T.	57.0			0.4			32.2	6	60	36.9	7	70
Oth.	31.6			89.4			18.6	3	30	21.6	4	40
B.G.								2	20			

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: Sept. 20 Angle 45° Cut 5 Oct. 25, 1961.
(Experiment II)

Table A 38

Reps. / Mix-tures	A % Comp.	A Hits	A G.C.	B % Comp.	B Hits	B G.C.	C % Comp.	C Hits	C G.C.	D % Comp.	D Hits	D G.C.
1 Tim.	17.5			29.3			15.7	11	22	16.0	5	10
R.C.	41.3			61.9			81.2	31	62	68.2	27	54
Oth.	41.2			8.8			3.0	10	20	15.8	19	38
B.G.								7	14		8	16
2 Tim.	1.6			5.0			8.0			17.1		
R.C.	5.8			11.5			32.9			44.3		
Af.	55.6			72.7			45.1			20.0		
Oth.	37.0			10.8			14.0			18.6		
B.G.												
3. Tim.	3.9			10.8			13.8			14.1		
R.C.	24.9			18.4			78.2			84.7		
As.	-			-			1.1			1.0		
Oth.	71.2			70.8			6.9			0.2		
B.G.												
4 Tim.	1.7			12.2			1.9	4	8	2.1	2	4
R.C.	5.3			1.6			18.4	11	22	3.1	7	14
Lad.	93.0			82.2			78.8	37	74	94.8	43	86
Oth.	-			3.9			1.0	1	2	-	-	
B.G.								8	16		5	10
5 Tim.	2.1			0.5			7.1			5.7		
R.C.	2.5			3.4			9.1			4.0		
Af.	41.5			64.1			15.9			19.2		
Lad.	53.9			32.0			65.9			71.0		
Oth.	-			-			2.0			-		
B.G.												

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: Sept. 20 Angle 45° Cut 5 Oct. 25, 1961.
(Experiment II)

Table A 38

Reps.	A			B			C			D		
Mix-tures	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	4.5			17.0			11.3	8	16	30.6	16	32
R.C.	14.6			65.9			80.5	33	66	55.9	27	54
B.T.	-			6.3			5.1	15	30	12.4	13	26
Oth.	80.9			10.7			3.1	-	-	1.1	6	12
B.G.								8	16		9	18
7 Tim.	6.7			2.4			14.4			3.3		
Af.	67.5			68.3			48.0			85.1		
Oth.	25.8			29.3			37.6			11.6		
B.G.												
8 Tim.	1.1			0.8			3.1	2	4	1.4	2	4
Af.	37.8			56.2			31.7	2	4	38.2	7	14
Lad.	61.1			42.2			65.2	42	84	60.4	42	84
Oth.	-			0.8				-	-	-	-	-
B.G.								7	14		5	10
9 Tim.	3.7			4.3			32.4	14	28	24.4	18	36
Af.	84.3			82.6			29.7	4	8	50.9	10	20
B.T.	0.1			0.1			29.7	31	62	18.5	28	56
Oth.	11.9			13.1			8.1	7	14	6.1	8	16
B.G.								6	12		5	10
10 Tim.	34.8			42.9			6.8			54.7		
As.	-			-			-			12.4		
Oth.	65.2			57.1			93.2			32.9		
B.G.												

Percentage Composition and Point Quadrat Analysis Pasture Mixtures 1961
Recorded: Sept. 20 Angle 45° Cut 5 Oct. 25, 1961.
(Experiment II)

Table A 38

Reps.		Blocks A			B			C			D		
Mixtures		% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
11	Tim.	8.7			38.0			36.4	11	22	58.5	22	44
	B.T.	87.5			12.5			50.0	37	74	22.4	28	56
	Oth.	3.8			49.5			13.6	3	6	19.1	5	10
	B.G.								8	16		11	22
12	Tim.	4.1			10.0			4.7	7	14	1.7	1	2
	Lad.	95.5			90.0			94.0	45	90	98.3	45	90
	Oth.	0.4			-			1.3	-	-	-	-	-
	B.G.								5	10		5	10
13	Br.	39.1			5.7			33.7	20	40	40.0	22	44
	B.T.	7.8			0.6			46.6	31	62	34.3	31	62
	Oth.	52.1			93.7			19.7	9	18	25.7	11	22
	B.G.								8	16		4	8
14	R.Can.	2.1			15.9	3	6	2.7	1	2	29.7		
	B.T.	0.4			19.2	21	42	25.0	27	54	49.5		
	Oth.	97.5			64.9	13	52	72.3	25	50	20.8		
	B.G.					16	64		8	16			
15	K.Bl.	38.2			21.0			57.5	20	40	43.2	16	32
	B.T.	26.5			0.8			24.9	29	58	10.8	22	44
	Oth.	35.3			78.2			17.6	7	14	45.9	19	38
	B.G.								8	16		8	16

Density from Point Quadrat Analysis Pasture Mixtures 1961
(Experiment II)

Table A 39

Blocks	1	2	3				4		5	
Mixtures	D	D	A	B	C	D	C	D	C	D
1 Tim.	30	32	52	16	4	8	50	70	24	12
R.C.	172	96	38	46	42	34	260	90	92	76
Oth.	-	8	48	42	8	20	20	90	20	44
B.G.	16	20	16	36	58	48	-	-	14	16
2 Tim.	10	28		12	8	32				
R.C.	158	56		58	66	46				
Af.	22	2		32	6	(2)				
Oth.	-	-		12	18	18				
B.G.	12	40		28	26	40				
3 Tim.	38	20		6	12	20				
R.C.	52	54		18	46	38				
As.	100	50		(2)	28	20				
Oth.	-	-		90	2	8				
B.G.	8	34		26	36	48				
4 Tim.	20	26			6	4	(2)	(2)	8	4
R.C.	156	60			54	24	110	30	26	18
Lad.	94	84			36	76	120	210	128	164
Oth.	-	2			-	-	-	20	2	-
B.G.	6	14			34	28	-	-	16	10
5 Tim.	32	14		12	4	6				
R.C.	126	110		30	24	18				
Af.	12	12		42	4	6				
Lad.	54	84		74	38	84				
Oth.	4	-		8	-	-				
B.G.	10	12		16	32	26				
6 Tim.	34	36		16	16	22	40	80	16	40
R.C.	162	84		74	64	62	100	170	104	80
B.T.	24	20		44	24	18	80	70	32	36
Oth.	-	-		26	4	4	4	30	-	12
B.G.	4	22		18	30	30	-	-	16	18
7 Tim.	68	40	36	12	54	22				
Af.	52	60	34	30	6	44				
Oth.	-	2	60	62	38	22				
B.G.	30	46	22	32	38	44				

Cuts

Density from Point Quadrat Analysis Pasture Mixtures 1961
(Experiment II)

Table A 39

Blocks		1	2	3				4		5	
Mixtures		D	D	A	B	C	D	C	D	C	D
8	Tim.	32	32			2	6	(2)	10	4	4
	Af.	20	30			4	6	20	30	4	18
	Lad.	134	108			54	84	230	230	164	156
	Oth.	-	-			-	-	-	-	-	-
	B.G.	12	16			50	28	10	-	14	10
9	Tim.	74	48	8	18	6	32	50	230	40	52
	Af.	22	8	30	62	(2)	8	100	90	8	28
	B.T.	58	108	24	28	102	66	240	260	88	98
	Oth.	6	6	32	40	10	8	-	20	18	18
	B.G.	16	22	36	14	40	34	-	-	12	10
10	Tim.	30	24	16	30	10	10				
	As.	220	92	30	64	32	78				
	Oth.	-	14	74	18	84	20				
	B.G.	6	32	28	26	18	40				
11	Tim.	56	50		22	22	14	120	90	28	56
	B.T.	74	142		58	74	36	210	190	108	76
	Oth.	-	-		28	8	26	30	40	6	12
	B.G.	28	18		26	36	54	10	10	16	22
12	Tim.	24	18			12	4	10	(2)	14	2
	Lad.	152	180			70	92	260	200	150	166
	Oth.	-	-			-	-	-	-	-	-
	B.G .	12	12			46	30	-	-	10	10
13	Br.	48	24	6		24	10	120	30	48	58
	B.T.	68	196	102		80	118	250	130	92	116
	Oth.	-	6	38		34	20	30	50	18	30
	B.G.	30	14	20		24	22	20	10	16	8
14	R.Can.	4	4		4	(2)	6	10	(2)	2	6
	B.T.	74	100		58	76	58	290	360	84	74
	Oth.	-	18		14	38	22	70	80	78	28
	B.G.	52	28		38	26	40	-	-	16	32
15	K.Bl.	28	40	14		34	34	80	120	44	36
	B.T.	50	122	136		82	60	100	150	72	60
	Oth.	-	4	16		22	18	30	40	16	44
	B.G.	60	14	20		30	32	20	-	16	16

Cuts: columns A–D under each block.

Point Quadrat Analysis with Improved P.Q. at 32.5° Angle
Pasture Mixture and Pure Stands. July 27, 1961.

Table A 40

	Blocks											
	C						D					
Mix-tures	Hits	G.C.	D.	Hits	G.C.	D.	Hits	G.C.	D.	Hits	G.C.	D.
1 Tim.	10	33	50	2	20	30	8	27	33	5	50	60
R.C.	27	90	240	8	80	260	24	80	187	7	70	210
Oth.	9	30	33	2	20	20	7	23	30	5	50	70
B.G.	-	-	-	1	10	10	4	13	13	-	-	-
4 Tim.				3	30	40				3	30	30
R.C.				7	70	150				3	30	40
Lad.				7	70	170				10	100	320
Oth.				-	-	-				1	10	10
B.G.				-	-	-				-	-	
6 Tim.	10	33	40	3	30	40	9	30	40	6	60	60
R.C.	27	90	217	10	100	230	28	93	250	9	90	220
B.T.	16	53	70	3	30	40	14	47	77	6	60	120
Oth.	5	17	17	2	20	20	12	40	60	3	30	40
B.G.							-	-	-	-	-	-
8 Tim.				2	20	20				5	50	60
Af.				4	40	60				4	40	50
Lad.				10	100	360				10	100	290
Oth.				1	10	10				1	10	10
B.G.				-	-					-	-	-
9 Tim.				3	30	40				7	70	70
Af.				(.1)	1	8 1				4	40	50
B.T.				10	100	310				10	100	340
Oth.				1	10	10				-	-	-
B.G.				-	-	-				-	-	-
11 Tim.				6	60	70				9	90	130
B.T.				10	100	390				10	100	250
Oth.				1	10	20				1	10	10
B.G.				-	-					-	-	-
12 Tim.				2	20	20				3	30	60
Lad.				9	90	270				10	100	390
Oth.				-	-	-				-	-	-
B.G.				-	-	-				-	-	-
13 Br.				2	20	50	10	33	60	3	30	30
B.T.				10	100	280	28	93	380	10	100	350
Oth.				3	30	30	10	33	40	4	40	90
B.G.				-	-		-	-	-	-	-	-
	30 points with 3 stations			10 points with 1 station			30 points with 3 stations			10 points with 1 station		

Analysis performed at cutting time.

Point Quadrat Analysis with improved P.Q. at 32.5° Angle
Pure Stands July 27, 1961.

Table A 40[a]

Components	E Hits	E G.C.	E D.	F Hits	F G.C.	F D.
i Tim.	8	80	250	25	83	210
Oth.	3	30	40	12	40	57
B.G.	1	10	10	3	10	10
ii R.C.	8	80	220	28	93	303
Oth.	9	90	140	20	67	100
B.G.	-	-	-	1	3	3
iii Af.				20	67	120
Oth.				27	90	90
B.G.				2	7	7
iv Br.	8	80	230	29	87	227
Oth.	7	70	170	17	57	127
B.G.	-	-	-	2	7	7
v Lad.	10	100	350	28	93	270
Oth.	-	-	-	-	-	-
B.G.	-	-	-	2	7	7
vi B.T.	10	100	370	30	100	330
Oth.	2	20	20	7	23	33
B.G.	-	-	-	-	-	-
vii Tim.	4	40	40	1	10	20
Lad.	10	100	310	10	100	410
B.T.	3	30	30	3	30	30
Oth.	-	-	-	-	-	-
B.G.	-	-	-	-	-	-
viii Tim.	4	40	60	4	40	50
Br.	3	30	40	1	10	10
Lad.	10	100	300	10	100	360
B.T.	5	50	90	1	10	10
Oth.	-	-	-	1	10	10
B.G.	-	-	-	-	-	-
	10 points with 1 station			Pure Stands: 30 points with 3 stations Mixtures: 10 points with 1 station		

Yield per Unit Area of Ground Cover of Pure Stands (gm/plot)

Pasture Mixtures 1960 - 61

Table A41 Cut 1960

Block	Blocks E						Blocks F					
Species	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Unit Area	Total D.M.	D.M. Comp.	D.M. of Species	Density	G.C.	Y/Unit Area
1	2	3	4	5	6	8	2	3	4	5	6	8
Tim.	314	10.5	33.0		20	1.6	286	11.1	31.8		17	2.2
R.C.	566	57.8	327.2		34	9.6	359	54.0	193.1		42	3.9
Af.	336	11.4	38.3		12	3.2	378	37.5	141.8		15	7.8
Brome	389	6.2	24.1		12	2.0	284	5.1	14.5		16	0.7
Lad.	436	37.5	163.5		38	4.3	460	22.6	104.0		37	2.9
B.T.	422	34.7	146.4		36	4.1	372	36.7	136.5		35	4.0
R.Can.	401	2.6	10.4		8	1.3						
K.Blue	418	3.7	15.5		16	1.0						

Table A42 Cut 1961

Tim.	1502	100	1502		70	21.5	1440	100	1440	68	48	30.0
R.C.	1258	100	1258		70	18.0	1050	100	1050	162	80	13.1
Af.	313	99.0	310		12	25.8	581	100	581	36	26	22.4
Br.	1245	100	1245		64	19.4	1294	100	1294	46	32	40.4
Lad.	1080	98.9	1068		68	15.7	1193	97.4	1162	124	70	16.6
B.T.	600	100	600		68	8.8	715	98.7	706	52	38	18.6
R.Can.	879	100	879	30	24	36.6						
K.Blue	820	98.3	806	68	52	15.5						

Table A 43 — Yield per Unit Area of Ground Cover and per Point Density of the Pure Stands 1961 (gm/plot)

Pasture Mixtures

CUT 2 1961 — Blocks

Species	E: Total D.M.	E: % Comp.	E: D.M. of Species	E: Density	E: G.C.	E: Y/Point Density	E: Y/Unit Area	F: Total D.M.	F: % Comp.	F: D.M. of Species	F: Density	F: G.C.	F: Y/Point Density	F: Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim.	3400	99.3	3376	94	56	35.9	60.3	3552	100.0	3552	136	78	26.1	44.5
R.C.	1795	99.1	1779	92	58	19.3	30.7	1631	99.4	1621	90	62	18.0	26.1
Af.	544	97.5	530	22	12	24.1	44.2	814	98.8	804	14	12	57.4	67.0
Br.	1841	90.3	1662	84	62	19.8	26.8	2520	95.8	2414	72	50	33.5	48.3
Lad.	2091	100.0	2091	164	88	12.8	23.8	1876	100.0	1876	156	84	12.0	22.3
B.T.	2419	97.9	2368	158	80	15.0	29.6	2245	99.1	2225	102	66	21.8	33.7
R.Can.	2754	85.2	2346	110	72	21.3	32.6							
K.Blue	4161	99.0	4119	92	92	44.8	44.8							

Table A 44 Cut 3 1961

Species	E: Total D.M.	E: % Comp.	E: D.M. of Species	E: Density	E: G.C.	E: Y/Point Density	E: Y/Unit Area	F: Total D.M.	F: % Comp.	F: D.M. of Species	F: Density	F: G.C.	F: Y/Point Density	F: Y/Unit Area
Tim.	573	56.7	325	46	38	7.1	8.6	823	70.5	580	44	34	13.2	17.1
R.C.	1272	91.2	1160	42	36	27.6	32.2	1382	94.7	1309	64	46	20.5	28.4
Af.	946	85.2	806	30	22	26.9	36.6	1080	84.5	913	58	36	15.7	25.4
Br.	1272	41.5	528	62	48	8.5	11.0	1058	54.2	573	24	18	23.9	31.9
Lad.	1469	100.0	1469	102	70	14.4	21.0	1228	100.0	1228	118	72	10.4	17.1
B.T.	1196	90.1	1078	168	74	6.4	14.6	793	86.1	683	84	56	8.1	12.2
R.Can.				63	33									
K.Blue				63	33									

Yield per Unit Area of Ground Cover and per Point Density of Pure Stands
with Point Quadrat (gm/plot)
Readings Taken at Different Angles Cut 3 1961

Table A 45 P.Q. inclined at 45° Blocks

	E							F						
Species	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Point Density	Y/Unit Area	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim.	573	56.7	325	46	28	7.1	11.6	823	70.5	580	54.	44	10.7	13.2
R.C.	1272	91.2	1160	122	74	9.5	15.7	1382	94.7	1309	134	76	9.8	17.2
Af.	946	85.2	806	22	22	36.6	36.6	1080	84.5	913	26	22	35.1	41.5
Br.	1272	41.5	528	44	34	12.0	15.5	1058	54.2	573	46	36	12.5	15.9
Lad.	1469	100.	1469	144	88	10.2	16.7	1228	100.	1228	158	78	7.8	15.7
B.T.	1196	90.1	1078	154	76	7.0	14.2	793	86.1	683	114	68	6.0	10.0

Table A 46 P.Q.inclined at 32.5° at cutting time

Species	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Point Density	Y/Unit Area	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Point Density	Y/Unit Area
Tim.	573	56.7	325	250	80	1.3	3.1	823	70.4	580	210	83	2.8	7.0
R.C.	1272	91.2	1160	220	80	5.3	14.5	1382	94.7	1309	303	93	4.3	14.1
Af.	946	85.2	806	-	-	-	-	1080	84.5	913	120	67	7.6	13.6
Br.	1272	41.5	528	230	80	2.3	6.6	1058	54.2	573	227	87	2.5	6.6
Lad.	1469	100.	1469	350	100	4.2	14.7	1228	100.	1228	270	93	4.5	13.2
B.T.	1196	90.1	1078	370	100	2.9	10.8	793	86.1	683	330	100	2.1	6.8

Yield per Unit Area of Ground Cover and per Point Density of Pure Stands (gm/plot)

Pasture Mixtures 1961

Table A 47 Cut 4 1961

	Blocks														
	E							F							
Species	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Point Density	Y/Unit Area	Total D.M.	% Comp.	D.M. of Species	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim.	29		184	80	60	2.3	3.1	33		216	90	50	2.4	4.3
R.C.	109		472	160	80	3.0	5.9	89		712	210	70	3.4	10.2
Af.	134		528	140	60	3.8	8.8	95		280	130	70	2.2	4.0
Br.	92		320	120	90	2.7	3.6	45		248	130	70	1.9	3.5
Lad.	140		1120	320	90	3.5	12.4	103		824	170	90	4.8	9.2
B.T.	166		1040	350	100	3.0	10.4	156		944	180	80	5.2	11.8
R.Can.	85		632	180	70	3.5	9.0							
K.Bl.	82		584	120	70	4.9	8.3							

T able A 48 Cut 5 1961

Tim.	266	84.4	225	58	46	3.9	4.9	341	94.1	321	90	60	3.6	5.4
R.C.	513	90.9	466	104	62	4.5	7.5	681	99.5	678	160	80	4.2	8.5
Af.	713	88.9	634	46	32	13.8	19.8	678	89.1	604	76	48	7.9	12.6
Br.	325	61.1	199	62	46	3.2	4.3	244	79.4	194	40	32	4.8	6.1
Lad.	786	99.0	778	250	100	3.1	7.9	760	99.7	758	190	90	4.0	8.4
B.T.	470	77.4	364	140	70	2.6	5.2	439	82.1	360	150	78	2.4	4.6
R.Can.	662	91.7	570	94	68	6.4	8.4							
K.Bl.	504	98.5	496	110	66	4.5	7.5							

Yield per Unit Area of Ground Cover of the Grass Components (in gm/plot)
Pasture Mixture 1960 (Experiment II)

Table A 49

	Blocks											
	A			B			C			D		
Mixt. No.	D.M. of Component	G.C.	Y/Unit Area	D.M. of Component	G.C.	Y/Unit Area	D.M. of Component	G.C.	Y/Unit Area	D.M. of Component	G.C.	Y/Unit Area
1	4	6	8	4	6	8	4	6	8	4	6	8
Tim.1	49	13.0	3.8	41	4.0	10.2	20	8.0	2.5	34	6.0	5.7
2	35	6.0	5.8	56	12.0	4.7	30	6.0	5.0	27	8.0	3.5
3	18	4.0	4.5	49	6.0	8.2	11	6.0	1.8	17	2.0	8.5
4	45	8.0	5.6	52	8.0	6.5	21	10.0	2.1	32	6.0	5.3
5	47	6.0	7.8	28	2.0	14.0	30	6.0	5.0	26	2.0	13.0
6	48	6.0	8.0	29	3.0	9.7	20	6.0	3.3	18	4.0	4.5
7	84	8.0	10.5	84	12.0	7.0	28	14.0	2.0	52	10.0	5.2
8	121	18.0	6.7	103	8.0	12.9	34	8.0	4.2	59	14.0	4.2
9	111	10.0	11.1	41	2.0	20.5	28	10.0	2.8	27	6.0	4.5
10	47	6.0	7.8	36	2.0	18.0	10	2.0	5.0	16	7.0	2.3
11	51	4.0	12.8	53	8.0	6.6	41	10.0	4.1	24	6.0	4.0
12	59	8.0	7.4	78	8.0	9.8	35	12.0	2.9	27	8.0	3.4
VII	13	6.0	2.1	7	8.0	0.8						
VIII	13	2.0	6.3	14	8.0	1.7						
IX	17	16.0	1.0	20	10.0	2.0						
Br.13	18	8.0	2.2	54	8.0	6.8	10	14.0		12	6.0	2.0
VIII	13	10.0	1.3	34	10.0	3.4						
IX	7	8.0	0.9	7	8.0	0.9						
R.Can. 14	6	4.0	1.5	7	2.0	3.5	13	2.0	6.5	10	2.0	5.0
K.Bl.15	8	2.0	4.0	13	8.0	1.6	8	6.0	1.3	10	4.0	2.5

Yield per Unit Area of Ground Cover of the Legume Components (gm/plot)
Pasture Mixture 1960 (Experiment II)

Table A 50

	Blocks											
	A			B			C			D		
Mixt. No.	D.M. of Component	G.C.	Y/Unit Area	D.M. of Component	G.C.	Y/Unit Area	D.M. of Component	G.C.	Y/Unit Area	D.M. of Component	G.C.	Y/Unit Area
1	4	6	8	4	6	8	4	6	8	4	6	8
R.C.1	325	37.0	8.7	370	36.0	10.3	205	42.0	4.9	310	40.0	7.8
2	244	18.0	13.6	280	12.0	23.3	278	26.0	10.7	222	26.0	8.5
3	183	32.0	5.7	214	24.0	8.9	44	20.0	2.2	203	26.0	7.8
4	223	12.0	18.6	131	26.0	5.0	167	34.0	4.9	230	24.0	9.6
5	188	20.0	9.4	229	20.0	11.4	181	28.0	6.5	238	26.0	9.2
6	241	30.0	8.0	204	30.0	6.8	133	26.0	5.1	178	32.0	5.6
Af. 2	296	6.0	49.3	337	14.0	24.1	30	6.0	5.0	12	2.0	6.0
5	140	4.0	35.0	402	6.0	67.0	55	6.0	9.2	26	1.1	23.6
7	303	5.0	60.6	369	8.0	46.1	28	2.0	14.0	378	10.0	37.8
8	211	4.0	52.8	284	2.0	142.0	68	4.0	17.0	213	2.3	106.5
9	223	10.0	22.3	473	12.0	39.4	9	4.0	2.2	68	2.0	34.0
IX	51	4.0	12.8	34	6.0	5.7						
Lad.4	238	40.0	6.0	262	28.0	9.4	83	14.0	5.9	131	26.0	5.0
5	210	20.0	10.5	144	12.0	12.0	84	14.0	6.0	106	18.0	5.9
8	302	28.0	10.8	361	40.0	9.0	111	34.0	3.3	178	24.0	7.4
12	204	28.0	7.3	495	12.0	41.2	190	26.0	7.3	332	42.0	7.9
VII	64	24.0	2.7	73	36.0	2.0						
VIII	89	16.0	5.6	57	12.0	4.7						
B.T.6	32	14.0	2.3	58	8.0	7.2	31	16.0	1.9	44	8.0	5.5
9	139	8.0	17.4	82	6.0	13.7	74	14.0	5.3	135	16.0	8.4
11	90	26.0	3.5	187	18.0	10.4	95	18.0	5.3	206	10.0	20.6
13	72	16.0	4.5	135	12.0	11.2	114	18.0	6.3	113	14.0	8.1
14	92	12.0	7.7	179	26.0	6.9	109	12.0	9.1	215	34.0	6.3
15	101	18.0	5.6	136	26.0	5.2	92	18.0	5.1	160	32.0	5.0
VII	76	8.0	9.5	33	18.0	1.8						
VIII	76	8.0	9.5	91	18.0	5.1						
As. 3	256	12.0	21.3	197	12.0	16.4	145	24.0	7.3	102	18.0	5.7
10	237	24.0	10.0	191	34.0	5.6	204	34.0	6.0	142	28.0	5.1

Yield per Unit Area of Ground Cover of the Grass Components (gm/plot)
Pasture Mixture 1961 Cut I

Table A51 Blocks

	C						D					
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area
2	2	3	4	5	6	8	2	3	4	5	6	8
Tim. 1	1498	7.1	106		20	5.3	1492	7.1	106	30	24	4.4
2	1688	6.2	105		22	4.8	1609	9.2	148	10	10	14.8
3	1654	8.9	147		12	12.2	2034	11.1	226	38	32	7.1
4	1458	11.3	165		48	3.4	1726	11.9	205	20	16	12.8
5	1525	10.3	157		26	6.0	1938	10.3	200	32	24	8.3
6	1383	10.5	145		38	3.8	1624	8.3	135	34	26	5.2
7	437	27.6	121		40	3.0	1806	10.0	181	68	62	3.5
8	1657	15.2	252		30	8.4	1823	12.4	226	32	30	7.1
9	753	19.6	148		46	3.2	1000	13.6	136	74	52	2.6
10	1764	9.1	160		26	6.2	1777	5.9	105	30	26	4.0
11	561	28.6	160		36	4.5	813	17.7	144	56	40	3.6
12	1232	20.4	251		48	5.2	1728	11.1	192	24	16	12.0
VII	1088	17.0	185		34	5.4	1036	8.5	88	20	16	5.5
VIII	1115	25.9	289		26	11.1	1247	12.2	152	30	22	6.9
IX	684	20.0	137		36	3.8	461	25.3	117	36	30	3.9
Br. 13	776	25.0	194		20	9.7	731	28.6	209	48	38	5.5
VIII	1115	0.9	10		10	1.0	1247	2.1	26	12	10	2.6
IX	684	5.7	39		18	2.2	461	8.1	37	14	14	2.6
R.Can.14	547	1.7	9		4	2.2	786	10.9	86	2	2	43.0
K.Bl.15	647	14.8	96		32	3.0	444	32.4	144	28	20	7.7

Yield per Unit Area of Ground Cover of the Legume Components (gm/plot)
Pasture Mixture 1961 Cut I

Table A52

	Blocks											
	C						D					
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area
1	2	3	4	5	6	8	2	3	4	5	6	8
R.C. 1	1498	92.9	1391		74	18.8	1492	91.1	1359	176	76	17.9
2	1688	77.1	1301		74	17.6	1609	84.6	1361	158	84	16.2
3	1654	28.6	473		52	9.1	2034	33.3	677	52	36	18.8
4	1458	53.0	773		42	18.4	1726	59.3	1023	156	76	13.5
5	1525	41.4	631		40	15.8	1938	58.6	1135	126	64	17.7
6	1383	73.7	1019		68	15.0	1624	81.7	1326	162	78	17.0
Af. 2	1688	16.7	282		8	35.2	1609	6.2	100	22	18	5.6
5	1525	20.7	316		10	31.6	1938	10.3	200	12	12	16.7
7	437	71.7	313		4	78.2	1806	88.3	1595	52	38	42.0
8	1657	19.6	325		6	54.2	1823	37.2	678	20	18	37.7
9	753	23.5	177		6	29.4	1000	29.5	295	22	22	13.4
IX	684	72.9	499		12	41.6	461	65.8	303	10	8	37.9
Lad. 4	1458	35.7	521		50	10.4	1723	27.1	467	94	58	8.0
5	1525	27.6	411		50	8.2	1938	19.0	368	54	36	10.2
8	1657	58.7	973		66	14.7	1823	49.6	904	134	74	12.2
12	1232	79.6	981		68	14.4	1728	88.9	1536	152	84	18.3
VII	1088	57.4	624		54	11.6	1036	52.3	542	92	54	10.0
VIII	1115	43.1	481		50	9.6	1247	55.1	687	74	48	14.3
B.T. 6	1383	15.8	218		24	9.1	1624	10.0	162	24	20	8.1
9	753	56.9	428		42	10.2	1000	54.5	545	58	44	12.4
11	561	71.4	401		46	8.7	813	81.4	662	74	52	12.7
13	776	75.0	582		40	14.6	731	70.5	515	68	54	9.5
14 B	547	96.6	528		66	8.0	786	87.3	686	74	46	14.9
15	647	85.2	551		52	10.6	444	64.7	287	50	34	8.4
VII	1088	21.3	232		18	12.9	1036	38.1	395	28	24	16.4
VIII	1115	25.9	289		46	6.3	1247	30.6	382	40	32	11.9
As. 3	1654	62.5	1034		70	14.8	2034	53.3	1084	100	56	19.4
10	1764	70.9	1251		84	14.9	1777	94.1	1672	220	92	18.2

YIELD per Unit Area of Ground Cover of the Grass Component
Pasture Mixture 1961 Cut 2

Table A53

	Blocks											
	A						B					
Mixt. No. 1	Total D.M. 2	% Comp. 3	D.M. of Component 4	Density 5	G.C. 6	Y/U.A. of G.C. 8	Total D.M. 2	% Comp. 3	D.M. of Component 4	Density 5	G.C. 6	Y/U.A. of G.C. 8
Tim 1	1033	58.0	599		24	25.0	1961	29.0	569		38	15.0
2	2231	11.5	257		8	32.1	2190	15.6	342		28	12.2
3	1822	9.8	179		12	14.9	1898	12.5	237		18	13.2
4	2025	17.4	352		16	22.0	1935	9.4	182		14	13.0
5	2067	17.3	358		12	29.8	2088	7.2	150		12	12.5
6	2077	14.4	299		12	24.9	2131	12.1	258		22	11.7
7	2042	32.9	672		40	16.8	2275	25.0	569		38	15.0
8	2123	14.3	304		28	10.8	2104	19.8	417		24	17.4
9	2416	16.3	394		46	8.6	2250	15.7	353		42	8.4
10	1445	33.8	488		28	17.4	1272	46.2	588		28	21.0
11	2652	25.0	663		28	23.6	2388	22.2	530		32	16.6
12	2062	23.3	480		32	15.0	1825	13.9	254		10	25.4
Brome13	2533	17.4	441		28	15.7	2112	1.6	34		2	17.0
R.Can.14	2065	0.2	4				2688	1.4	38		6	6.3
K.Blue15	2581	3.3	85		20	4.2	2142	6.9	148		38	3.9

Yield per Unit Area of Ground Cover of the Grass Components Cut 2 (gm/plot)
Pasture Mixtures 1961

Table A 54

	Blocks												
	C						D						
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	8	2	3	4	5	6	7	8
Tim. 1	2042	11.6	237		22	10.8	1987	18.8	374	32	28	11.7	13.4
2	2074	18.8	390		22	17.7	1735	17.1	297	28	20	10.6	14.8
3	1773	16.0	284		22	12.9	1535	17.2	264	20	16	13.2	16.5
4	2096	11.3	237		22	10.8	1885	11.4	215	26	26	8.3	8.3
5	2313	7.6	176		26	6.8	1782	11.5	205	14	14	14.6	14.6
6	2087	15.4	321		22	14.6	1918	18.7	359	18	15	19.9	23.9
7	1267	44.3	561		46	12.2	2009	14.0	281	40	32	7.0	8.9
8	2111	11.5	243		14	17.3	2096	7.3	153	32	26	4.8	5.9
9	2360	21.6	510		36	14.1	2038	19.4	395	48	36	8.2	11.0
10	1756	12.1	212		14	15.2	1161	34.3	398	24	22	16.6	18.1
11	2347	16.1	378		24	15.7	2069	23.4	484	50	34	9.7	14.2
12	2206	17.2	379		34	11.2	2079	25.0	520	18	16	28.9	32.5
vii	2294	21.7	498	34	18	27.7	2398	19.4	465	44	32	10.6	14.5
viii	2241	10.6	238	18	16	14.8	2207	14.4	318	18	14	17.7	22.7
ix	1096	32.1	352	60	46	7.6	499	45.1	225	46	44	4.9	5.1
Br. 13	2067	7.4	153		14	10.9	1742	10.5	183	24	22	7.6	8.3
viii	2241	0.2	4	4	4	1.0	2207	1.0	22	14	14	1.6	1.6
ix	1096	1.5	16	14	8	2.0	499	2.0	10	14	10	0.7	1.0
R.Can. 14	B) 2688	1.4	38		6	6.3	2212	2.4	53	4	4	1.3	13.2
K.Bl. 15	2152	5.0	108		24	4.5	963	6.2	60	40	34	1.5	1.8

Yield per Unit Area of Ground Cover of the Legume Components Cut 2
Pasture Mixtures 1961

Table A 55

	Blocks A						Blocks B					
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/U.A. of G.C.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/U.A. of G.C.
1	2	3	4	5	6	8	2	3	4	5	6	8
R.C. 1	1033	37.0	382		44	8.7	1961	66.7	1307		52	25.1
2	2231	27.1	605		20	30.2	2190	33.8	740		42	17.6
3	1822	35.9	654		50	13.1	1898	41.3	784		40	19.6
4	2025	14.7	298		24	12.4	1935	18.7	362		30	12.1
5	2067	18.3	378		28	13.5	2088	21.7	453		42	10.8
6	2077	49.5	1028		48	21.4	2131	77.3	1647		56	29.4
Af. 2	2231	31.2	696		38	18.3	2190	48.0	1051		28	37.5
5	2067	13.5	279		10	27.9	2088	43.4	906		20	45.3
7	2042	59.1	1207		30	40.2	2275	66.7	1517		22	69.0
8	2123	18.7	397		22	18.0	2104	22.8	480		22	21.8
9	2416	70.7	1708		34	50.2	2250	67.5	1519		46	33.0
Lad. 4	2025	67.9	1375		72	19.1	1935	71.9	1391		60	23.2
5	2067	50.9	1052		48	21.9	2088	27.7	578		46	12.6
8	2123	67.0	1422		76	18.7	2104	57.4	1208		66	18.3
12	2062	76.7	1582		68	23.3	1825	86.1	1571		78	20.1
B.T. 6	2077	2.1	44		4	11.0	2131	9.1	194		24	8.1
9	2416	5.4	130		12	10.9	2250	8.4	189		16	11.8
11	2652	10.5	278		22	12.7	2388	64.5	1540		50	30.8
13	2533	57.4	1454		68	21.4	2112	6.4	135		12	11.3
14	2065	9.4	194		34	5.7	2688	90.4	2430		74	32.8
15	2581	90.2	2328		70	33.3	2142	13.8	296		44	6.7
As. 3	1822	2.2	40		16	2.5	1898	1.2	23		14	1.6
10	1445	7.0	101		34	3.0	1272	43.1	548		58	9.4

Yield per Unit Area of Ground Cover of the Legume Components Cut 2 (gm/plot)
Pasture Mixtures 1961

Table A 56

	Blocks												
	C						D						
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	8	2	3	4	5	6	7	8
R.C.1	2042	88.4	1805		56	32.2	1987	81.2	1613	96	56	16.8	28.8
2	2074	69.3	1437		68	21.1	1735	76.2	1322	56	38	23.6	34.8
3	1773	55.6	986		36	27.4	1535	58.6	900	54	38	16.7	23.7
4	2096	38.7	811		58	14.0	1885	40.0	754	60	44	12.6	17.1
5	2314	37.1	858		44	19.5	1782	34.5	615	110	60	5.6	10.2
6	2087	71.4	1490		62	24.0	1918	69.2	1327	84	42	15.8	31.6
Af. 2	2074	7.9	164		8	20.5	1735	6.7	116	2	2	58.0	58.0
5	2314	1.9	44		2	22.0	1782	0.4	7	12	10	0.6	0.7
7	1267	32.1	407		12	33.9	2009	83.0	1668	60	42	27.8	39.7
8	2111	18.0	380		20	19.0	2096	25.4	532	30	20	17.7	26.6
9	2360	6.7	158		6	26.3	2038	26.4	538	8	6	67.2	89.7
ix	1096	65.6	719	6	4	179.7	499	51.6	255	2	2	127.5	127.5
Lad.4	2096	50.0	1048		60	17.5	1885	48.6	916	84	62	10.9	14.8
5	2314	53.3	1233		54	22.8	1782	53.6	955	84	58	11.4	16.5
8	2111	70.5	1488		84	17.7	2092	66.4	1392	108	68	12.9	20.5
12	2206	82.0	1809		78	23.2	2079	75.0	1559	180	86	8.7	18.1
vii	2294	72.6	1665	126	76	21.9	2398	71.3	1710	64	48	26.7	35.6
viii	2241	77.7	1741	102	66	26.4	2207	76.3	1684	98	70	17.2	24.1
B.T.6	2087	12.1	252		20	12.6	1918	12.1	232	20	14	11.6	16.6
9	2360	70.2	1657		62	26.7	2038	52.8	1076	108	58	10.0	18.6
11	2344	83.9	1969		76	25.9	2069	72.7	1504	142	72	10.6	20.9
13	2067	88.2	1712		64	26.7	1742	86.0	1498	196	82	7.6	18.3
14	2894	92.0	2662		74	36.0	2212	67.0	1482	100	58	14.8	25.6
15	2152	93.3	2008		62	32.4	963	90.7	873	122	70	7.2	12.5
vii	2294	5.7	131	46	30	4.4	2398	8.5	204	36	28	5.7	7.3
viii	2241	10.6	238	62	46	5.2	2207	8.3	183	34	24	5.4	7.6
As. 3	1773	25.7	456		58	7.9	1535	23.4	359	50	32	7.2	11.2
10	1756	24.1	423		48	8.8	1161	62.7	728	92	50	7.9	14.6

Yield per Unit Area of Ground Cover of the Grass Components Cut 3
Pasture Mixtures 1961.

Table A 57

	Blocks A						Blocks B					
Mixt. No. 1	Total D.M. 2	% Comp. 3	D.M. of Component 4	Density 5	G.C. 6	Y/U.A. of G.C. 8	Total D.M. 2	% Comp. 3	D.M. of Component 4	Density 5	G.C. 6	Y/U.A. of G.C. 8
Tim 1	1123	26.9	302	52	42	7.2	1184	13.0	154	16	12	12.8
2	1784	4.1	73		4	18.3	1722	3.6	62	12	12	5.2
3	1505	7.4	111		4	27.8	1515	6.1	92	6	6	15.4
4	1486	5.6	83		4	20.8	1601	8.7	139		14	10.0
5	1679	3.0	50		12	4.2	1774	2.2	39	12	10	3.9
6	1618	2.0	32		8	4.0	1241	4.6	57	16	14	4.1
7	1767	10.1	178	36	28	6.4	1886	4.6	87	12	12	7.2
8	1739	2.0	35		20	1.7	1828	2.0	37		12	3.0
9	1930	4.4	85	8	8	10.6	1937	5.6	108	18	16	6.8
10	1269	18.7	237	16	12	19.8	821	32.1	263	30	26	10.1
11	1496	4.2	63		10	6.3	1098	22.5	247	22	20	12.4
12	1455	6.0	87		10	8.7	1409	8.1	114		6	19.0
Br.13	1371	11.1	152	6	6	25.4	1786					
R.Can.14	1432						1071	2.9	31	4	4	7.8
K.Bl. 15	1229	9.1	112	14	14	8.0	1870					

Yield per Unit Area of Ground Cover of the Grass Components Cut 3 (gm/plot)
Pasture Mixtures 1961

Table A 58

	Blocks													
	C							D						
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim 1	1048	4.9	51	4	4	12.8	12.8	1055	7.5	79	8	8	9.9	9.9
2	1248	3.9	49	8	8	6.1	6.1	1118	5.4	60	32	24	1.9	2.5
3	1022	7.9	81	12	10	6.7	8.1	981	8.1	79	20	16	4.0	5.0
4	1315	1.9	25	6	6	4.2	4.2	1425	2.5	36	4	4	8.9	8.9
5	1296	2.2	29	4	4	7.1	7.1	1289	1.5	19	6	6	3.2	3.2
6	1230	6.7	82	16	14	5.2	5.9	1049	12.7	133	22	16	6.1	8.3
7	910	5.5	50	54	34	0.9	1.5	1820	2.8	51	22	18	2.3	2.8
8	1344	2.5	34	2	2	16.8	16.8	1677	0.7	12	6	6	2.0	2.0
9	1068	10.8	115	6	6	19.2	19.2	1101	13.6	150	32	24	4.7	6.2
10	1020	4.4	45	10	8	4.5	5.6	544	36.6	199	10	10	19.9	19.9
11	1019	12.2	124	22	16	5.7	7.8	700	27.6	193	14	14	13.8	13.8
12	1203	3.1	37	12	12	3.1	3.1	1460	1.9	28	4	4	6.9	6.9
vii	1293	0.9	12	14	12	0.9	1.0	1268	2.5	32	6	6	5.3	5.3
viii	1376	2.1	29	(2)	(2)	14.5	14.5	1509	1.1	17	6	6	2.8	2.8
ix	820	6.9	57	36	28	12.9	2.0	583	6.8	40	26	18	1.5	2.2
Br.13	1274	3.1	106	24	20	4.4	5.3	1143	8.9	101	10	10	10.2	10.2
viii	1376	0.1	1.4	2	2	0.7	0.7	1509	0.3	5	6	6	0.8	0.8
ix B)	820	3.0	25	16	12	1.6	2.1	583	7.6	44	24	20	1.8	2.2
R.Can.14	1071	2.9	21	4	4	0.1	7.8	974	4.1	40	6	6	6.7	6.7
K.Bl. 15	1285	21.6	278	34	30	8.2	8.2	925	18.3	169	34	26	5.0	6.5

Yield per Unit Area of Ground Cover of the Legume Components Cut 3
Pasture Mixtures 1961

Table A 59

	Blocks												
	A							B					
Mixt. No.	Total D.M.	% Comp.	D.M. of Components	Den-sity	G.C.	Y/U.A. of G.C.		Total D.M.	% Comp.	D.M. of Components	Den-sity	G.C.	Y/U.A. of G.C.
1	2	3	4	5	6	8		2	3	4	5	6	8
R.C. 1	1123	56.4	633	38	28	22.6		1184	81.3	1531	23	18	85.1
2	1784	8.2	146		26	5.6		1722	24.7	425	58	50	8.5
3	1505	14.8	223		28	8.0		1515	15.8	239	18	12	19.9
4	1486	6.7	100		14	7.1		1601	12.7	203		16	12.7
5	1679	6.4	107		16	6.7		1774	5.9	105	30	22	4.8
6	1618	20.6	333		30	11.1		1241	82.7	1026	74	48	21.4
Af. 2	1784	45.4	810		14	57.9		1722	65.1	1121	32	26	43.1
5	1679	18.1	304		12	25.3		1774	52.6	933	42	30	31.1
7	1767	72.7	1284	34	26	49.4		1886	68.7	1296	30	28	43.6
8	1739	16.8	292		12	24.3		1828	28.8	526		26	20.2
9	1930	79.4	1532	30	28	54.7		1937	79.9	1548	62	50	31.0
Lad. 4	1486	87.8	1305		82	15.9		1601	77.8	1246		66	18.9
5	1679	72.4	1216		68	17.9		1774	39.2	695	74	50	13.9
8	1739	81.2	1412		76	18.6		1828	68.9	1259		70	18.9
12	1455	91.8	1336		80	16.7		1409	90.7	1278		72	17.7
B.T. 6	1618	0.8	13		6	2.2		1241	6.0	74	44	32	2.3
9	1930	4.1	79	24	18	4.4		1937	3.5	68	28	24	2.8
11	1496	1.3	19		4	4.9		1098	41.6	457	58	46	9.9
13	1371	53.1	728	102	64	11.4		1786					
14	1432							1071	65.7	704	80	54	13.0
15	1229	75.0	922	136	76	12.1		1870					
As. 3	1505	(1.9)	19	(2)	(2)	9.5		1515	(2.3)	39		(2)	19.5
10	1269	2.0	25	30	22	1.1		821	12.5	133	64	40	3.3

Yield per Unit Area of Ground Cover of the Legume Components Cut 3 (gm/plot)
Pasture Mixtures 1961

Table A 60

	Blocks													
	C							D						
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
R.C.1	1048	94.4	989	42	32	23.6	30.9	1055	84.2	888	34	32	26.1	27.8
2	1248	66.7	832	66	50	12.6	16.6	1118	79.8	892	46	36	19.4	24.8
3	1022	86.4	883	46	38	19.2	23.2	981	78.1	766	38	30	20.2	25.5
4	1315	26.8	352	36	28	9.8	12.6	1425	9.3	133	24	22	5.5	6.0
5	1296	27.0	350	24	18	14.6	19.4	1289	17.7	228	18	16	12.7	14.3
6	1230	81.0	996	64	46	15.6	21.7	1049	73.9	775	62	48	12.5	16.2
Af. 2	1248	20.9	261	6	6	43.5	43.5	1118	13.4	150	(2)	(2)	75.0	75.0
5	1296	10.9	141	4	4	35.3	35.3	1289	7.7	99	6	6	16.5	16.5
7	910	85.4	777	6	6	129.5	129.5	1820	93.8	1707	44	30	56.9	38.8
8	1344	17.8	239	4	4	59.8	59.8	1677	20.9	350	6	6	58.4	58.4
9	1068	26.2	280	2	2	140.0	140.0	1101	28.7	316	8	8	39.5	39.5
ix	820	87.3	716	6	6	119.3	119.3	583	76.0	443	2	2	221.5	221.5
Lad.4	1315	71.3	938	54	44	17.4	21.3	1425	85.6	1220	76	62	16.0	19.7
5	1296	59.9	776	38	30	20.4	25.9	1289	73.1	942	84	58	11.2	16.2
8	1344	79.5	1068	54	46	19.8	23.2	1677	78.3	1313	84	64	15.6	20.5
12	1203	96.8	1165	70	48	16.6	24.3	1960	98.0	1431	92	64	15.6	22.4
vii	1293	97.8	1265	76	52	16.6	24.3	1268	96.6	1225	112	76	10.9	16.1
viii	1376	95.8	1318	86	50	15.3	26.4	1509	97.3	1468	90	66	16.3	22.2
B.T.6	1230	10.0	123	24	18	5.1	6.8	1049	11.9	125	18	16	6.9	7.8
9	1068	57.7	616	102	54	6.0	11.4	1101	54.4	599	66	44	9.1	13.6
11	1019	85.0	866	74	48	11.7	18.0	700	67.6	473	36	28	13.1	16.9
13	1274	83.3	1061	80	56	13.3	19.0	1143	80.2	917	108	72	8.5	12.7
14 B)	1071	65.7	704	80	54	13.0	8.8	974	67.0	653	58	44	11.3	14.8
15	1285	68.8	884	80	52	10.8	17.0	925	63.4	586	60	44	9.8	13.3
vii	1293	1.3	17	34	34	0.5	0.5	1268	0.9	11	4	2	2.8	5.5
viii	1376	2.0	28	10	8	2.8	3.4	1509	1.4	21	16	12	1.3	1.8
As. 3	1022	2.9	30	28	26	1.1	1.2	981	6.7	66	20	16	3.3	4.1
10	1020	3.0	31	32	24	1.0	1.3	544	56.3	306	78	54	3.9	5.7

Yield per Point and per Unit Area of Ground Cover of Mixture Components with P.Q. taken at Cutting (gm/plot)

Pasture Mixtures Cut 3 1961

Table A 61

Blocks

Mixt. No.	C Total D.Wt	C % Comp.	C D.Wt.of Component	C Density	C G.C.	C Yield/ Point	C Y/U.A. G.C.	D Total D.Wt.	D % Comp.	D D.Wt. of Component	D Density	D G.C.	D Yield/ Point	D Y/U.A. G.C.
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim 1	1048	4.9	51	30	20	1.7	2.5	1055	7.5	79	60	50	1.3	1.6
4	1315	1.9	25	40	30	0.6	0.8	1425	2.5	36	30	30	1.2	1.2
6 B	1230	6.7	82	60	60	1.4	1.4	1049	12.7	133	40	30	3.3	4.4
8	1344	2.5	34	20	20	1.7	1.7	167	0.7	12	60	50	0.2	0.24
9	1068	10.8	115	40	30	2.9	3.8	1101	13.6	150	70	70	2.1	2.1
11	1019	12.2	124	70	60	1.7	2.1	700	27.6	193	130	100	1.5	1.9
12	1203	3.1	37	20	20	1.8	1.8	1460	1.9	28	60	30	0.5	0.9
vii	1293	0.9	12	40	40	0.3	0.3	1268	2.5	32	20	10	1.6	3.2
viii	1376	2.1	29	60	40	0.5	0.7	1509	1.1	17	50	40	0.3	0.4
Br.13	1274	8.3	106	50	30	2.1	3.5	1143	8.9	101	30	30	3.4	3.4
viii	1376	0.1	1.4	40	30	0.04	0.05	1509	0.3	5	10	10	0.5	0.5
R.C.1	1048	94.4	989	260	80	3.8	12.4	1055	84.2	888	210	70	4.2	12.7
4	1315	26.8	352	150	70	2.3	5.0	1425	9.3	133	40	30	3.3	4.4
6 B	1230	81.0	996	220	90	4.5	11.1	1049	73.9	775	230	100	3.4	7.8
Af. 8	1344	17.8	239	60	40	4.0	6.0	1677	20.9	350	50	40	7.0	8.8
9	1068	26.2	280	2	2	140.0	140.0	1101	28.7	316	40	30	7.9	10.5
Lad.4	1315	71.3	938	170	70	5.5	13.4	1425	85.6	1220	320	100	3.8	12.2
8	1344	79.5	1068	360	100	3.0	10.7	1677	78.3	1313	290	100	4.5	13.1
12	1203	96.8	1165	270	90	4.3	12.9	1460	98.0	1431	390	100	3.7	14.3
vii	1293	97.8	1265	310	100	4.1	12.6	1268	96.6	1225	410	100	3.0	12.2
viii	1876	95.8	1318	300	100	4.4	13.2	1509	97.3	1468	360	100	4.1	14.7
B.T.6 B	1230	10.0	123	70	60	1.8	2.0	1049	11.9	125	40	30	3.1	4.2
9	1068	57.7	616	370	100	1.7	6.2	1101	54.4	599	340	100	1.8	6.0
11	1019	85.0	866	390	100	2.2	8.7	700	67.6	473	250	100	1.9	4.7
13	1274	83.3	1061	280	100	3.8	10.6	1143	80.2	917	350	100	2.6	9.2
vii	1293	1.3	17	30	30	0.57	0.57	1268	0.9	11	30	30	0.4	0.4
viii	1376	2.0	28	90	50	0.31	0.56	1509	1.4	21	10	10	2.1	2.1

10 stations with 1 point at 32.50

Yield per Unit Area of Ground Cover of the Grass Component (gm/plot)
Pasture Mixtures 1961 Cut 4

Table A 62 Blocks

	C							D						
Species	Total DM/m²	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area	Total DM/m²	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim.1	114		96	50	30	1.9	3.2	145		80	70	50	1.1	1.6
4	117		16	(2)	(2)	8.0	8.0	125		15	(2)	(2)	7.5	7.5
6	119		196	40	30	4.9	6.5	132		152	80	50	1.9	3.0
8	139		8	(2)	(2)	4.0	4.0	134		12	10	10	1.2	1.2
9	155		152	50	30	3.0	5.1	167		264	230	100	1.1	2.6
11	136		168	120	80	1.4	2.1	107		256	90	80	2.8	3.2
12	136		24	10	10	2.4	2.4	162		11	(2)	(2)	5.5	5.5
VII	124		4.0	(2)	(2)	2.0	2.0	106		9	(2)	(2)	4.5	4.5
VIII	139		2.9	(2)	(2)	1.4	1.4	139		52	10	10	5.2	5.2
Br.13	132		120	30	30	4.0	4.0	131		152	120	50	1.3	3.0
VIII	139		0.6	(2)	(2)	0.3	0.3	139		28	10	10	2.8	2.8
R.Can14	189		6.7	10	10	0.7	0.7	197		48	(2)	(2)	24.0	24.0
K.B.15	141		464	80	70	5.8	6.6	168		288	120	90	2.4	3.2

P.Q. taken at cutting time as 1 point at 10 stations at a 45° angle

Yields/m^2 were cornected to yield per plots for the D.M. of the components (i.e. 8X)

Yield per Unit Area of Ground Cover and per Point of Density of the Legume Components (gm/plot)

Pasture Mixtures Cut 4 1961

Table A 63

Mixt. No.	C: Total D.M./m^2	C: % Comp.	C: D.M. of Component	C: Density	C: G.C. 100p	C: Y/Point Density	C: Y/U.A. of G.C.	D: Total D.M/m^2	D: % Comp.	D: D.M. of Component	D: Density	D: G.C. 100p	D: Y/Point Density	D: Y/U.A. G.C.
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
R.C.1	114		664	260	100	2.6	6.6	145		568	90	60	6.3	9.5
4	117		120	110	50	1.1	2.4	125		120	30	30	4.0	4.0
6	119		632	100	50	6.3	12.6	132		568	17	80	3.3	7.1
Af. 8	139		144	20	20	7.2	7.2	134		184	80	50	2.3	3.7
9	155		312	100	70	3.1	4.5	167		288	90	30	3.2	9.6
Lad.4	117		792	120	70	6.6	11.3	125		936	210	80	4.5	11.7
8	139		960	230	90	4.2	10.7	134		856	230	100	3.7	8.6
12	136		1064	260	100	4.1	10.6	162		1080	200	90	5.4	12.0
vii	124		976	280	100	3.5	9.8	106		808	270	100	3.0	8.1
viii	139		1104	330	90	3.3	12.3	139		920	250	100	3.7	9.2
B.T.6	119		120	80	40	1.5	3.0	132		224	70	50	3.2	4.5
9	155		600	240	100	2.5	6.0	167		672	260	90	2.6	7.5
11	136		864	210	90	4.1	9.6	107		600	190	90	3.2	6.7
13	132		800	130	70	6.2	11.4	131		664	250	80	2.7	8.3
14	189		640	290	100	2.2	6.4	B 197		896	360	100	2.5	9.0
15	141		416	100	60	4.2	6.9	168		560	150	70	3.7	8.0
vii	124		8	20	20	0.4	0.4	106		30	2	2	15.0	15.0
viii	139		3.2	2	2	1.6	1.6	139		112	10	10	1.1	1.1

D.M. of the components was obtained from the hand separations of a square metre quadrat, and the values thereof obtained were multiplied by 8

Yield per Unit Area of Ground Cover and per Point Density of the Grass Components (gm/plot)

Pasture Mixtures Cut 5 1961

Table A 64

	Blocks													
	C							D						
Compon. Mixt.No.	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Point Density	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim.1	629	15.7	99	24	22	4.1	4.5	487	16.0	78	12	10	6.5	7.8
4	801	1.9	15	8	8	1.9	1.9	818	2.1	17	4	4	4.2	4.2
6	792	11.3	89	16	16	5.6	5.6	813	30.6	249	40	32	6.2	7.8
8	826	3.1	26	4	4	6.5	6.5	901	1.4	13	4	4	3.2	3.2
9	667	32.4	216	40	28	5.4	7.7	735	24.4	179	52	36	3.4	5.0
11	521	36.4	190	28	22	6.8	8.6	474	58.5	278	56	44	4.8	6.3
12	689	4.7	32	14	14	2.3	2.3	799	1.7	14	2	2	7.0	7.0
vii	750	2.0	15	4	4	3.8	3.8	639	4.9	31	6	4	5.2	7.8
viii	851	0.9	8	8	6	1.0	1.3	707	2.1	15	4	4	3.8	3.8
Br. 13	459	33.7	155	48	40	3.2	3.9	525	40.0	210	58	44	3.6	4.8
viii	851	2.1	18	2	2	9.0	9.0	707	1.9	13	6	6	2.2	2.2
R.Can.14	781	2.7	21	2	2	10.5	10.5	B 329	15.9	52	6	6	8.7	8.7
K.Bl. 15	780	57.5	448	44	40	10.2	11.2	901	43.2	389	36	32	10.8	12.2

Yield per Unit Area of Ground Cover and per Point Density of the Legume Components (gm/plot)

Pasture Mixtures Cut 5 1961

Table A 65

	Blocks													
	C							D						
Compon. Mixt.No.	Total D.M.	$ Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Y/Point Density	Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Y/Point Density
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
R.C. 1	629	81.2	511	92	62	8.2	5.6	487	68.2	332	76	54	6.1	4.4
4	801	18.4	147	26	22	6.7	5.7	818	3.1	25	18	14	1.8	1.4
6	792	80.5	638	104	66	9.7	6.1	813	55.9	454	80	54	8.4	5.7
Af. 8	826	31.7	262	4	4	65.5	65.1	901	38.2	344	18	14	24.6	19.1
9	667	29.7	198	8	8	24.8	24.8	735	50.9	374	28	20	18.7	13.4
Lad. 4	801	78.8	631	128	74	8.5	4.9	818	94.8	775	164	86	9.0	4.7
8	826	65.2	539	164	84	6.4	3.3	901	60.4	544	156	84	6.5	3.5
12	689	94.0	648	150	90	7.2	4.3	799	98.3	785	164	90	8.7	4.8
vii	750	97.5	731	168	88	8.3	4.4	639	93.7	599	168	98	6.1	3.6
viii	851	96.0	817	230	96	8.5	3.6	707	95.2	672	154	90	7.5	4.4
B.T. 6	792	5.1	40	32	30	1.3	1.3	813	12.4	101	36	26	3.9	2.8
9	667	29.7	198	88	62	3.2	2.2	735	18.5	136	98	56	2.4	1.4
11	521	50.0	260	108	74	3.5	2.4	474	22.4	106	76	56	1.9	1.4
13	459	46.6	214	92	62	3.5	2.3	525	34.3	180	116	62	2.9	1.6
14	781	25.0	195	84	54	3.6	2.3	B329	19.2	63	74	42	1.5	0.8
15	780	24.9	194	72	58	3.3	2.7	901	10.8	97	60	44	2.2	1.6
vii	750	0.5	4	(2)	(2)	2.0	2.0	639	0.9	6	(2)	(2)	3.0	3.0
viii	851	1.0	9	6	6	1.5	1.5	707	0.8	6	(2)	(2)	3.0	3.0

Competition Indices of Forage Species in Pasture Mixtures.

Table A 66 - Fall 1960

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af.	Lad.	B.T.	Mixt-ures
1	2.00				1.02				1.25
2	2.16				1.58	0.87			1.34
4	1.74				1.10		1.50		1.32
5	3.68				1.26	1.68	1.64		1.74
6	2.00				.87			.78	
7	1.74					5.63			4.70
8	2.21					7.80	1.39		4.87
9	1.79					2.13		1.75	1.95
11	2.16							2.70	2.52
12	1.63						2.14		1.96
13		1.83						2.78	1.79
14			4.46					1.78	2.43
15				1.80				1.20	1.24
vii	.74						.64	1.05	0.83
viii	1.42	2.00					1.44	1.60	1.59
ix	.74	.75							1.21

Table A 67 Cut I

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af.	Lad.	B.T.	Mixt-ures
1	.19				1.19				.57
2	.32				1.11	.63			.62
4	.23				.99		.47		.33
5	.28				1.10	1.00	.56		.59
6	.18				1.04			.70	.55
7	.12					1.94			1.00
8	.32					1.79	.83		.98
9	.12					.72		.92	.51
11	.16							.88	.40
12	.28						1.02		.57
13		.26						.95	.48
14			.43					1.24	.63
15				.30				.79	.51
vii	.22							1.21	.58
viii	.37	.07					.67	.70	.40
ix	.15	.09				1.71	.74		.62

Competition Indices of Forage Species in Pasture Mixtures.

Table A 68 Cut 2

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af.	Lad.	B.T.	Mixt-ures
1	.24				1.08				.53
2	.16				.92	.50			.46
4	.19				.54		.70		.40
5	.18				.50	.08	.84		.30
6	.37				.96			.45	.54
7	.21					.64			.43
8	.19					.41	.82		.40
9	.24					1.04		.72	.67
11	.29							.75	.46
12	.35						.89		.52
13		.26						.70	.46
14			.24					.94	.58
15				.07				.69	.32
vii	.37						1.18	.18	.49
viii	.36	.04					1.09	.19	.34
ix	.12	.04				2.92			1.18

Table A 69 Cut 3

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af.	Lad.	B.T.	Mixt-ures
1	.47				.97				.82
2	.27				.66	1.74			1.27
4	.48				.32		1.09		.59
5	.38				.56	.81	1.04		.72
6	.57				.62			.54	.59
7	.15					2.33			1.68
8	.46					1.99	1.16		1.42
9	.70					2.01		.91	1.28
11	.84							1.29	1.08
12	.32						1.24		.87
13		.41						1.14	.74
14			(.50)					1.00	.81
15				(1.10)				1.12	1.12
vii	.19						1.04	.06	.51
viii	.61	.05					1.28	.18	.57
ix	.13	.13				4.90			2.50

Competition Indices of Forage Species in Pasture Mixtures.

Table A 70 Cut 4

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af.	Lad.	B.T.	Mixtures
1	.55				.98				.83
4	1.95				.38		1.06		.72
6	1.10				1.16			.34	.76
8	.42					.76	.89		.78
9	.80					.97		.61	.75
11	.65							.74	.71
12	.72						1.05		.99
13		.94						.89	.90
14			.50					.70	.66
15				.57				.68	.63
vii	0.80						.82	.17	.47
viii	1.15	.67					.99	.11	.69

Table A 71 Cut 5

Mixt. No.	Tim.	Br.	R.Can.	K.Blue	R.C.	Af.	Lad.	B.T.	Mixtures
1	1.08				.90				.95
4	.49				.59		1.09		.79
6	1.37				1.12			.51	1.03
8	.96					2.17	.79		1.57
9	1.22					1.32		.57	1.15
11	1.39							.51	.99
12	.57						.99		.83
13		.78						.65	.72
14			1.08					.55	.89
15				1.56				.59	1.17
vii	1.14						.89	.51	.99
viii	.45	.71					.99	.39	.71

Seasonal Average Yield per Unit Area of Ground Cover of the Grasses, Legumes and their Respective Pure Stands (Average of Blocks C, D. E, F)

Table A 72

Analysis of Variance of the Pure Stands

Source	D.F.	S.S.	M.S.	F.	F.05	F.01
Reps.	1	33.00	33.00	0.61		
Treat	5	416.98	83.40	1.54	5.05	
Error	5	270.29	54.06	-		S = 7.35
Total	11	720.27	-	-		CV = 27.3%
$\bar{x}$ = 26.91						$SE_{\bar{x}}$ = 5.199

Table A 73

Analysis of Variance of the Grasses

Source	D.F.	S.S.	M.S.	F.	F.05	F.01
Reps	1	44.730	44.730	1.96	4.32	
Treat	21	2500.043	119.050	5.22	2.09	2.88
Error	21	478.920	22.806	-	S = 4.776	
Total	43	3023.693	-	-	CV = 46.64%	
$\bar{x}$ = 10.24					$SE_{\bar{x}}$ = 3.376	

Ta ble A 74

Analysis of Variance of the Legumes

Source	D.F.	S.S.	M.S.	F.	F.05	F.01
Reps.	1	124.044	124.044	5.14	4.17	7.56
Treat	31	13703.164	442.038	18.33	1.84	2.38
Error	31	743.431	24.111	-		
Total	63	14574.639	-	-	S = 4.190	
$\bar{x}$ = 22.495					CV = 21.83%	
					$SE_{\bar{x}}$ = 3.5434	

Yield of D.M./Plot of Pure Stands and One Mixture 1961
Hay Mixtures

Table A 75

	Cut I (June 27, 1961)						Blocks Cut 2 (Aug. 3,1961)					
	E			F			E			F		
Mixt. No.	G.W.	% D.M.	D.W.	G.W.	% D.M.	D.W.	G.W.	% D.M.	D.W.	G.W.	% D.M.	D.W.
i	25600	20.2	5171	31800	16.4	5215	7400	19.9	1473	8000	21.2	1696
ii	30700	15.8	4851	29500	17.1	5044	8000	20.6	1648	8000	21.2	1696
iii	32350	17.1	5532	34000	13.7	4658	4700	17.3	813	4000	20.0	800
iv	29600	20.8	6157	25400	21.6	5486	10900	22.7	2474	7900	29.5	2331
v	23350	13.2	3082	24600	11.9	2927	7000	20.7	1449	9200	15.3	1408
vi	30200	14.5	4379	22200	14.6	3241	10150	20.0	2030	10000	16.4	1640
vii	13450	30.7	4129	13500	29.2	3942	3800	22.6	859	6000	19.0	1140
viii	13400	26.9	3605	18300	23.8	4355	5000	21.6	1080	4300	23.9	1028

Cut 3 (Oct. 25,1961)	Mixt.No.	E			F		
	i	5600	28.3	1776	5050	26.6	1523
	ii	5250	26.9	1598	5150	25.8	1487
	iii	-	-	-	-	-	-
	iv	4350	32.8	1602	4800	35.7	1918
	v	425	30.0	188	600	26.3	200
	vi	6350	25.2	1772	4800	25.4	1358
	vii	3250	30.8	1191	3900	28.9	1320
	viii	1900	38.7	874	2630	35.1	1046

Yield of D.M./Plot of Hay Mixtures 1961

Table A 76

Cut 1 (June 27,1961) Blocks

Mixt. No.	A G.W.	A % D.M.	A D.W.	B G.W.	B % D.M.	B D.W.	C G.W.	C % D.M.	C D.W.	D G.W.	D % D.M.	D D.W.	Total D.W.
1	25600	23.0	5888	28800	22.1	6365	26500	20.9	5539	30500	19.1	5826	23618
2	24600	20.2	4969	29100	19.8	5762	29300	19.9	5831	29600	21.0	6216	22778
3	27650	17.8	4922	29450	19.7	5802	30250	18.8	5687	30900	19.2	5933	22344
4	26700	19.6	5233	27900	18.6	5189	30650	18.8	5762	28100	18.9	5311	21495
5	30200	20.0	6040	30900	19.4	5995	31250	18.0	5625	29500	19.5	5753	23413
6	31700	18.1	5738	20000	23.3	4660	29250	19.4	5675	30000	19.5	5850	21923
7	28400	20.6	5850	26400	20.2	5333	31000	19.7	6107	30550	18.2	5560	22850
8	27800	23.1	6422	25400	24.5	6223	23950	28.0	6706	29100	22.0	6402	25753
9	28500	18.6	5301	29300	19.5	5714	27300	19.0	5187	27400	19.8	5425	21627

Table A 77

Cut 2 (Aug. 3, 1961)

Mixt. No.	A G.W.	A % D.M.	A D.W.	B G.W.	B % D.M.	B D.W.	C G.W.	C % D.M.	C D.W.	D G.W.	D % D.M.	D D.W.	Total D.W.
1	10700	26.7	2857	12700	24.5	3112	11800	23.9	2820	14800	20.9	3093	11882
2	11800	23.4	2761	12600	23.0	2898	12000	24.6	2952	13150	21.8	2867	11478
3	8400	22.6	1898	8700	20.2	1757	7900	21.9	1651	10900	19.9	2169	7475
4	8000	23.5	1880	9900	20.9	2069	8600	22.5	1935	10200	21.0	2142	8026
5	9500	22.4	2128	11300	19.8	2237	11000	20.4	2264	11300	19.8	2237	8866
6	9400	22.4	2106	5600	24.1	1350	10400	20.9	2174	12200	18.8	2294	7924
7	8100	21.4	1733	10300	20.9	2153	10000	21.9	2190	11800	20.6	2431	8507
8	12500	25.6	3200	9650	27.0	2606	7700	25.1	1933	14850	22.9	3401	11140
9	10100	21.1	2131	10900	21.7	2365	9300	23.4	2176	10200	21.3	2173	8845

Yield of D.M./Plot of Hay Mixtures 1961

Table A 78

Cut 3 (Oct. 25, 1961) Blocks

Mixt. No.	A G.W.	A % D.M.	A D.W.	B G.W.	B % D.M.	B D.W.	C G.W.	C % D.M.	C D.W.	D G.W.	D % D.M.	D D.W.	Total D.W.
1	5400	34.9	2105	5200	33.5	1942	5100	32.3	1877	4850	34.3	1894	7818
2	6150	32.6	2005	5950	32.6	1940	5850	33.1	1936	5650	33.6	1898	7779
3	7550	26.2	1978	7750	26.7	2069	7500	27.2	2040	8800	26.4	2323	8410
4	6100	28.6	1985	4250	29.2	1471	6550	24.6	1891	6500	27.1	2012	7359
5	6850	27.2	2093	7250	26.3	2187	7400	27.6	2352	7000	26.0	2040	8672
6	8100	26.8	2171	6925	28.0	1939	7200	29.2	2102	8500	26.2	2227	8439
7	7200	26.9	1937	7350	27.7	2036	7850	26.4	2072	8100	27.3	2211	8256
8	5350	33.8	2068	5550	33.0	2062	5000	33.9	1935	5350	34.4	2030	8095
9	6850	26.8	2056	7550	25.7	2160	6850	27.0	2110	6650	26.5	1972	8298

Analysis of Variance for Season's Total

Source	D.F.	M.S.	F	F.05	F.01
Reps.	3	451910	1.38	3.01	
Var. or Mixt.	8	1,792594	5.48	2.36	3.36
Error	24	326930			
Total	35				

Percentage Composition and Point Quadrat Analysis Cut 1
One Hay Mixture and Pure Stands

P.Q. readings taken May 11. Angle 29° Cut: June 27, 1961.

Table A 79

	Blocks					
	E			F		
Species	% Composition	Hits	G.C.	% Composition	Hits	G.C.
i Tim	28.0	5	10	15.7	11	22
R.C.	71.6	26	52	83.9	38	76
Oth.	0.4	tr	tr	0.3	tr	tr
B.G.		21	42		7	14
ii R.C.	99.3	36	72	92.7	38	76
Oth.	0.7	tr	tr	7.3	tr	tr
B.G.		14	28		12	24
iii As.	100.0	41	82	97.2	38	76
Oth.		tr	tr	2.8	tr	tr
B.G.		9	18		12	24
iv Af.	98.0	31	62	99.2	28	56
Oth.	2.0	tr	tr	0.8	tr	tr
B.G.		19	38		22	44
v Lad.	99.0	40	80	90.5	37	74
Oth.	1.0	tr	tr	9.5	tr	tr
B.G.		10	20		13	26
vi B.T.v	96.6	35	70	77.9	12	24
Oth.	3.4	tr	-	22.1	tr	tr
B.G.		15	30		38	76
vii Br.	89.1	22	44	96.6	28	56
Oth.	10.9	tr	tr	3.4	tr	tr
B.G.		28	56		22	44
viii Tim.	97.8	25	50	70.4	23	46
Oth.	2.2	tr	tr	29.6	tr	tr
B.G.		25	50		27	54

Percentage Composition and Point Quadrat Analysis Cut 2
One Hay Mixture and Pure Stands

P.Q. readings taken July 13. Angle 45° Cut: Aug. 3, 1961.

Table A 80

		Blocks							
		E				F			
Species		% Comp.	Hits	G.C.	Density	% Comp.	Hits	G.C.	Density
i	Tim.	22.1	6	12	12	25.2	6	12	20
	R.C.	76.3	13	26	56	71.5	12	24	24
	Oth.	1.7	1	2	2	3.3	tr	tr	tr
	B.G.		30	60	60		13	26	26
ii	R.C.	93.6	17	34	58	97.1	16	32	50
	Oth.	6.4	1	2	2	2.9	4	8	8
	B.G.		32	64	64		31	62	62
iii	As.	12.0	7	14	18	12.0	7	14	18
	Oth.	88.0	2	4	4	88.0	tr	tr	tr
	B.G.		41	82	82		43	86	86
iv	Af.	96.7	19	38	46	99.5	17	34	46
	Oth.	3.3	3	6	6	0.5	1	2	2
	B.G.		29	58	58		32	24	48
v	Lad.	98.1	45	90	148	96.5	42	84	136
	Oth.	1.9	1	2	2	3.5	tr	tr	tr
	B.G.		5	10	10		8	16	16
vi	B.T.v	87.0	19	38	44	89.5	14	28	38
	Oth.	13.0	3	6	6	10.5	6	12	12
	B.G.		30	60	60		30	60	60
vii	Br.	90.6	13	26	34	82.3	11	22	28
	Oth.	9.4	6	12	12	17.7	15	30	30
	B.G.		31	62	62		28	56	56
viii	Tim.	87.8	11	22	26	97.8	10	20	32
	Oth.	12.2	10	20	20	2.2	4	8	8
	B.G.		29	58	58		36	72	72

Percentage Composition One Hay Mixture and Pure Stands
Cut 3

Table A 81 Cut: Oct. 25, 1961

		Blocks	
		E	F
i	Tim.	27.3	17.5
	R.C.	64.6	78.1
	Others	8.1	4.4
ii	R.C.	82.7	92.8
	Others	17.3	7.2
iii	As.	-	-
	Others	- Not harvested -	
iv	Af.	97.4	100
	Others	2.6	
v	Lad.	72.3	95.8
	Others	27.7	4.2
vi	B.T.v	85.3	83.8
	Others	14.7	16.2
vii	Brome	90.5	85.9
	Others	9.5	14.1
viii	Tim.	77.5	77.9
	Others	22.5	22.1

Percentage Composition and Point Quadrat Analysis Hay Mixtures
(P.Q. readings Date: May 11 Angle 29° Cut: June 27, 1961

Table A 82 Blocks Cut 1

Mixt. Compon.	A % Comp.	A Hits	A G.C.	B % Comp.	C % Comp.	D % Comp.	D Hits	D G.C.
1 Tim.	8.9	2	4	0.7	0.3	1.5	4	8
R.C.	18.7	25	50	23.5	35.3	22.2	32	64
Af.	70.0	25	50	75.3	62.8	76.0	36	72
Oth.	2.3	2	4	0.5	1.7	0.3	5	10
B.G.		5	10				2	4
2 Tim.	11.3	9	18	8.3	0.2	3.0	3	6
R.C.	22.7	19	38	21.8	17.7	28.5	25	50
Af.	58.7	22	44	68.0	80.3	57.8	41	82
Lad.	6.9	6	12	1.1	1.4	10.7	28	56
Oth.	0.4	2	4	0.7	0.3		1	2
B.G.		7	14					
3 Tim.	8.8	2	4	0.6	4.2	4.4	1	2
R.C.	54.2	40	80	55.5	59.9	51.6	35	70
As.	29.3	17	34	42.9	32.0	43.7	41	82
Oth.	7.7	5	10	1.0	3.9	0.3	-	-
B.G.		5	10				2	4
4 Tim.	4.8	7	14	7.0	1.0	7.4	1	2
R.C.	84.0	24	48	82.5	80.9	80.2	45	90
Lad.	10.6	18	36	9.7	14.4	9.9	33	66
Oth.	0.6	7	14	0.9	3.8	2.5	14	26
B.G.		6	12				1	2
5 Tim.	9.8	7	14	5.5	1.9	11.0	9	18
R.C.	86.8	40	80	86.9	93.0	76.8	42	84
B.T.v	1.5	19	38	4.7	3.8	11.9	23	46
Oth.	1.9	5	10	2.9	1.3	0.3	13	26
B.G.		2	4				1	2
6 Tim.	6.8	11	22	33.0	6.0	8.2	2	4
R.C.	91.4	41	82	53.4	86.8	84.2	43	86
B.T.e	0.9	13	26	8.2	1.1	4.3	18	36
Oth.	0.9	1	2	5.4	6.0	3.3	6	12
B.G.		4	8				4	8
7 Tim.	14.8	4	8	24.0	3.6	5.2	10	20
R.C.	72.3	28	56	60.3	92.8	82.8	45	90
B.T.m	10.7	15	30	10.5	2.9	5.2	32	64
Oth.	2.2	10	20	5.2	0.7	6.7	tr	tr
B.G.		3	6				-	-
8 Br.	40.9	15	30	41.9	38.6	32.7	29	58
Af.	58.4	30	60	57.5	59.9	67.0	39	78
Oth.	0.7	3	6	0.6	1.4	0.3	3	6
B.G.		11	22				4	8
9 Tim.	28.4	20	40	37.5	34.8	38.9	19	38
B.T.v	59.4	32	64	56.4	51.4	33.2	23	46
Oth.	12.2	11	22	6.1	13.9	27.9	21	42
B.G.		10	20				10	20

Percentage Composition and Point Quadrat Analysis Hay Mixtures Cut 2
(P.Q. readings Date: July 13,1961. Angle 45° Cut: Aug.3, 1961)

Table A 83

Mixt. Compon.	A % Comp.	A Hits	A G.C.	B % Comp.	B Hits	B G.C.	C % Comp.	C Hits	C G.C.	D % Comp.	D Hits	D G.C.
1 Tim.	11.7	3	6	0.4	(1)	(2)	0.4	(1)	(2)	3.8	2	4
R.C.	6.4	3	6	10.9	12	24	8.5	7	14	16.8	14	28
Af.	80.1	16	32	88.6	8	16	91.1	16	32	66.7	20	40
Oth.	1.9	1	2	0.2	2	4	tr	(1)	(2)	12.7	2	4
B.G.		29	58		29	58		30	60		16	32
2 Tim.	10.1	8	16	1.5	(1)	(2)	0.6	(1)	(2)	0.5	(1)	(2)
R.C.	10.1	8	16	10.7	3	6	18.9	7	14	9.9	7	14
Af.	75.4	6	12	80.3	10	20	78.5	14	28	86.8	11	22
Lad.	4.4	5	10	6.8	7	14	2.0	5	10	2.3	7	14
Oth.	tr	tr	tr	0.7	7	14	tr	1	2	0.6	2	4
B.G.		27	54		28	56		28	56		28	56
3 Tim.	25.6	1	2	5.8	1	2	8.7	1	2	9.5	3	6
R.C.	68.4	11	22	87.0	16	32	87.0	21	42	86.3	15	30
As.	1.1	3	6	2.9	3	6	1.9	1	2	0.6	4	8
Oth.	4.9	tr	tr	4.3	2	4	2.4	tr	tr	3.7	1	2
B.G.		36	72		30	60		27	54		29	58
4 Tim.	19.9	5	10	11.1	1	2	0.9	(1)	(2)	8.8	1	2
R.C.	61.2	14	28	63.5	11	22	82.7	20	40	76.5	31	62
Lad.	16.7	15	30	23.1	12	24	14.9	7	14	13.1	6	12
Oth.	2.2	tr	tr	2.3	1	2	1.5	tr	tr	1.6	tr	tr
B.G.		20	40		7	14		25	50		16	32
5 Tim.	14.1	3	6	10.7	2	4	3.8	3	6	14.8	2	4
R.C.	81.0	14	28	84.8	22	44	90.1	35	70	81.0	30	60
B.T.v	3.8	1	2	2.4	1	2	3.2	(1)	2	2.2	3	6
Oth.	1.0	1	2	2.1	1	2	2.9	tr	tr	2.1	tr	tr
B.G.		33	66		24	48		13	26		17	34

Percentage Composition and Point Quadrat Analysis Hay Mixtures Cut 2
(P.Q.readings Date: July 13,1961. Angle 45° Cut: Aug. 3, 1961)

Table A 83

	Blocks											
	A			B			C			D		
Mixt. Compon.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.	% Comp.	Hits	G.C.
6 Tim.	6.1	4	8	32.7	3	6	8.8	(1)	(2)	5.7	1	2
R.C.	93.5	26	52	48.4	11	22	89.8	21	42	91.2	20	40
B.T.e	0.2	(1)	(2)	8.9	2	4	0.1	(1)	(2)	1.5	1	2
Oth.	0.2	tr	tr	10.1	tr	tr	1.3	2	4	1.7	1	2
B.G.9		20	40		34	68		29	58		27	54
7 Tim.	6.6	10	20	36.1	6	12	3.2	1	2	6.9	7	14
R.C.	74.4	17	34	56.3	16	32	93.8	24	48	89.3	23	46
B.T.m	8.5	2	4	4.2	4	8	2.5	2	4	2.5	3	6
Oth.	10.5	tr	tr	3.4	tr	tr	0.5	tr	tr	1.4	tr	tr
B.G.		22	44		25	50		25	50		21	42
8 Br.	11.9	14	28	21.7	17	34	13.7	18	36	22.9	17	34
Af.	88.1	15	30	78.2	11	22	85.6	14	28	77.1	16	32
Oth.	tr	1	2	0.1	tr	tr	0.7	3	6	tr	1	2
B.G.		23	46		26	52		18	36		18	36
9 Tim.	20.3	7	14	26.9	9	18	24.0	12	24	29.4	15	30
B.T.v	79.2	24	48	72.5	19	38	75.0	27	54	66.4	14	28
Oth.	0.5	1	2	0.6	4	8	1.0	tr	tr	4.3	1	2
B.G.		21	42		21	42		14	28		23	46

B.T.v = Variety Viking B.T.e = Variety Empire B.T.m = Selection of Morshausk

Percentage Composition Hay Mixtures Cut 3
(Cut: Oct. 25, 1961)

Table A 84

Mixt. Compon.	Blocks A	B	C	D
1 Tim.	0.8	0.01	0.03	0.03
R.C.	0.8	0.8	0.6	2.0
Af.	95.5	98.1	99.1	97.9
Oth.	3.0	1.1	tr	tr
2 Tim.	3.6	0.05	0.03	tr
R.C.	0.1	0.4	0.6	1.0
Af.	91.4	98.5	98.4	96.8
Lad.	4.8	1.1	1.0	1.2
Oth.	tr	tr	tr	tr
3 Tim.	14.0	2.9	1.2	10.5
R.C.	78.8	92.3	97.8	67.3
As.	0.2	-	0.02	tr
Oth,	7.0	4.8	0.9	22.2
4 Tim.	14.4	12.6	1.8	4.7
R.C.	68.5	55.1	73.3	94.0
Lad.	16.4	26.0	23.3	1.3
Oth.	0.7	6.3	1.6	tr
5 Tim.	3.4	9.2	2.8	10.4
R.C.	85.0	80.6	91.7	76.2
B.T.v	8.7	6.9	5.5	10.4
Oth.	2.8	3.3	tr	2.9
6 Tim.	6.9	39.7	5.6	5.7
R.C.	89.6	50.4	92.5	88.9
B.T.e	0.4	1.3	0.08	0.2
Oth.	3.1	8.6	1.8	5.3
7 Tim.	14.8	30.4	3.6	9.8
R.C.	81.2	57.0	93.6	85.2
B.T.m	3.1	6.8	1.3	0.8
Oth.	0.9	5.7	1.5	4.1
8 Br.	0.7	3.9	1.7	1.9
Af.	99.3	96.1	98.3	97.2
Oth.	tr	tr	tr	tr
9 Tim.	14.5	10.5	5.7	26.6
B.T.v	84.0	85.0	93.6	70.9
Oth.	1.5	4.5	0.7	2.5

B,T.v = Variety Viking B.T.e = Variety Empire
B.T.m - Selection of Morshansk
No point quadrat analysis taken before the 3rd cut

Density by Point Quadrat Analysis Hay Mixtures Cut 2 1961

Table A 85

Mixt. Compon.		Blocks A	B	C	D
1	Tim.	6	(2)	(2)	4
	R.C.	6	30	18	34
	Af.	34	18	42	48
	Oth.	2	4	tr	4
	B.G.	58	58	60	32
2	Tim.	20	(2)	(2)	(2)
	R.C.	20	10	20	24
	Af.	12	24	34	24
	Lad.	12	16	12	16
	Oth.	tr	14	2	4
	B.G.	54	56	56	56
3	Tim.	2	2	2	6
	R.C.	38	42	48	44
	As.	6	6	2	10
	Oth.	tr	4	tr	2
	B.G.	72	60	54	58
4	Tim.	10	2	tr	2
	R.C.	38	32	62	82
	Lad.	50	38	20	22
	Oth.	tr	2	tr	tr
	B.G.	40	14	50	32
5	Tim.	10	4	8	6
	R.C.	44	82	114	110
	B.T.v	4	2	(2)	8
	Oth.	2	2	tr	tr
	B.G.	66	48	26	34
6	Tim.	8	14	(2)	2
	R.C.	92	28	58	60
	B.T.e	(2)	6	(2)	2
	Oth.	tr	tr	4	2
	B.G.	40	68	58	54
7	Tim.	24	12	2	14
	R.C.	62	40	80	64
	B.T.m	4	12	2	8
	Oth.	tr	2	tr	tr
	B.G.	44	50	50	42
8	Br.	32	42	44	34
	Af.	36	28	34	32
	Oth.	2	tr	6	2
	B.G.	46	52	36	36
9	Tim.	20	26	24	38
	B.T.v	68	54	68	32
	Oth.	2	8	tr	6
	B.G.	42	42	28	46

Table A 86 Yield per Unit Area of Ground Cover of the Pure Stands 1961 (in gm)

Hay Mixtures

Cut 1	Blocks													
	E							F						
Pure Stand	Total D.M.	% Comp.	D.M. of Species	Den-sity	G.C.	Y/ P.D.	Y/Unit Area	Total D.M.	% Comp.	D.M.of Species	Den-sity	G.C.	Y/ P.D.	Y/Unit Area
1	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Tim.	3605	97.8	3526		50		70.5	4355	70.4	3066		46		66.7
R.C.	4851	99.3	4817		72		66.9	5044	92.7	4903		76		64.5
Af.	6157	98.0	6034		62		97.3	5486	99.2	5442		56		97.2
Br.	4129	89.1	3679		44		83.6	3942	96.6	3808		56		68.0
Lad.	3082	99.0	3051		80		38.1	2927	90.5	2649		74		35.8
B.T.	4379	96.6	4230		70		60.4	3241	77.9	2525		24		105.2
As.	5532	100.0	5532		82		67.5	4658	97.2	4528		76		59.6
Cut 2														
Tim.	1080	87.8	948	26	22	36.5	43.1	1028	97.8	1005	32	20	31.4	50.2
R.C.	1648	76.3	1257	58	34	27.1	37.0	1696	71.5	1213	50	32	24.3	37.9
Af.	2474	96.7	2392	46	38	52.0	62.9	2331	99.5	2319	46	34	50.4	68.2
Br.	859	90.6	778	34	26	22.9	29.9	1140	82.3	938	28	22	33.5	42.6
Lad.	1449	98.1	1421	148	90	9.6	15.8	1408	96.5	1359	136	84	10.0	16.2
B.T.	2030	87.0	1766	44	38	40.1	46.5	1640	89.5	1468	38	28	38.6	52.4
As.	813	12.0	98	18	14	5.4	7.0	800	12.0	96	18	14	5.3	6.9

Yield per Unit Area of Ground Cover of the Grass Components Cut 1 (in gm)
Hay Mixtures 1961

Table A 87

	Blocks									
	A					D				
Mixt. No. 1	Total D.M. 2	% Comp. 3	D.M. of Component 4	G.C. 6	Y/Unit Area 8	Total D.M. 2	% Comp. 3	D.M. of Component 4	G.C. 6	Y/Unit Area 8
Tim. i	E 5353	28.0	1499	10	149.9	F 5215	17.8	928	22	42.2
1	5888	8.9	524	4	131.0	5826	1.5	87	8	10.9
2	4969	11.3	561	18	31.2	6216	3.0	186	6	31.0
3	4922	8.8	433	4	108.2	5933	4.4	261	2	130.5
4	5233	4.8	251	14	17.9	5311	7.4	393	2	196.5
5	6040	9.8	592	14	42.3	5753	11.0	633	18	35.2
6	5738	6.8	390	22	17.7	5850	8.2	480	4	120.0
7	5850	14.8	866	8	108.2	5560	5.2	289	20	14.4
Br. 8	6422	40.9	2627	40	65.7	6402	32.7	2093	38	55.1
Tim. 9	5301	28.4	1505	30	50.2	5425	38.9	2110	58	36.4

Yield per Unit Area of Ground Cover of the Legume Components Cut 1 (in gm)
Hay Mixtures 1961

Table A 88

Mixt. No.	Blocks A: Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area	Blocks D: Total D.M.	% Comp.	D.M. of Component	Density	G.C.	Y/Unit Area
1	2	3	4	5	6	8	2	3	4	5	6	8
R.C. i	E 5353	71.6	3832		52	73.7	F 5215	83.9	4375		76	57.6
1	5888	18.7	1101		50	22.0	5826	22.2	1293		64	20;2
2	4969	22.7	1128		38	29.7	6216	28.7	1784		50	35.7
3	4922	54.2	2668		80	33.4	5933	51.6	3061		70	43.7
4	5233	84.0	4396		48	91.6	5311	80.2	4259		90	47.3
5	6040	86.8	5243		80	65.5	5753	76.8	4418		84	52.6
6	5738	91.4	5245		82	64.0	5850	84.2	4926		86	57.3
7	5850	72.3	4230		56	75.5	5560	82.8	4604		90	51.2
Af. 1	5888	70.0	4122		50	82.4	5826	76.0	4428		72	61.5
2	4969	58.7	2117		44	48.1	6216	57.8	3593		82	43.8
8	6422	58.4	3750		60	62.5	6402	67.0	4289		78	59.6
Lad. 2	4969	6.9	343		12	28.6	6216	10.7	665		56	11.9
4	5233	10.6	555		36	15.4	5311	9.9	526		66	8.0
B.T. 5v	6040	1.5	91		38	2.4	5753	11.9	685		46	14.9
6e	5738	0.9	52		26	2.0	5850	4.3	252		36	7.0
7m	5850	10.7	626		30	20.9	5560	5.2	289		64	4.5
9v	5301	59.4	3149		64	49.2	5425	33.2	1801		46	39.2
As. 3	4922	29.3	1442		34	42.4	5933	43.7	2593		82	31.6

Yield per Unit Area of Ground Cover of the Grass Components Cut 2 (in gm)
Hay Mixtures 1961

Table A 89

	Blocks													
	A							B						
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	G.C.	Den-sity	Y/Unit Area	Y/Point Density	Total D.M.	% Comp.	D.M. of Component	G.C.	Den-sity	Y/Unit Area	Y/Point Density
1	2	3	4	5	6	8	7	2	3	4	5	6	8	7
Tim.i	E 1473	22.1	326	12	12	27.2	27.2	F 1696	25.2	427	12	20	35.6	21.3
1	2105	11.7	246	6	6	41.0	41.0	1942	0.4	8	(2)	(2)	4.0	4.0
2	2005	10.1	203	16	20	12.7	10.2	1940	1.5	29	(2)	(2)	14.5	14.5
3	1978	25.6	506	2	2	203.0	203.0	2069	5.8	120	2	2	60.0	60.0
4	1985	19.9	395	10	10	39.5	39.5	1471	11.1	163	2	2	81.5	81.5
5	2093	14.1	295	6	10	49.2	29.5	2187	10.7	234	4	4	58.5	58.5
6	2171	6.1	132	8	8	16.5	16.5	1939	32.7	634	6	14	105.7	45.3
7	1937	6.6	128	20	24	6.4	5.3	2036	36.1	735	12	12	61.3	61.3
Br. 8	2068	11.9	246	28	32	8.8	7.7	2062	21.7	447	34	42	13.1	10.6
Tim.9	2056	20.3	417	14	20	29.8	20.9	2160	26.9	581	18	26	32.3	22.3

Yield per Unit Area of Ground Cover of the Grass Components Cut 2 (in gm)
Hay Mixtures 1961

Table A 90

	Blocks													
	C							D						
Mixt. No. 1	Total D.M. 2	% Comp. 3	D.M. of Component 4	G.C. 5	Density 6	Y/Unit Area 8	Y/Point Density 7	Total D.M. 2	% Comp. 3	D.M. of Component 4	G.C. 5	Density 6	Y/Unit Area 8	Y/Point Density 7
Tim.1	1877	0.4	8	(2)	(2)	4.0	4.0	1894	3.3	72	4	4	18.0	18.0
2	1936	0.6	12	(2)	(2)	6.0	6.0	1898	0.5	9	(2)	(2)	4.5	4.5
3	2040	8.7	177	2	2	88.5	88.5	2323	9.5	221	6	6	36.8	36.8
4	1891	0.9	17	(2)	(2)	8.5	8.5	2012	8.8	177	2	2	88.5	88.5
5	2352	3.8	89	6	8	14.8	11.1	2040	14.8	302	4	6	75.5	50.3
6	2102	8.8	185	(2)	(2)	92.4	92.5	2227	5.7	127	2	2	63.5	63.5
7	2072	3.2	66	2	2	33.0	33.0	2211	6.9	153	14	14	10.9	10.9
Br. 8	1935	13.7	265	36	44	7.4	6.0	2030	22.9	465	34	34	13.7	13.7
Tim.9	2110	24.0	506	24	24	21.0	21.0	1972	29.4	580	30	38	19.3	12.6

Yield per Unit Area of Ground Cover of the Legume Components Cut 2 (in gm)
Hay Mixture 1961

Table A 91

	Blocks													
	A							B						
Mixt. No.	Total D.M.	% Comp.	D.M. of Component	G.C.	Den-sity	Y/Unit Area	Y/Point Density	Total D.M.	% Comp.	D.M. of Component	G.C.	Den-sity	Y/Unit Area	Y/Point Density
1	2	3	4	5	6	8	7	2	3	4	5	6	8	7
R.C.1	E1473	76.3	1124	26	56	43.2	20.1	F1696	71.5	1213	24	24	50.5	50.5
1	2105	6.4	135	6	6	22.5	22.5	1942	10.9	212	24	30	8.8	7.1
2	2005	10.1	203	16	20	12.7	10.2	1940	10.7	208	6	10	35.0	20.8
3	1978	68.4	1353	22	38	61.5	35.6	2069	87.0	1800	32	42	56.2	42.9
4	1985	61.2	1215	28	38	43.4	32.0	1471	63.5	934	22	32	42.5	29.2
5	2093	81.0	1695	28	48	60.5	35.3	2187	84.8	1855	44	82	42.2	22.6
6	2171	93.5	2030	52	92	39.0	22.1	1939	48.4	938	22	28	42.6	33.5
7	1937	74.4	1441	34	62	42.4	23.2	2036	56.3	1146	32	40	35.8	28.6
Af. 1	2105	80.1	1686	32	34	52.7	49.6	1942	88.6	1721	16	18	107.6	95.6
2	2005	75.4	1512	12	12	126.0	126.0	1940	80.3	1558	20	24	77.9	64.9
8	2068	88.1	1822	30	36	60.7	50.6	2062	78.2	1612	22	28	73.3	57.6
Lad.2	2005	4.4	88	10	12	8.8	7.3	1940	6.8	132	14	16	9.4	8.2
4	1985	16.7	331	30	50	11.0	6.6	1471	23.1	340	26	38	13.1	8.9
B.T.5	2093	3.8	80	2	4	40.0	20.0	2187	2.4	52	2	2	26.0	26.0
6	2171	0.2	4	(2)	(2)	4.0	4.0	1939	8.9	173	4	6	43.2	28.8
7	1937	8.5	165	4	4	41.2	41.2	2036	4.2	86	8	12	10.8	7.2
9	2056	79.2	1628	48	68	33.9	23.9	2160	72.5	1566	38	54	41.2	29.0
As. 3	1978	1.1	22	6	6	3.5	3.5	2069	2.9	60	6	6	10.0	10.0

Yield per Unit Area of Ground Cover of the Legume Components Cut 2 (in gm)
Hay Mixtures 1961

Table A 92

	Blocks													
	C							D						
Mixt. No. 1	Total D.M. 2	% Comp. 3	D.M. of Component 4	G.C. 5	Density 6	Y/Unit Area 8	Y/Point Density 7	Total D.M. 2	% Comp. 3	D.M. of Component 4	G.C. 5	Density 6	Y/Unit Area 8	Y/Point Density 7
R.C.1	1877	8.5	160	14	18	11.4	8.9	1894	16.8	318	28	34	11.4	9.4
2	1936	18.9	366	14	20	26.1	18.3	1898	9.9	189	14	24	13.5	7.9
3	2040	87.0	1775	42	48	42.3	37.0	2323	86.3	2005	30	44	66.9	45.6
4	1891	82.7	1564	40	62	39.1	25.2	2012	76.5	1539	62	82	24.8	18.8
5	2352	90.1	2119	70	114	30.3	18.6	2040	81.0	1652	60	110	27.5	15.0
6	2102	89.8	1888	42	58	45.0	32.6	2227	91.2	2031	40	60	50.8	33.8
7	2072	93.8	1944	48	80	40.5	24.3	2211	89.3	1974	46	64	42.9	30.8
Af. 1	1877	91.1	1710	32	42	53.4	40.7	1894	66.7	1263	40	48	31.6	26.3
2	1936	78.5	1520	28	34	54.3	44.7	1898	86.8	1647	22	24	74.9	68.6
8	1935	85.6	1656	28	34	59.1	48.7	2030	77.1	1565	32	32	48.9	48.9
Lad.2	1936	2.0	39	10	12	3.9	3.2	1898	2.3	44	14	16	3.1	2.8
4	1891	14.9	282	14	20	20.1	14.1	2012	13.1	264	12	22	22.0	12.0
B.T.5v	2352	3.2	75	(2)	(2)	37.5	37.5	2040	2.2	45	6	8	7.5	5.6
6e	2102	0.1	2	(2)	(2)	1.0	1.0	2227	1.5	33	2	2	16.5	16.5
7m	2072	2.5	52	2	2	26.0	26.0	2211	2.5	55	6	8	9.2	6.9
9v	2110	75.0	1582	54	68	29.3	23.4	1972	66.4	1309	28	32	46.8	40.9
As. 3	2040	1.9	39	2	2	19.5	19.5	2323	0.6	14	8	10	1.8	1.4

Average Yield per Unit Area of Ground and per Point Density for both Grasses and Legumes

Hay Mixture 1961 Cut 2 (in gm)

Table A 93

Grasses

Mixt. No.	Total D.M. of Compon.	Total G.C.	Total Density	Ave. Y/U.A.	Ave Y/P.D.
1	4	5	6	8	7
Tim.(i)	753	24	32	31.4	23.5
1	334	14	14	23.9	23.9
2	253	22	26	11.0	9.7
3	1024	12	12	85.4	85.4
4	752	16	16	47.0	47.0
5	920	20	28	46.0	32.9
6	1078	18	26	59.9	41.5
7	1082	48	52	22.5	20.8
Br. 8	1423	132	152	10.8	9.3
Tim. 9	2084	86	108	24.2	19.3

Legumes

Mixt. No.	Total D.M. of Compon.	Total G.C.	Total Density	Ave. Y/U.A.	Ave. Y/P.D.
1	4	5	6	8	7
R.C.(i)	2337	50	80	46.7	29.2
1	825	72	80	11.5	10.3
2	966	50	74	19.3	13.1
3	6933	126	162	55.0	42.8
4	5252	152	194	34.6	27.1
5	7321	202	354	36.2	20.7
6	6887	156	238	44.1	28.9
7	6505	160	246	40.7	26.4
Af. 1	6380	120	262	53.2	24.4
2	6237	88	94	70.9	66.4
8	6655	112	130	59.4	51.2
Lad. 2	303	48	56	6.3	5.4
4	1217	82	130	14.8	9.4
B.T. 5v	252	12	16	21.0	15.8
6e	212	10	12	21.2	17.8
7m	358	20	26	17.9	13.8
9v	6085	168	222	36.2	27.4
As. 3	135	22	24	6.1	5.6

Competition Indices of Forage Species in Hay Mixtures

Table A 94 Cut 1

Mixt. No.	Tim.	Br.	R.C.	Af.	Lad.	B.T.	As.	Mixtures
i	1.10		.98					1.04
1	.74		.32	.72				.61
2	.45		.50	.47	.400			.46
3	1.68		.58				.55	.95
4	.58		.95		.29			.66
5	.56		.90			.13		.52
6	.49		1.12			.07		.51
7	.61		.92			.14		.54
8		.81		.60				.69
9	.600							.61

Table A 95 Cut 2

Mixt. No.	Tim.	Br.	R.C.	Af.8	Lad.	B.T.	As.	Mixtures
i	.67		.78					.72
1	.72		.28	.37				.47
2	.34		.35	1.02	.34			.61
3	1.83		1.14				.81	1.47
4	1.16		.72		.59			.90
5	.99		.55			.43		.66
6	1.45		.77			.54		.92
7	.48		.71			.28		.47
8		.30		.78				.61
9	.52							.54

Seasonal Average Yield per Unit Area of Ground Cover (in gm)

Table A 96 — Grasses, Legumes and Pure Stands. Hay Mixtures 1961

Grasses

Mixt. No.	Total D.M. of Compon.	Total Ground Cover	Ave. Yield/ Unit Area
1	4	5	8
Tim.i	3180	56	56.8
1	864	26	33.2
2	1000	46	21.7
3	1718	18	95.4
4	1396	32	43.6
5	2145	52	41.2
6	1948	44	44.3
7	2237	76	29.4
Br. 8	6133	210	29.2
Tim.9	5699	174	32.8

Pure Stands

Species	Total D.M. of Compon.	Total Ground Cover	Ave. Yield/ Unit Area
Tim.	8545	138	61.9
R.C.	12190	214	57.0
Af.	16187	190	85.2
Br.	9203	148	62.2
Lad.	8480	328	25.9
B.T.	9989	160	62.4
As.	10176	186	54.7

Legumes

Mixt. No.	Total D.M. of Compon.	Total Ground Cover	Ave. Yield / Unit Area
1	4	5	8
R.C.i	10544	178	59.2
1	3219	186	17.3
2	3878	138	28.1
3	12662	276	45.9
4	13907	290	48.0
5	16982	366	46.4
6	17058	324	52.6
7	15339	306	50.1
Af. 1	14930	242	61.7
2	11947	214	55.8
8	14694	250	58.8
Lad.2	1311	116	11.3
4	2298	184	12.5
B.T.5	1028	96	10.7
6	516	72	7.2
7	1273	114	11.2
9	11035	278	39.7
As. 3	4170	138	30.2

Analysis of Variance of Yield per Unit Area of Ground Cover 1961. Hay Mixtures

Sources	D.F.	S.S.	M.S.	F.	F.05	F.01
Table A 97 Pure Stands						
Reps.	1	144.0	144.0	0.72		
Treat	6	16,226.48	2,704.41	13.53	4.28	8.47
Error	6	1,199.35	199.89			
Total	13	17,569.83		$SE_{\bar{x}}$ =	9.997	
				CV =	13.21%	
Table A 98 Grasses (Cut 1 and 2)						
Reps.	1	575.26	575.26	0.10		
Treat	11	61,501.12	5,591.01	0.93	2.82	4.46
Error	11	66,521.51	6,047.41			
Total	23	128,597.89		S =	77.765	
				CV =	70.44%	
Table A 99 Grasses (Cut 1)						
Reps.	1	201.26	201.26	0.06		
Treat	11	15,811.95	1,437.45	0.41		
Error	11	38,945.41	3,540.49			
Total	23	54,958.62		S =	59.502	
				CV =	84.83%	
Table A 100 Grasses (Cut 2)						
Reps.	1	96.0	96.0	0.06		
Treat	11	21,470.55	1,951.87	1.27		
Error	11	16,882.57	1,534.78			
Total	23	38,449.12		S =	39.176	
				CV =	97.3%	
Table A 101 Legumes (Cut 1 & 2)						
Reps.	1	1,634.47	1,634.47	5.38	4.30	7.94
Treat	22	81,303.38	3,695.61	12.16	2.07	2.83
Error	22	6,686.99	303.95			
Total	45	89,624.84		$SE_{\bar{x}}$ =	12.328	
				CV =	21.34%	

Table A 102 PAI and NAR Pasture Mixtures Cut 3

Pure Stands	E D.M. of Comp.	E PAI	E NAR	F D.M. of Comp.	F PAI	F NAR
Tim.	325	2.50	.167	580	2.10	.343
R.C.	1160	2.20	.660	1309	3.03	.573
Af.	-	-	-	913	1.20	.845
Br.	528	2.30	.290	573	2.27	.318
Lad.	1469	3.50	.570	1228	2.70	.413
B.T.	1078	3.70	.400	683	3.30	.288

Mixtures	B or C D.M. of Comp.	B or C PAI	B or C NAR	D D.M. of Comp.	D PAI	D NAR
Tim. C_1	51	0.50	.093	79	0.33	.193
B_6	82	0.40	.175	133	0.40	.285
Br. C_{13}	106	0.50	.192	101	0.60	.160
R.C. C_2	989	2.40	.524	888	1.87	.577
B_6	996	2.50	.510	775	2.17	.446
B.T. B_6	123	0.67	.180	125	0.70	.176
C	1061	2.80	.495	917	3.77	.335

LAI obtained by improved PQ at 32.5° prior to cutting

PAI F value for species in pure stand was significant at 5% level. CV= 15.5%

NAR F " " " " " " was significant at 1% level. CV= 17.7%

PAI F " " " " mixtures was significant at 1% level. CV= 24.2%

NAR F " " " " " was significant at 1% level. CV= 22.0%

Table A 103

NAR Calculations of Grass and Legume Components
Cut 3 Aug. 4, 1961. Pasture Mixtures

PAI Obtained with Improved P.Q.

Grasses

Species	C: D.M. of Comp.	C: PAI	C: NAR	D: D.Wt. of Compon.	D: PAI	D: NAR
Tim. 1	51	0.30	0.134	79	0.60	0.125
4	25	.40	.053	36	.30	.095
6	B82	.60	.130	133	.40	.285
8	34	.20	.118	12	.60	.019
9	115	.40	.246	150	.70	.211
11	124	.70	.175	93	1.30	.168
12	37	.20	.129	28	0.60	.044
vii	12	.40	.026	32	.20	.111
viii	29	.60	.047	17	.50	.031
Br. 13	106	.50	.192	101	.30	.266
viii	1.4	.40	.003	5	.10	.027

PAI F not sign. CV = 23.5%
NAR F sign. at 1% level CV = 40.0%

PQ readings taken as 1 point at 10 stations at 32.5° angle on the uncut borders.

Legumes

Species	C: D.M. of Comp.	C: PAI	C: NAR	D: D.Wt. of Compon.	D: LAI	D: NAR
R.C. 1	989	2.60	0.491	888	2.10	0.525
4	352	1.50	.273	133	0.40	.285
6	B996	2.20	.567	775	2.30	.426
Af. 8	239	0.60	.378	350	0.50	.635
9	280	-	-	316	0.40	.676
Lad. 4	938	1.70	.657	1220	3.20	.510
8	1068	3.60	.405	1313	2.90	.596
12	1165	2.70	.560	1431	3.90	.508
vii	1265	3.10	.543	1225	4.10	.417
viii	1318	3.00	.581	1468	3.60	.557
B.T. 6	B 123	1.20	.114	125	0.40	.267
9	616	3.70	.228	599	3.40	.238
11	866	3.90	.307	473	2.50	.242
13	1061	2.80	.495	917	3.50	.356
vii	17	0.30	.045	11	0.30	.029
viii	28	0.90	.032	21	0.10	.112

PAI F sign. at 1% CV= 28.3%
NAR F " " " CV= 21.4%

Table A 104 PAI and NAR of the Pure Stands Cut 4

Pasture Mixtures 1961

	Disc Method Blocks								Point Quadrat Blocks			
	E				F				E		F	
Species	DW/ /m^2	Lwt/ /Ldm^2 (a)	PAI	NAR	DW/ /m^2	Lwt/ /Ldm^2	PAI	NAR	PAI	NAR	PAI	NAR
Tim.	23	.340	0.6765	.358	27	.401	0.6733	.422	.8	.315	.9	.337
R.C.	59	.333	1.7717	.431	89	.348	2.5575	.482	1.6	.468	2.1	.567
Af.	66	.413	1.5981	.524	35	.420	0.8333	.464	1.4	.582	1.3	.328
Brome	40	.423	0.9456	.481	31	.374	0.8289	.413	1.2	.399	1.3	.290
Lad.	140	.321	4.3613	.488	103	.360	2.8611	.509	3.2	.631	1.7	.778
B.T.	130	.374	3.4759	.547	118	.367	3.2153	.530	3.5	.544	1.8	.851
R.Can.	79	.291	2.7148	.408					1.8	.570		
K.Blue	73	.405	1.8025	.526					1.2	.728		

Point Quadrats taken: Aug. 30 and 31
m^2 sample cut " 31 and Sept. 1
Plots cut : Sept. 1

(a) To read total photosynthetic area shift decimal two places to the left.

Table A 105 PAI and NAR of the Grass Components Cut 4

Pasture Mixtures 1961

Mixt.No. Species	Disc Method Blocks C DW/m^2	Lwt/ /Ldm^2	PAI	NAR	D DW/m^2	Lwt/ /Ldm^2	PAI	NAR	Point Quadrat Blocks C PAI	NAR	D PAI	NAR
Tim. 1	12	.298	0.4027	.275	10	.345	0.2890	.291	.5	.235	.7	.152
4	2.0	.326	0.0613	.148	1.85	.292	0.0634	.135	(.2)	.075	(.2)	.069
6	12	.295	0.4068	.273	19	.325	0.5846	.331	.3	.340	.8	.260
8	1.0	.258	0.0388	.087	1.5	.232	0.0647	.108	(.2)	.038	.1	.086
9	19	.343	0.5539	.344	33	.311	1.0611	.363	.5	.372	2.3	.195
11	21	.392	0.5357	.390	32	.535	0.5981	.547	1.2	.209	.9	.400
12	3.0	.255	0.1176	.157	1.32	.260	0.0508	.106	.1	.173	(.2)	.050
vii	0.5	.292	0.0171	.039	1.12	.275	0.0407	.097	(.2)	.019	(.2)	.042
viii	.36	.257	0.0140	.022	6.5	.326	0.1994	.244	(.2)	.014	.1	.374
Br. 13	19	.381	0.4987	.372	15	.432	0.3472	.383	1.2	.189	.3	.425
viii	.07	.181	0.0039	.105	3.5	.292	0.1199	.181	(.2)	.003	.1	.201
R.Can.14	.84	.233	0.0361	.075	B6	.223	0.2691	.184	.1	.048	(.2)	.225
(a) K.Bl. 15	58	.192	(b) 3.0208	.274	36	.317	1.1356	.375	.8	.794	1.2	.359

(a) Evaluated by cutting out .5 dm segments of the leaf.
Nos. vii and viii belong to rep. Or Block E and F

(b) To read total photosynthetic area shift decimal point two places to the left.

P Point Quadrat was taken as one station or 10 needles per m^2

Table A 106 PAI and NAR of the Legume Components Cut 4

Pasture Mixtures 1961

Species Mixt.No.	Disc Method Blocks C DW/$/m^2$	Lwt/$/Ldm^2$	PAI	NAR	D DW/$/m^2$	Lwt/$/Ldm^2$	PAI	NAR	Point Quadrat Blocks C PAI	NAR	D PAI	NAR
R.C. 1	83	.305	2.7213	.427	71	.321	2.2118	.433	2.6	.444	.9	.887
4	15	.335	0.4478	.318	15	.278	0.5396	.277	1.1	.160	.3	.425
6	79	.310	2.5484	.434	71	.327	2.1713	.440	1.0	.910	1.7	.536
Af. 8	18	.365	0.4932	.356	23	.322	0.7143	.344	.2	.674	.8	.315
9	39	.377	1.0345	.437	36	.365	0.9863	.419	1.0	.449	.9	.459
Lad. 4	99	.310	3.1935	.447	117	.312	3.7536	.462	1.2	.987	2.1	.745
8	120	.256	4.6875	.394	107	.236	4.5338	.361	2.3	.709	2.3	.632
12	133	.245	5.4286	.386	135	.279	4.8387	.431	2.6	.711	2.0	.894
vii	122	.305	4.0000	.457	101	.333	3.0330	.476	2.8	.614	2.7	.524
viii	138	.297	4.6464	.456	115	.303	3.7953	.450	3.3	.606	2.5	.635
B.T. 6	15	.343	0.4373	.324	28	.352	0.7955	.385	.8	.205	.7	.438
9	75	.386	1.9430	.508	84	.343	2.4490	.472	2.4	.428	2.6	.449
11	108	.337	3.2047	.486	75	.303	2.4752	.417	2.1	.687	1.9	.518
13	83	.386	2.1503	.518	100	.383	2.6109	.533	2.5	.458	1.3	.936
14	80	.352	2.2727	.478	112	.329	3.4042	.480	2.9	.390	3.6	.458
15	52	.329	1.5805	.416	70	.280	2.5000	.387	1.0	.599	1.5	.585
vii	1.0	.316	0.0316	.091	3.75	.378	0.0992	.217	.2	.037	(.2)	.141
viii	0.4	.286	0.0140	.024	14	.326	0.4294	.306	(.2)	.015	.1	.806

Table A 107 PAI and NAR of the Pure Stands Cut 5a

Pasture Mixture 1961

	Disc Method								Point Quadrat			
	E				F				E		F	
Species	DW/ /m^2	Lwt/ /Ldm^2	PAI	NAR	DW/ /m^2	Lwt/ /Ldm^2	PAI	NAR	PAI	NAR	PAI	NAR
Tim.	28	.381	0.7349	.546	30	.472	0.6356	.653	1.0	.430	1.0	.415
R.C.	30	.337	0.8902	.504	60	.276	2.1739	.495	.9	.400	1.5	.667
Af.	32	.338	0.9467	.513	12	.301	0.3987	.367	.9	.500	.4	.366
Brome	28	.471	0.5945	.641	34	.444	0.7658	.642	1.0	.430	.5	.887
Lad.	92	.296	3.1081	.566	86	.289	2.9758	.549	2.8	.617	2.2	.703
B.T.	10	.423	0.2364	.446	20	.455	0.4396	.574	1.3	.125	1.3	.250
R.Can.	40	.307	1.3029	.498					0.9	.667		
K. Blue	39	.351	1.1111	.551					.8	.731		

Point Quadrat taken: Sept. 20th

1/2 m^2 sample cut: " 21st

Table A 108 PAI and NAR of the Grass Components Cut 5a

Pasture Mixtures 1961

Species Mixt.No.	Disc Method Blocks C DW/ /m²	Lwt/ /Ldm²	PAI	NAR	Disc Method Blocks D DW/ /m²	Lwt/ /Ldm²	PAI	NAR	Point Quadrat Blocks C PAI	NAR	Point Quadrat Blocks D PAI	NAR
Tim. 1	10	.369	0.2710	.406	6	.369	0.1626	.343	.3	.378	(.2)	.300
4	4.23	.335	0.1262	.283	.70	.252	0.0278	.086	.2	.211	(.2)	.034
6	11	.326	0.3374	.382	16	.343	0.4665	.439	.1	.844	.4	.492
8	.82	.264	0.0311	.100	1.59	.257	0.0619	.156	(.2)	.040	.1	.122
9	18	.315	0.5714	.425	22	.386	0.5699	.520	.2	.899	.3	.831
11	20	.415	0.4819	.536	26	.475	0.5474	.634	.2	.999	.7	.536
12	1.11	.215	0.0516	.086	1.54	.266	0.0579	.156	.1	.256	.1	.119
vii	.38	.172	0.0221	.045	.82	.258	0.0318	.099	(.2)	.018	.2	.041
viii	.028	.240	0.0012	-.272	3.8 (a)	.286	0.1329	.247	(.2)	.001	.2	.190
Br. 13	20	.401	0.4988	.523	20	.383	0.5222	.505	.7	.405	.5	.522
viii	.02	.178	0.0011	-.219	1.31	.269	0.0487	.142	(.2)	.0003	.1	.101
R.Can.14	.54	.300	0.0180	.059	B 2.04	.373	0.0547	.211	(.2)	.037 B	(.2)	.102
K.Bl. 15	31	.344	0.9012	.505	14	.319	0.4389	.402	.3	1.172	.2	.699

(a) Same method as for K.B.

Table A 109 PAI and NAR of the Legume Components Cut 5a
Pasture Mixtures 1961

Species Mixt.No.	Disc Method Blocks C DW/ /m²	Lwt/ /Ldm²	PAI	NAR	D DW/ /m²	Lwt/ /Ldm²	PAI	NAR	Point Quadrat Blocks C PAI	NAR	D PAI	NAR
R.C. 1	50	.301	1.6611	.513	38	.285	1.3333	.465	1.1	.712	1.3	.474
4	9.9	.260	0.3807	.315	6.5	.263	0.2471	.281	.1	.760	(.2)	.326
6	56	.305	1.8361	.530	44	.324	1.3580	.530	1.2	.824	.7	.890
Af. 8	9.4	.264	0.3561	.314	6.0	.267	0.2247	.277	(.2)	.470	(.2)	.300
9	20	.370	0.5405	.492	18	.293	0.6143	.402	.2	.999	.7	.364
Lad. 4	74	.276	2.6812	.514	100	.278	3.5971	.545	1.6	.782	1.6	1.057
8	96	.294	3.2653	.508	76	.296	2.5676	.547	1.6	1.102	1.8	.731
12	108	.269	4.0149	.538	114	.269	4.2379	.544	1.6	1.129	1.8	1.100
vii	94	.285	3.2982	.551	72	.328	2.1951	.589	1.7	.947	1.8	.692
viii	92	.262	3.5114	.512	70	.296	2.3649	.539	3.0	.583	1.8	.673
B.T. 6	4.60	.321	0.1433	.285	12	.332	0.3614	.397	(.2)	.230	.7	.243
9	18	.298	0.6040	.407	18	.378	0.4762	.487	.9	.300	.7	.364
11	28	.378	0.7407	.542	14	.464	0.3017	.527	1.5	.312	.8	.256
13	32	.329	0.9726	.502	40	.423	0.9456	.641	.8	.584	.9	.667
14	18	.398	0.4523	.506	B 15	.423	0.3546	.503	.8	.329	B .6	.342
15	20	.478	0.4184	.605	20	.372	0.5376	.494	.6	.463	.6	.455
vii	-	-	-	-	1.36	.258	0.0527	.137	-	-	(.2)	.068
viii	.004	.122	0.0003	-.186	1.45	.238	0.0609	.143	(.2)	.001	(.2)	.072

Table A 110 PAI and NAR of the Pure Stands Cut 5 (b&c)

Pasture Mixture 1961 (Oct. 23,1961)

	Blocks													
	E							F						
Species	(i) W_2 gms/m^2	W_2-W_1 gms/m^2	Lwt/ /Ldm^2	(ii) L_2	L_2-L_1	NAR_b	NAR_c	W_2	W_2-W_1	Lwt/ /Ldm^2	L_2	L_2-L_1	NAR_b	NAR_c
Tim.	84	56	.449	1.8708	1.1359	.102	.313	88	58	.479	1.8371	1.2015	.114	.333
R.C.	56	26	.287	1.9512	1.0610	.043	.202	106	46	.360	2.9444	0.7705	.041	.273
Af.	44	12	.360	1.2222	0.2755	.025	.231	30	18	.443	0.6772	0.2785	.080	.249
Brome	90	62	.575	1.5652	0.9707	.137	.387	86	52	.526	1.6350	0.8692	.101	.357
Lad.	130	38	.331	3.9275	0.8194	.024	.264	112	26	.349	3.2092	0.2334	.020	.269
B.T.	66	56	.418	1.5789	1.3425	.176	.282	44	24	.471	0.9342	0.4946	.081	.285
R.Can.	80	40	.435	1.8391	0.5362	.057	.302							
K.Bl.	66	27	.405	1.6296	0.5185	.044	.275							

(i) W_2 = Yield of cut 5_b (ii) L_2 = PAI from cut 5_b NAR_b = NAR of PAI L_2- L_1 (in gm/dm^2/week)

W_1 = " " " 5_a L_1 = PAI " " 5_a NAR_c = " " PAI L_2- L_0

Table A 111

PAI and NAR of the Grass Components Cut 5 (b&c)

Pasture Mixture 1961 (Oct. 23,1961)

	Blocks													
	C							D						
Species	W_2	W_2-W_1	Lwt//Ldm^2	L_2	L_2-L_1	NAR_b	NAR_c	W_2	W_2-W_1	Lwt//Ldm^2	L_2	L_2-L_1	NAR_b	NAR_c
Tim.1	18	8	.349	0.5158	0.2448	.047	.183	10	4	.441	0.2268	0.0642	.046	.183
4	1.71	-2.52	.355	0.0482	-.0780	-.003	.074	4.26	3.56	.376	0.1133	0.0855	.130	.122
6	24	13	.379	0.6332	0.2958	.061	.210	22	6	.474	0.4641	-0.0024	.029	.243
8	2.33	1.51	.365	0.0638	0.0327	.074	.090	6.02	4.43	.267	0.2255	0.1636	.029	.111
9	46	28	.336	1.3690	0.7976	.068	.220	46	24	.583	0.7890	0.2191	.079	.340
11	32	12	.519	0.6166	0.1347	.049	.285	38	12	.523	0.7266	0.1792	.042	.299
12	6.24	5.13	.325	0.1920	0.1404	.107	.128	1.23	-.31	.366	0.0336	-0.0243	-.015	.059
vii	3.97	3.59	.451	0.0880	0.0659	.167	.131	2.55	1.73	.422	0.0604	0.0286	.086	.101
viii	0.818	.790	.326	0.0251	0.0239	-.191	-.040	8.21	4.41	.423	0.1941	0.0620	.060	.167
Br.13	32	12	.515	0.6214	0.1226	.049	.284	26	6.0	.531	0.4896	-0.0326	.027	.275
viii	0.718	.698	.342	0.0210	0.0199	-.223	.034	9.75	6.44	.392	0.2487	0.2000	.117	.168
R.Cl4	4.12	3.58	.293	0.1406	0.1226	.133	.103	6.89	4.85	.356	0.1935	0.1388	.098	.141
K.B15	52	21	.347	1.4986	0.5974	.048	.232	28	14	.355	0.7887	0.3498	.052	.207

Refer to Table A for explanation of table

Table A 112 PAI and NAR of the Legume Components Cut 5 (b&c)

Pasture Mixture 1961 (Oct. 23, 1961)

Blocks

Species	C W_2	C W_2-W_1	C Lwt/ /Ldm^2	C L_2	C L_2-L_1	C NAR_b	C NAR_c	D W_2	D W_2-W_1	D Lwt/ /Ldm^2	D L_2	D L_2-L_1	D NAR_b	D NAR_c
R.C.1	108	58	.330	3.2727	1.6116	.054	.255	44	6	.371	1.1860	-0.1473	.011	.236
4	10.4	0.5	.314	0.3312	-0.0495	.003	.147	7	.282	.342	0.1983	-0.0488	.033	.136
6	102	46	.355	2.8732	1.0371	.044	.268	86	42	.349	2.4642	1.1062	.050	.256
Af. 8	11.4	2.0	.409	0.2326	-0.1235	.015	.206	17.2	11.2	.456	0.3772	0.1525	.085	.221
9	44	24	.444	0.9910	0.4505	.072	.272	24	6	.526	0.4563	-.1580	.025	.268
Lad.4	122	48	.351	3.4758	0.7946	.035	.274	110	10	.351	3.1339	-.4632	.007	.269
8	140	44	.340	4.1176	0.8523	.095	.273	124	48	.342	3.6257	1.0581	.035	.269
12	142	34	.346	4.1040	0.0891	.002	.278	114	.082	.342	3.3333	-.9046	$4.8x10^{-5}$	.266
vii	148	54	.399	3.7092	0.4111	.045	.315	116	44	.426	2.7230	0.5279	.040	.318
viii	150	58	.367	4.0872	0.5758	.034	.294	110	40	.346	3.1792	0.8143	.032	.266
B.T.6	12	5.4	.338	0.3550	0.2117	.051	.208	8	-3.83	.345	0.2368	-.1246	-.029	.146
9	38	20	.380	1.0000	0.4060	.055	.233	28	10	.420	0.6667	-.1904	.039	.235
11	56	28	.441	1.2698	0.5291	.063	.289	28	14	.447	0.6264	0.3247	.070	.211
13	52	20	.425	1.2235	0.2509	.041	.272	B 44	4	.471	0.9342	-.0114	.009	.285
14	30	12	.338	0.8876	0.4353	.041	.202	20	5	.338	0.5917	0.2371	.024	.184
15	20	-.054	.379	0.5277	0.1093 (ii)	.0003	.203	9	-11	.368	0.2537	-.2839	-.064	.159
vii	1	1.204	.310 (i)	0.0388	0.0388	.093	.093	1	-.326	.403	0.0257	-.0270	-.019	.051
viii	.08	.076	(.204)	0.0039	.0036	-.092	-.064	3	1.904	.412	0.0814	0.0205	.061	.115

(i) estimated from Cut 4 and 5a
(ii) L_1 was 0

Table A 113 Analysis of Variance of the Photosynthetic Area Index (PAI) Grasses - Pasture Mixtures 1961

Cut 4

Source	D.F.	S.S.	M.S.	F.	F.05	F.01	
Rep.	1	.0191	.0191	0.13	4.60		
Species	14	7.3492	0.5249	3.66	2.84	3.70	
Error	14	2.0073	0.1434				S=0.3787
Total	29	9.3756					CV= 72.3%
$\bar{x}$ =	0.52						$SE_{\bar{x}}$ = 0.268

Cut 5 a

Source	D.F.	S.S.	M.S.	F.	F.05	F.01	
Rep.	1	.0003	.0003	.03	4.60		
Species	14	2.1235	.1517	13.31	2.84	3.70	
Error	14	.1597	.0114				S= .1068
Total	29	2.2835					CV= 70.6%
$\bar{x}$ =	0.15						$SE_{\bar{x}}$= .076

Cut 5(b) = (5a - 5c) (i)

Source	D.F.	S.S.	M.S.	F.	F.05	F.01	
Rep.	1	.0433	.0433	2.22	4.60		
Species	14	3.3711	.2408	12.35	2.84	3.70	
Error	14	0.2729	.0195				
Total	29	3.6873					S= .1396
$\bar{x}$ =	0.28						CV= 50.71%
							$SE_{\bar{x}}$= .099

Cut 5c

Source	D.F.	S.S.	M.S.	F.	F.05	F.01	
Rep.	1	.0521	.0521	1.42	4.60		
Species	14	9.6091	.6864	18.75	2.84	3.70	
Error	14	.5120	.0366				
Total	29	10.1732					S= .1913
$\bar{x}$ =	0.58						CV= 33.2%
							$SE_{\bar{x}}$= .135

(i) The difference in Photosynthetic area index of any grass between Cut 5a and 5c gave the PAI of 5b. Also any negative values in this cut were analyzed as zero, i.e., no change in photosynthetic area.

Table A 114 **Analysis of Variance of NAR Grasses**

Pasture Mixtures 1961

Cut 4

Source	D.F.	S.S.	M.S.	F	F.05	F.01
Rep.	1	.026107	.026107	7.62	4.60	8.86
Species	14	.556593	.039757	11.60	2.84	3.70
Error	14	.047980	.003427			
Total	29	.630680				

Statistics: $\bar{x}$ = .249; S = .0585; CV = 23.5%; $SE_{\bar{x}}$ = .0414

Cut 5a

Source	D.F.	S.S.	M.S.	F	F.05	F.01
Rep.	1	.001429	.001429	0.32	4.60	
Species	14	1.095862	.078276	17.56	2.84	3.70
Error	14	.062396	.004457			
Total	29					

Statistics: $\bar{x}$ = .342; S = .0668; CV = 19.5%; $SE_{\bar{x}}$ = .0472

Cut 5b (i)

Source	D.F.	S.S.	M.S.	F	F.05	F.01
Rep.	1	3×10^{-9}	0	0	4.60	
Species	14	.024806	.001772	0.88	2.84	3.70
Error	14	.028261	.002019			
Total	29	.053067				

Statistics: $\bar{x}$ = .063; S = .0449; CV = 70.8%; $SE_{\bar{x}}$ = .0316

Cut 5c

Source	D.F.	S.S.	M.S.	F	F.05	F.01
Rep.	1	.008102	.008102	4.58	4.60	
Species	14	.199262	.014233	8.04	2.84	3.70
Error	14	.024781	.001770			
Total	29	.232145				

Statistics: $\bar{x}$ = .185; S = .0421; CV = 22.8%; $SE_{\bar{x}}$ = .0297

(i) These NAR values have been obtained by using Watson's complete formula, i.e.,

$$\frac{(W_2-W_1) \times (\log_e L_2 - \log_e L_1)}{(t_2-t_1) \times (L_2-L_1)} = \text{NAR (gm/dm}^2\text{/week)}$$

Table A 115 **Analysis of Variance of PAI Legumes**

Pasture Mixtures 1961

Cut 4

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.0096	.0096	0.04	4.32		
Species	21	84.4026	4.0192	16.61	2.09	2.88	$\bar{x}$ = 2.36
Error	21	5.0821	0.2420				S = .4919
Total	43	89.4943					CV = 20.8%
							$SE_{\bar{x}}$ = .348

Cut 5a

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.1216	.1216	0.77	4.35		
Species	20	62.4366	3.1218	19.71	2.12	2.94	$\bar{x}$ = 1.38
Error	20	3.1676	.1584				S = .3980
Total	41	65.7254					CV = 28.9%
							$SE_{\bar{x}}$ = .035

Cut 5b(i)

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.4028	.4028	3.51	4.32		
Species	21	4.9407	.2353	2.05	2.09	2.88	$\bar{x}$ = 0.42
Error	21	2.4079	.1147				S = .3387
							CV = 81.0%
Total	43	7.7514					$SE_{\bar{x}}$ = .240

Cut 5b (corrected)(ii)

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.6384	.6384	4.31	4.32		
Species	21	5.5252	.2631	1.78	2.09	2.88	$\bar{x}$ = 0.89
Error	21	3.1109	.1481				S = .3848
Total	43	9.2745					CV = 43.4%
							$SE_{\bar{x}}$ = .272

Cut 5c

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	1.9741	1.9741	12.50	4.32	8.02	
Species	21	80.4178	3.8294	24.25	2.09	2.88	$\bar{x}$ = 1.66
Error	21	3.3153	0.1579				S = .3974
Total	43	85.7072					CV = 23.9%
							$SE_{\bar{x}}$ = .281

(ii) Corrected by increasing each value by 0.5 so as to eliminate the negative values.

(i) Refer to table A 108

Table A 116 Analysis of Variance of NAR Legumes

Pasture Mixtures 1961

Cut 4

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.002520	.002520	0.93	4.32		
Species	21	.427678	.020366	7.49	2.09	2.88	$\bar{x}$ = .414
Error	21	.057091	.002719				S = .0521
Total	43	.487289					CV = 12.6%
							$SE_{\bar{x}}$ = .0369

Cut 5a

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.003439	.003439	1.39	4.35		
Species	20	.652779	.032639	13.22	2.09	2.88	$\bar{x}$ = .475
Error	20	.049383	.002469				S = .0497
Total	41	.705601					CV = 10.5%
							$SE_{\bar{x}}$ = .0351

Cut 5b (i)

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.005331	.005331	7.13	4.32	8.02	
Species	21	.030972	.001475	1.97	2.09		$\bar{x}$ = .039
Error	21	.015704	.000748				S = .0273
Total	43	.052007					CV = 69.6%
							$SE_{\bar{x}}$ = .0193

Cut 5c

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.000201	.000201	0.25	4.32		
Species	21	.188881	.008994	11.05	2.09	2.88	$\bar{x}$ = .228
Error	21	.017096	.000814				S = .0285
Total	43	.206178					CV = 12.5%
							$SE_{\bar{x}}$ = .0202

(i) Refer to Table A 109

Table A 117 Analysis of Variance of PAI and NAR
Total of Cut 4 and 5

Pasture Mixtures 1961

PAI Grasses

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.1347	.1347	0.52	4.60		
Species	14	27.3491	1.9535	7.51	2.84	3.70	$\bar{x}$ = 1.101
Error	14	3.6425	.2602				S = .5101
							CV = 46.3%
Total	29	31.1263					$SE_{\bar{x}}$ = .3607

NAR Grasses

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.063296	.063296	8.14	4.60	8.86	
Species	14	1.398699	.099907	12.85	2.84	3.70	$\bar{x}$ = .4342
Error	14	.108812	.007772				S = .0882
							CV = 20.3%
Total	29	1.570807					$SE_{\bar{x}}$ = .0623

PAI Legumes

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	2.2591	2.2591	3.53	4.35		
Species	21	306.0996	14.5762	22.76	2.09	2.88	$\bar{x}$ =4.0243
Error	21	13.4490	.6404				S = .8002
							CV = 19.9%
Total	43	321.8077					$SE_{\bar{x}}$ = .5659

NAR Legumes

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.003844	.003844	0.76	4.35		
Species	21	1.104704	.052605	10.46	2.09	2.88	$\bar{x}$ = .6419
Error	21	.105563	.005027				S = .0709
							CV = 11.0%
Total	43	1.214111					$SE_{\bar{x}}$ = .0501

(i) Represents the total of Cut 4 and 5c, i.e., complete recovery in each cut.

Table A 118 PAI and NAR of Hay Mixtures and Pure Stands Cut 3 1961

Grass Components — Blocks

Component	A DW / m^2	A Lwt / Ldm^2	A PAI	A NAR	B DW / m^2	B Lwt / Ldm^2	B PAI	B NAR	C DW / m^2	C Lwt / Ldm^2	C PAI	C NAR	D DW / m^2	D Lwt / Ldm^2	D PAI	D NAR
Tim. i	47	.310	1.5161	.130	90	.513	1.7544	.221								
1	13	.366	.3552	.109	No	Tim.	present		No	Tim.	present		5.594	.255	.2194	.066
4	48	.400	1.2000	.160	46	.512	.8984	.192	5.274	.301	.1752	.072	12	.508	.2362	.134
5	57	.354	1.6102	.148	14	.492	.2846	.137	15	.439	.3417	.129	11	.349	.3152	.100
9	53	.406	1.3054	.165	37	.430	.8605	.160	70	.474	1.4768	.197	43	.460	.9348	.174
Br. 8	6.043	.369	.1638	.086	24	.258	.9302	.097	10	.329	.3040	.094	13	.356	.3652	.107

Legume Components

Component	A DW / m^2	A Lwt / Ldm^2	A PAI	A NAR	B DW / m^2	B Lwt / Ldm^2	B PAI	B NAR	C DW / m^2	C Lwt / Ldm^2	C PAI	C NAR	D DW / m^2	D Lwt / Ldm^2	D PAI	D NAR
R.C. i	E 126	.290	4.3448	.147	F 81	.348	2.3276	.158								
1	3.057	.284	.1076	.056	4.44	.315	.1410	.069	6.634	.240	.2764	.066	6.076	.272	.2234	.070
4	142	.360	3.9444	.179	120	.387	3.1008	.185	219	.330	6.6364	.179	201	.314	6.4013	.169
5	169	.331	5.1057	.172	244	.314	7.7707	.174	275	.296	9.2905	.169	198	.378	5.2381	.197
Lad. 4	43	.331	1.2991	.134	62	.296	2.0946	.132	51	.353	1.4448	.146	34	.330	1.0303	.128
Af. 1	191	.256	7.4609	.141	200	.383	5.2219	.200	223	.381	5.8530	.202	214	.401	5.3366	.210
8	249	.401	6.2095	.215	202	.511	3.9530	.255	235	.425	5.5294	.224	174	.450	3.8667	.223
B.T. 5	43	.587	.7325	.210	13	.456	.2851	.127	5.15	.369	.1396	.081	11	.393	.2799	.109
9	154	.472	3.2627	.228	185	.415	4.4578	.211	181	.528	3.4280	.257	155	.508	3.0512	.242

Pure Stands	E				F			
R.C. 2	170	.367	4.6322	.188	143	.322	4.4410	.164
Af. 4	171	.409	4.1809	.206	203	.406	5.0000	.210
Lad. 5	56	.328	1.7073	.140	38	.367	1.0354	.142
B.T. 6	146	.422	3.4597	.206	45	.422	1.0664	.164
Br. 7	158	.479	3.2985	.231	183	.406	4.5174	.210
Tim. 8	125	.580	2.1552	.260	114	.477	2.3899	.218

Table A 119

Analysis of Variance Cut 3
Hay Mixtures 1961

PAI Pure Stands & 1 Mixt. (i)

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.4761	.4761	0.58	5.59		
Species	7	22.7871	3.2553	3.95	3.79	7.00	$\bar{x}$ = 2.99
Error	7	5.7758	0.8251				S = 0.91
							CV = 30.4%
Total	15	29.039					$SE_{\bar{x}}$ = 0.6423

PAI Grasses

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	3	.8354	0.2785	1.40	3.86		
Species	3	1.0949	0.3648	1.84	3.86	6.99	$\bar{x}$ = 0.71
Error	9	1.7898	0.1987				S = 0.446
							CV = 62.5%
Total	15	3.7201					$SE_{\bar{x}}$ = 0.223

PAI Legumes

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	3	3.5497	1.1832	0.90	3.07		
Species	7	186.1424	26.5918	20.29	2.49	3.65	$\bar{x}$ = 3.54
Error	21	27.5202	1.3105				S = 1.145
							CV = 32.4%
Total	31	217.2123					$SE_{\bar{x}}$ = 0.572

NAR Pure Stands & 1 Mixt.

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.000027	.000027	0.03	5.59		
Species	7	.015661	.002237	2.43	3.79	7.00	$\bar{x}$ = 0.4030
Error	7	.006456	.000922				S = 0.03
							CV = 16.0%
Total	15	.022144					$SE_{\bar{x}}$ = 0.0215

NAR Grasses

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	3	0.001348	0.000449	0.46	3.86		
Species	3	0.012414	0.004138	4.27	3.86	6.99	$\bar{x}$ = 0.1345
Error	9	0.008712	0.000968				S = 0.0311
							CV = 23.1%
Total	15	0.022474					$SE_{\bar{x}}$ = 0.0156

NAR Legumes

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	3	0.000064	0.000021	0.01	3.07		
Species	7	0.086970	0.012424	5.71	2.49	3.65	$\bar{x}$ = 0.1675
Error	21	0.015226	0.002175				S = 0.0470
							CV = 28.1%
Total	31	0.102260					$SE_{\bar{x}}$ = 0.0233

(i) In pure stands, mixture (i) containing Tim. and R.C. was included.

Table A 120 Analysis of Variance[(i)] Cut 3

Hay Mixtures 1961

PAI Grasses

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.3452	.3452	0.92	5.59		
Species	7	18.3412	2.6202	6.98	3.79	7.00	$\bar{x}$ = 1.491
Error	7	2.6295	.3756				s = .6129
							CV = 41.1%
Total	15	21.3159					$SE_{\bar{x}}$ = .554

PAI Legumes

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	1.9553	1.9553	2.01	4.75		
Species9	12	99.6740	8.3062	8.53	2.69	4.16	$\bar{x}$ = 3.298
Error	12	11.6845	0.9737				s = .9868
							CV = 29.9%
Total	25	113.3138					$SE_{\bar{x}}$ = .698

NAR Grasses

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.000218	.000218	0.20	5.59		
Species	7	.041866	.005981	5.44	3.79	7.00	$\bar{x}$ = .1574
Error	7	.007700	.001100				s = .0033
							CV = 14.93%
Total	15	.049784					$SE_{\bar{x}}$ = .0235

NAR Legumes

Source	D.F.	S.S.	M.S.	F	F.05	F.01	Statistics
Rep.	1	.000049	.000049	0.02	4.75		
Species	12	.045624	.003802	1.74	2.69	4.16	$\bar{x}$ = .1695
Error	12	.026181	.002182				s = .0467
							CV = 27.6%
Total	25	.071854					$SE_{\bar{x}}$ = .0330

(i) An. of Var. of Blocks A, D and E,F only.

Table A 121 Average PAI and NAR of Grasses in Mixtures and Pure Stands

Pasture Mixtures Cut 4, 5a and 5b 1961

	CUT 4		CUT 5 a		CUT 5 b	
	PAI	NAR	PAI	NAR	PAI	NAR
Pure Tim.	0.68 b	.390 abc	0.69 a	.600 a	1.17 a	.108 a
Pure Br.	.89 b	.447 ab	.68 a	.642 ab	.92 a	.042 a
Tim. 1	.34 b	.283 c	.22 cd	.374 cd	.15 d	.047 a
4	.62 b	.142 d	.08 d	.184 ef	.04 cd	.066 a
6	.50 b	.302 c	.40 bc	.410 cd	.15 cd	.045 a
8	.52 b	.098 d	.04 d	.128 ef	.10 d	.052 a
9	.80 b	.354 abc	.57 ab	.472 bc	.56 b	.073 a
11	.57 b	.468 a	.52 ab	.585 ab	.16 cd	.046 a
12	.08 b	.132 d	.06 d	.121 ef	.07 d	.054 a
vii	.03 b	.068 d	.03 d	.072 f	.05 d	.126 a
viii	.10 b	.133 d	.06 d	.260 de	.04 d	.030 a
Br. 13	.42 b	.378 abc	.51 ab	.514 abc	.06 d	.038 a
viii	.06 b	.090 d	.02 d	.180 ef	.11 d	.058 a
R.Can.14	.16 b	.130 d	.04 d	.135 ef	.13 cd	.116 a
K.Blue15	2.08 a	.324 bc	.67 a	.454 bc	.48 bc	.050 a

Means followed by the same lower case letter are not significantly different at the 5% level. (Duncan's Multiple Range Test)

Table A 122 Average PAI and NAR of Grasses in Mixtures and Pure Stands

Pasture Mixtures Cut 5c and Total (4 & 5c) 1961

	CUT 5 c		TOTAL (4 and 5 c)	
	PAI	NAR	PAI	NAR
Pure Tim.	1.86 a	.323 a	2.51 ab	.373 ab
" Br.	1.60 ab	.238 ab	2.52 ab	.348 ab
Tim. 1	0.38 def	.183 bcd	0.72 cd	.237 abcd
4	0.08 f	.098 d	.70 cd	.128 cd
6	0.54 def	.226 ab	1.04 cd	.287 abcd
8	0.14 ef	.100 d	0.66 cd	.110 d
9	1.08 c	.280 ab	1.88 bc	.352 ab
11	0.68 cd	.292 a	1.24 cd	.423 a
12	.11 ef	.094 d	0.20 d	.082 d
vii	.08 f	.116 d	.10 d	.099 d
viii	.11 ef	.104 d	.22 d	.206 abcd
Br. 13	.56 de	.280 ab	.98 cd	.329 abc
viii	.14 ef	.101 d	.20 d	.174 bcd
R.Can.14	.17 ef	.122 cd	.32 d	.162 bcd
K.Blue15	1.14 bc	.220 abc	3.22 a	.291 abcd

Means followed by the same lower case letter are not significantly different at the 5% level. (Duncan's test)

Table A 123 Average PAI and NAR of Legumes in Mixtures and Pure Stands

Pasture Mixtures Cut 4, 5a, and 5b 1961

	CUT 4		CUT 5 a		CUT 5 b	
	PAI	NAR	PAI	NAR	PAI	NAR
Pure R.C.	2.17 fghi	.456 abcde	1.53 cd	.500 bc	0.92 a	.042 a
" Af.	1.22 hij	.494 abc	0.68 cdef	.642 a	.28 a	.052 a
" Lad.	3.61 bcd	.498 abc	3.06 b	.558 abc	.52 a	.022 a
B.T.	3.34 cdef	.538 a	0.34 f	.510 bc	.92 a	.128 a
R.C. 1	2.46 defg	.428 abcde	1.50 cde	.489 bc	.80 a	.032 a
4	0.50 j	.298 f	0.32 f	.298 e	0.0 a	.003 a
6	2.36 efgh	.437 abcde	1.60 c	.530 abc	1.08 a	.047 a
Af. 8	0.60 j	.350 ef	0.30 f	.296 e	0.08 a	.050 a
9	1.01 ij	.428 abcde	0.58 def	.447 cd	0.22 a	.048 a
Lad. 4	3.47 bcde	.454 abcde	3.14 ab	.530 abc	0.40 a	.021 a
8	4.61 ab	.378 cdef	2.92 b	.528 abc	0.96 a	.065 a
12	5.14 a	.408 bcdef	4.12 a	.541 abc	0.50 a	.001 a
vii	3.52 bcde	.466 abcde	2.75 b	.570 ab	0.47 a	.042 a
viii	4.22 abc	.453 abcde	2.93 b	.526 abc	0.70 a	.033 a
B.T. 6	0.62 j	.354 def	0.25 f	.341 de	0.10 a	.026 a
9	2.20 fghi	.490 abc	0.54 ef	.447 cd	0.30 a	.047 a
11	2.84 defg	.452 abcde	0.52 f	.534 abc	0.42 a	.066 a
13	2.38 efgh	.526 ab	0.96 cdef	.572 ab	0.12 a	.025 a
14	2.84 defg	.479 abcd	0.40 f	.504 bc	0.34 a	.032 a
15	2.04 ghi	.402 bcdef	0.48 f	.550 abc	0.06 a	.0. a
vii	0.66 j	.154 g	-	-	0.02 a	.046 a
viii	0.22 j	.165 g	0.03 f	.072 f	0.01 a	.036 a

Means followed by the same lower case letter are not significantly different at the 5% level. (Duncan's Test)

Table A 124 Average PAI and NAR of Legumes in Mixtures and Pure Stands

Pasture Mixtures Cut 5c and Total (4 and 5c) 1961

	CUT 5 c		TOTAL (4 and 5 c)	
	PAI	NAR	PAI	NAR
Pure R.C.	2.44 cd	.238 bcde	4.62 de	.694 abc
" Af.	0.95 fgh	.240 bcde	2.16 fgh	.734 ab
" Lad.	3.57 ab	.216 bcde	7.18 ab	.765 a
" B.T.	1.26 ef	.284ab	4.60 de	.822 a
R.C. 1	2.23 de	.246abcde	4.70 de	.673 abc
4	0.26 gh	.142 f	0.76 hi	.439 d
6	2.66 bcd	.262abc	5.02 cd	.699 abc
Af. 8	0.30 fgh	.214 bcde	0.90 hi	.564 bcd
9	0.72 fgh	.270ab	1.74 ghi	.698 abc
Lad. 4	3.31 abc	.272ab	6.78 bc	.726 ab
8	3.88 a	.271ab	8.48 ab	.648 abc
12	3.72 a	.272ab	8.85 a	.680 abc
vii	3.22 abc	.316a	6.73 bc	.783 a
viii	3.64 ab	.280ab	7.86 ab	.733 ab
B.T. 6	0.30 fgh	.177 ef	0.92 hi	.532 cd
9	0.84 fgh	.234 bcde	3.03 efg	.724 ab
11	0.95 fgh	.250abcd	3.79 def	.702 abc
13	1.08 fg	.278ab	3.46 defg	.804 a
14	0.74 fgh	.193 cdef	3.58 defg	.672 abc
15	0.39 fgh	.181 def	2.53 fgh	.582 bcd
vii	0.04 h	.072 g	0.69 hi	.226 e
viii	0.04 h	.058 g	0.26 i	.222 e

Table A 125 Average PAI and NAR of Species in Mixture and Pure Stands
Hay Mixtures Cut 3 1961

Grasses

		PAI	NAR
Pure	Tim.	2.28 ab	.239 a
"	Br.	3.91 a	.220 ab
Tim.	i	1.64 b	.176 abc
	1	0.29 b	.088 d
	4	0.72 b	.147 bcd
	5	0.96 b	.124 cd
	9	1.12 b	.170 abcd
Br.	8	1.00 b	.096 cd

Legumes

		PAI	NAR	NAR(i)
Pure	R.C.	4.54 abc	.176 a	
"	Af.	4.59 abc	.208 a	
"	Lad.	1.38 de	.141 a	
"	B.T.	2.26 cde	.185 a	
R.C.	i	3.33 bcd	.152 a	
	1	0.16 e	.063 a	.065 c
	4	5.17 ab	.174 a	.178 ab
	5	5.18 ab	.184 a	.178 ab
Lad.	4	1.16 de	.131 a	.135 bc
Af.	1	6.40 a	.176 a	.188 ab
	8	5.04 ab	.219 a	.229 a
B.T.	5	0.50 e	.160 a	.132 bc
	9	3.16 bcd	.235 a	.234 a
			$SE_{\bar{x}}$ = .032	$SE_{\bar{x}}$ = .023

(i) Duncan's Test applied to legumes in mixtures of blocks A, B, C, D only. All others are species in pure stands and mixtures of blocks A, D, E, F.

(ii) Means followed by the same lower case letter are not significantly different at the 5% level. (Duncan's Test)