THE EFFECT OF ALLEY CROPPING ON AN UPLAND RICE AGROECOSYSTEM

by

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SHORT TITLE

ALLEY CROPPING UPLAND RICE

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This thesis is dedicated to my parents, Rachel and Ronald, who have taught me over the years that perseverance and forbearance would eventually lead to knowledge and discipline.

ABSTRACT

Ph.D. Richard H. MacLean Plant Science

If upland rice production is to be sustained on sloping land, soil erosion and fertility decline must be addressed. Where soil profiles are deep, hedgerows of *Gliricidia sepium* and *Cassia spectabilis*, planted on the contour, reduce soil erosion by promoting terrace formation and overcome fertility depletion by providing nutrient rich biomass. *G. sepium* and *C. spectabilis* established by seed survived better than by cuttings. Although increased hedgerow biomass was initially obtained when both species were intercropped, intense competition was observed in established hedgerows. Consequently, mixing both species at high planting density is not recommended as *C. spectabilis*, a non-fixing legume, may deplete soil-N reserves. In acid soils, biomass production of *G. sepium* was significantly increased when lime (6 t/ha) was applied. On 18 to 30% slopes, upland rice and maize production improved along fertility and moisture gradients. Rice yields were increased when biomass of *G. sepium* was incorporated into the soil, up to an optimum level equivalent to 40 kg N/ha. Mulching *C. spectabilis* increased maize productivity during the drought prone second season. Competition was observed at the hedgerow-crop interface particularly at the upper one as a result of terracing. Although green manuring increased crop yield, broadleaf weeds, seedling maggot, stemborer and blast also increased. Strategies to manage hedgerow biomass that minimize these problems need to be developed.

RÉSUMÉ

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La culture durable du riz pluvial nécessite une réduction de l'érosion et de l'épuisement de la fertilité du sol. Où les sols sont profonds, une solution efficace se trouve dans la culture en courbes de niveau de haies de *Gliricidia sepium* et de *Cassia spectabilis*. Un taux d'établissement élevé a été obtenu lorsque les haies ont été établies par semis comparativement aux boutures. Bien qu'un rendement de biomasse de haies plus élevé a été obtenu initialement lorsque les deux espèces ont été intercalées, une forte compétition a été observé 18 mois après que les haies ont été établis. Par conséquent, la culture intercalaire de ces deux espèces n'est pas recommandée. Suite a l'application de chaux (6 t/ha), le rendement de biomasse de *G. sepium* a augmenté de façon significative. Sur des pentes de 18 a 30%, les rendements du riz pluvial et du maïs ont suivis la gradation de fertilité et de teneur en eau du sol et on été les plus élevés avec l'application d'engrais vert de *G. sepium*. Cependant, aucune augmentation a été obtenu lorsque l'équivalent de plus de 40 kg N/ha d'engrais vert a été appliqué. La production de maïs a augmenté avec l'utilisation de paillis durant la deuxième saison où la sécheresse est fréquente. Le rendement du riz semé dans les rangs adjacents aux haies a été diminué par la compétition qui à son tour a été accrue par le terrassement du sol. L'application d'engrais vert a également causé une augmentation de dicotylédones, des mouches de semis (*Atherigone oryzae* Mallock), des perce-tiges (*Sesamia inferens* Walker), et de coulure (*Pyricularia oryzae* Cav.). La biomasse des haies doit être gérée de façon a ce que les contraintes biologiques soient réduites.

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FOREWORD

The thesis comprises five chapters. Chapter 1 is a general introduction describing the nature of the problem. Chapters 2, 3, and 4 constitute the body of the thesis (each is at least one complete manuscript). Section 5 is a synthesis of the conclusion. This format received Department and Faculty approval and the conditions associated with it can be consulted in appendix 1.

Manuscripts 1 and 3: Biomass production of *Gliricidia sepium* and *Cassia spectabilis* as monocropped and mixed hedgerows and The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on upland rice and maize production were submitted to Agroforestry Systems in February and May 1992, respectively. Both were accepted for publication in July, 1992. Manuscript 2: The decomposition rate of *Gliricidia sepium* and *Cassia spectabilis* and its influence on biomass management on an acid soil in Southern Philippines was published in Nitrogen Fixing Tree Research Reports in July, 1991. The last paper in section 4 entitled The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on weeds and selected insect pests associated with upland rice and maize will be submitted to Agriculture, Ecosystems and Environment.

Although the work was the candidate's responsibility, the project was supervised by Dr. A. K. Watson from Macdonald Campus, McGill University and Drs. J. A. Litsinger and K. Moody from the International Rice Research Institute. Consequently, all are co-authors of the manuscripts submitted.

CONTRIBUTIONS TO KNOWLEDGE

1. In this first study of intercropped *G. sepium* and *Cassia spectabilis* hedgerows, survival of either species when vegetatively propagated in an acid soil, regardless of planting pattern, was less than when planted by seed. As planting density increased, so did inter and intra-specific competition. Biomass production however, was still greatest at 25 cm spacing. Intercropping these species in acid soils (pH < 5) is not recommended however, because of *G. sepium*'s inability to effectively compete with *C. spectabilis*.

2. In Claveria, Philippines, the application of lime to soils with pH < 5 significantly increased *Gliricidia sepium* biomass production. Results from this experiment confirm previously reported results from other locations.

3. *G. sepium* biomass decomposes more rapidly than that of *C. spectabilis* and as a result may be less effective in suppressing weeds and reducing the effect of drought.

4. Green manuring and mulching *G. sepium* or *C. spectabilis* in upland rice and/or maize had previously been studied. Green manuring and mulching *G. sepium* and *C. spectabilis* simultaneously however, is novel. Upland rice and maize yields were significantly increased when biomass of *G. sepium* was incorporated into the soil. The observed increase in crop productivity is likely due to increased nutrient availability. Statistical differences in crop yield however, between incorporating 10 t/ha of *G. sepium* (treatment 3) and

incorporating 5 t/ha of *G. sepium* plus mulching 5 t/ha of *C. spectabilis* (treatment 4) were rarely significant, suggesting that 10 t/ha of *G. sepium* green manure may be excessive. Reducing within hedgerow planting density and replacing some of the *G. sepium* and *C. spectabilis* with grasses, fruit and/or timber trees, may be more appropriate.

5. Hedgerows of *G. sepium* and *C. spectabilis* planted on the contour effectively reduce soil erosion by enhancing terrace formation. Terracing however, may intensify competition at the interface, particularly in shallow soils, because the crop in the upper portion of each alley must obtain nutrients from deeper, less fertile soil horizons.

6. Whereas mulching with *C. spectabilis* reduced the dry weight of grassy weeds, green manuring with *G. sepium* increased broadleaf weed dry weight, the number of seedling maggot eggs and the number of seedling maggot and stemborer deadhearts.

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From the paper in chapter 3 entitled "The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on upland rice and maize production"

From the paper in chapter 4 entitled "The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on weeds and selected insect pests associated with upland rice and maize".

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GENERAL INTRODUCTION

Upland rice is grown without standing water on level and sloping fields that are prepared and seeded under dry conditions. Cultivation of upland rice ranges from slash and burn systems in Southeast Asia and West Africa to highly mechanized culture in Brazil (De Datta, 1972). Worldwide, there are 18 million ha of upland rice; 64% in Asia, 25% in Latin America, and 11% in Africa (IRRI, 1990). Although most upland rice is in Asia, the crop's relative importance in Latin America and Africa is reflected in the percent of total rice area that upland rice represents; 72% and 75% respectively (Sanchez, 1976).

The upland rice agroecosystem is extremely diverse in terms of climate, soils and topography. Seasonal rainfall extends from less than 1000 to more than 2000 mm (Oldeman and Woodhead, 1986). Soil texture varies from sand to clay; pH from 3 to 10; organic matter content from 1 to 50%; salt content from almost 0 to 1%; and nutrient availability from acute deficiency to surplus (De Datta, 1975). Topography ranges from alluvial valley bottoms and flat plains in South Asia to steep hillsides in Southeast Asia (Odelman and Woodhead, 1986).

Upland rice yields are low because of a complex array of interacting physical and biological constraints. The main physical constraints are soil erosion, declining soil fertility, and drought; and the main biological constraints are weeds, insect pests, diseases and nematodes (Arraudeau and Harahap, 1986).

In the humid tropics, soil erosion is primarily caused by water. It is a two-step process that includes the detachment and transport of soil particles. Contributing factors include rainfall distribution and intensity, topography, and soil type and depth (Wischmeier, 1976; El-Swaify et al., 1983). Soil erosion has been classified on the basis of severity and three classes exist; sheet, rill and gully. Sheet erosion is the removal of entire layers of soil from a large sector of land, whereas rill erosion occurs when water flows down a slope and concentrates in surface depressions creating small channels. If left unchecked, flowing water can transform rills into gullies that inhibit normal cultivation of the land (El-Swaify et al., 1983).

A primary cause of soil erosion by water is removal of cover, at the ground, intermediate, and/or upper levels. Ground cover is effective in preventing erosion because of the extensive root network holding the soil. The degree of protection provided by intermediate and/or upper canopies is related to plant architecture, as particle detachment resulting from throughfall can be equal to or greater than that of rainfall itself (Moench, 1991). Removing cover without implementing appropriate soil conservation measures can lead to increased erosion.

Soil degradation is accelerated by the combined effect of soil erosion, continuous cultivation and inappropriate management practices. Erosion hastens soil fertility decline by removing the top soil which is the layer that is nutritionally and physically most able to support crop production (El-Swaify et al., 1983; Young, 1986). Continuous cereal cultivation without sufficient inputs can deplete nutrient reserves, and erosion and leaching of base cations can lower soil pH (Kang and Juo, 1984). Short fallows, crop residue burning and inadequate soil conservation measures also promote fertility decline.

Where population pressure is high and land holdings are small, farmers are reluctant to fallow as food and needed income are not generated during this period. Furthermore, if vegetative succession is dominated by few species (such as *Imperata cylindrica* (L.) Beauv.), then restoring fertility by fallowing is a long term venture, one that farmers are often not prepared to undertake. The use of fertilizers is not widespread among upland rice farmers because capital and credit are often lacking. In addition, many hillside farmers know that fertilizers may be transported with run-off down the slope and consequently refrain from applying them. Green manures have not been widely accepted because of lack of seed, encroachment on the main cropping season and the need for additional labor. Burning crop residues and dry season vegetation is common because the alternative, incorporation, requires expensive and often unavailable labor. Many farmers are also aware that the subsequent crop is not always benefited by residue incorporation because of nitrogen immobilization. Soil conservation practices such as contour farming, terracing and strip cropping are unfortunately used by only few upland farmers (IRRI, 1990).

Drought, "the period when available stored water in the soil will support actual evapotranspiration at only a fraction of the potential evaporation" (Hounam et al., 1975 as quoted by Gupta and O'Toole, 1986) is common in many upland farming areas. This is partly because of the loss of soil organic matter and fine soil particles both of which enhance the soil's water- and nutrient-holding capacities (Lal, 1976). Because reduced soil moisture slows the nutrient delivery rate to roots (Parish, 1975), physiological processes such as photosynthesis, transpiration, translocation, and cell division and enlargement may be adversely affected (O'Toole and Moya, 1981). These processes are governed by the degree, duration, and growth stage sensitivity of the crop species and are used to determine yield reductions (Beggs and Turner, 1976).

Weeds are an integral component of all agroecosystems and a major biological constraint to upland rice production. Weeds are particularly troublesome in upland rice because without flooding, weeds germinate together with the crop. Although weed populations associated with upland crops are diverse (Mercado, 1986), most are composed of three or four principal species (Moody and Drost, 1981) that thrive at higher densities and produce more biomass than those species associated with lowland rice (Moody, 1983). Developing effective and affordable weed control strategies has posed a major problem for upland farmers.

Many upland rice growing regions are characterized by a distinct wet and dry season. Because rainfall is often erratic, farmers normally plant upland rice once a year during the wettest months, and usually on only a small portion of their land along with other annuals and perennials (Litsinger et al., 1987). The resulting patchwork of crops, fallows and forests differs considerably from the homogeneous lowlands and these differences are reflected in the more diverse insect pest complex associated with upland rice. Some of this diversity is accounted for by the larger populations of soil-inhabiting pests that build up in the nonpuddled upland rice soils (Litsinger et al., 1987). Although the upland insect fauna is more diverse than that of the lowlands, many of the pests are common to both systems (Litsinger et al., 1987). Insect abundance and yield loss caused by insect pests in upland rice are similar to those observed in lowland rice culture (Litsinger, 1984; Loevinsohn et al., 1982).

However, because the risks associated with upland rice remain high, few farmers are willing to invest in inputs and pest control measures (Litsinger et al., 1987).

Blast is caused by the fungus *Pyricularia oryzae* Cav. and is one of the most widespread diseases of rice (Seshu et al., 1986). Acidic, drought prone and infertile soils with high aluminum content are typical soils where blast is common and severe (Ahn and Mukelar, 1986). In areas where large differences in minimum and maximum daily temperatures are common, a favorable environment for the development of the disease is created by the dew, which prolongs leaf wetness (Ahn and Mukelar, 1986). This disease continues to impede upland rice from reaching its yield potential, especially in marginal areas favorable to its development (John and Bonman, 1986).

Several genera of plant-parasitic nematodes are associated with upland rice. One of the most prevalent is *Pratylenchus*, and upland rice yield losses up to 70% caused by *P. zeae* Graham have been reported (IRRI, 1990).

Under field conditions, yield losses can rarely be attributed to a single factor. Most often the crop is subjected to several pressures simultaneously, and the combined stress synergistically reduces the crop's ability to compete, tolerate and/or compensate. For example, with the loss of soil organic matter (Moench, 1991), the soil's water and nutrient holding capacities are reduced and consequently the likelihood of drought is increased and soil fertility decline is accelerated. Weeds not only cause significant yield loss, but may also intensify problems associated with insects, rats, diseases, and nematodes (Moody, 1990; Pancho et al., 1969). Blast severity can be exacerbated by drought stress (John and Bonman, 1986). In addition, cultural practices designed to improve one facet of crop production can be detrimental to another. For example, increasing nutrient availability via fertilizer application may increase both crop and weed biomass production. The resulting dense vegetation with the moist microclimate may promote the development of various diseases (Litsinger, 1992). During wet years, recommended fertilizer rates can increase the crop's susceptibility to blast (IRRI, 1988). Although crop yield may be enhanced by a weed-free environment, soil erosion may be increased by reduced ground cover. These examples serve to illustrate the complexities inherent in upland rice research.

Although research has increased our understanding of the crop and its environment, few strategies have been developed that effectively overcome this complex array of interacting constraints and consequently, of all rice farmers, the upland rice farmer remains the poorest (Fujisaka, 1987).

Because of hydrology, the upland rice agroecosystem is most suited to crop diversification. Many upland farmers already grow rice together with other annual and/or perennial species in an effort to overcome some of the above mentioned constraints. The two principal types of crop diversification are intercropping and relay cropping. Intercropping is when two or more crops are planted simultaneously on the same piece of land, whereas in relay cropping, one or more species is planted into an established crop, usually after the established crop has flowered (Gupta and O'Toole, 1986). General benefits to intercropping include improved ground cover, better use of light, water and nutrients, and improved yield stability (Kass, 1978). Although intercropping has also been reported to reduce insect- (Altieri et al., 1978; Risch et al., 1983), weed- (Liebman, 1988; Bantilan et al., 1974) and disease-related problems (Trenbath, 1974), there are also several accounts of increased yield losses caused by pests in mixed systems (CIAT, 1976; ICRISAT, 1977; Yamoah and Burleigh, 1988). In a comprehensive literature review, Risch et al., (1983) reported that 53% of intercropping studies claimed that insect pests were reduced as a result of crop diversification. Specific advantages with respect to pest suppression, however, rest with the type and degree of diversity (van Emden and Williams, 1974).

Intercropping, a traditional form of crop diversification, has recently received increasing research attention, with particular focus on the incorporation of grain legumes. Reported advantages include increased protein availability, greater revenue potential, reduced labor peaks, and reduced drought stress during grain filling (IRRI, 1974; Bradfield, 1972). Increasing spatial and temporal complementarity may be achieved by mixing crops with different rooting depths, different durations (peak resource demands) and different nutrient needs (soil N versus N fixation) (Snaydon and Harris, 1981; Gupta and O'Toole, 1986). Improved utilization of available natural resources such as light, water and soil nutrients can lead to increased crop yield (Willey, 1979). Increased nutrient availability for subsequent crops has also been reported (Morris, 1986). Extensive on-farm research at the International Rice Research Institute (IRRI) however, indicates that upland rice productivity "was not enhanced by previous legumes" (IRRI, 1990) and that other than potassium, nutrients in the surface soil decreased (IRRI, 1991). As grain legumes approach physiological maturity, mobile nutrients in the vegetative biomass are translocated to the grain, which is then harvested and removed from the field. Consequently, nutrient contributions by way of legume stover incorporation may not increase the yield of subsequent crops (IRRI, 1991). Intermingling root systems may facilitate nitrogen transfer from legume to cereal (Martin et al., 1990), however, if intercrops exploit similar soil horizons, competition for soil resources may exceed supply causing uneven sharing between components (Trenbath, 1976).

In tropical Asia, rice and maize-based cropping systems dominate the uplands because of limited local market demand for grain legumes (IRRI, 1988). Other problems associated with grain legume production are seed availability, low acid soil tolerance, stand establishment, and increased labor. In an effort to increase farmer acceptance, farming systems research at many International Agricultural Research Centers (IARCs) has been broadened to include multipurpose leguminous trees and shrubs with grain, fodder, and fuel yielding capacities; their ability to conserve soil and water, recycle nutrients, contribute to the soil N pool and enhance soil physico-chemical properties were also essential attributes (IRRI, 1988). This evolution of research focus was one of the catalysts that gave rise to the emergence of agroforestry as a scientific discipline.

> Agroforestry is a land use system that involves deliberate retention, introduction, or mixture of trees or other woody perennials in crop/animal production fields to benefit from the resultant ecological and economic interactions (MacDicken and Vergara, 1990).

Although agroforestry may potentially ameliorate certain situations, its success is not universal and must not be regarded as the panacea to all problems (MacDicken and Vergara, 1990). Agroforestry land-use systems have been effective where tree communities have been maintained (Nair, 1984). One promising agroforestry system is alley cropping, a system in which crops are grown between hedgerows of leguminous trees, shrubs and/or grasses that are periodically pruned to minimize crop-hedgerow competition (Kang and Duguma, 1985). Benefits of alley cropping include: 1) the amelioration of soil physico-chemical properties (Lal, 1989b; Lal, 1989c; Yamoah et al., 1986a), 2) the reduction of soil erosion by contoured hedgerows and mulched biomass (Lal, 1989a), 3) the uptake and recycling of leachates by deep rooted perennials (Glover and Beer, 1986; Kang et al., 1984), 4) improved weed control (Yamoah et al., 1986b), and 5) increased availability of fuelwood and/or fodder. Shade created by the hedgerow canopy during the dry season, may also reduce water evaporation and the abundance of shade intolerant weed species, thus facilitating land preparation at the onset of the next rainy season (Kang et al., 1984).

Alley cropping research to date has focused primarily on multipurpose, nitrogen fixing *Leucaena leucocephala* (Lam.) de Wit and *Gliricidia sepium* (Jacq.) Walp. with particular emphasis on biomass management (Kang and Duguma, 1985). In cereal production systems, hedgerow biomass can be green manured or mulched. Although nitrogen uptake from decomposing green manures is low, estimated to be 36% by Gueverra, (1976), green manuring is more effective than mulching in terms of increasing crop yield (Kang et al., 1984). Mulching is more effective than green manuring in reducing drought, soil erosion, (Lal, 1976) and yield losses attributed to weeds (Castin and Moody, 1977). As a result, alley cropping systems designed to produce a green manure and a mulch, may be more effective at overcoming constraints associated with upland rice production.

Green manures and mulches, however, have distinct physical and chemical properties. Effective green manures have a low carbon:nitrogen ratio and contain simple nitrogenous compounds that are easily broken down, thereby enhancing humification. In contrast, effective mulches have a high carbon:nitrogen ratio and complex nitrogenous compounds that decompose slowly (Schnitzer, 1986). Consequently, diversified hedgerows with function-specific species may be more effective than hedgerows with single 'multipurpose' tree species.

The objectives of this study were to develop a mixed hedgerow system with *Gliricidia sepium* and *Cassia spectabilis* DC (synonym *Senna spectabilis* (DC.) Irwin and Barnaby) and to determine the effect of such a system on a) upland rice and maize production and b) on the pest complex associated with both crops. An experiment on establishment of these species was initiated to compare biomass production of different planting materials (seedlings and cuttings), planting patterns (monocrop *G. sepium*, monocrop *C. spectabilis*, and mixed hedgerows), and within hedgerow spacing (25, 50, and 75 cm) of *G. sepium* and *C. spectabilis*. A second experiment was set up to determine the effect of different rates of lime application on *G. sepium* biomass production. A third experiment was designed to determine how quickly both species decompose when mulched on the soil surface. The main experiment was conducted in an effort to generate a biomass management strategy that could sustainably increase upland rice and maize yields above farmers' present levels and to determine the impact of such strategies on the main insect pests and weed species associated with upland rice and maize. A secondary objective was to assess the impact of slope on rice and maize production.

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Biomass production of *Gliricidia sepium* and *Cassia spectabilis* as monocropped and mixed hedgerows.

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Key words. mixed hedgerows, inter- and intra-specific competition

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Abstract.

This paper examines the effect of spacing on biomass production of monocropped and mixed hedgerows of seedlings and cuttings of *Gliricidia sepium* and *Cassia spectabilis*. The effect of lime on *G. sepium* biomass production was also evaluated. Seedlings survived better than cuttings; and no differences in biomass production were observed between seedlings in either pattern at the highest density tested. Although spacing reduced inter- and intra-specific competition, total biomass production was greatest at higher densities. Based on biomass production, mixing hedgerow species reduced intraspecific competition within *C. spectabilis*, resulting in increased biomass production. Six, 8 and 12 tons of lime per hectare significantly increased fresh *G. sepium* biomass production over the no lime treatment at all harvest dates except the first. Extrapolated to an alley cropping system, applying 6 t/ha of lime increased fresh cumulative *G. sepium* biomass production by almost 39 t/ha over the no lime treatment. This represented a gain of more than 200 kg N/ha.

Introduction

Alley cropping, a system in which food crops are grown between hedgerows of perennial leguminous, woody shrubs and/or grasses, is an agroforestry system that addresses some of the problems facing upland farmers [14]. Benefits of alley cropping include: 1) the amelioration of soil chemical and physical properties [18, 19, 38], 2) the reduction of soil erosion by contoured hedgerows and mulched biomass [17], 3) the potential uptake and recycling of leachates by deep rooted perennials [9, 15], 4) improved weed control [39], and 5) increased availability of fuelwood and/or fodder. The degree to which alley cropping can provide the above benefits depends partly on the quantity of biomass that hedgerows can produce. Hedgerow biomass production is governed by species selection, spatial arrangement and management practices [40].

Almost two thirds of the soils in the humid tropics are acid [30]. Phosphorus, an essential nutrient for lateral and fibrous rootlet development, can be adsorbed and made unavailable by aluminum and iron complexes in acid soils, thus reducing the plant's growth rate and increasing its susceptibility to drought [5, 6, 31]. Acid soils are particularly unfavorable for legumes because of iron, aluminum, and manganese toxicities as well as molybdenum, calcium, and/or magnesium deficiencies [12, 13]. Because molybdenum is an essential nutrient in nitrogen fixation, and because calcium requirements in legumes are high, deficiencies of either element can cause low biomass yields in leguminous species [3, 4].

Two leguminous trees suited for alley cropping are nitrogen fixing *Gliricidia sepium* (Jacq.) Walp and non-nitrogen fixing *Cassia spectabilis* DC [1, 16] (*Senna spectabilis* (DC.)

Irwin and Barnaby). Mixing *G. sepium* and *C. spectabilis* within the same hedgerow was deemed to be desirable because a green manure and a mulch could be produced simultaneously [21]. Diversifying the hedgerow may also reduce the likelihood of severe pest infestations, as has occurred with *Leucaena leucocephala* (Lam.) de Wit by the psyllid *Heteropsylla cubana* Crawford [37].

An experiment on establishment of these species was initiated in July 1987 to determine the effect of planting material (seedlings or cuttings), planting pattern (monocrop *G. sepium*, monocrop *C. spectabilis*, and mixed hedgerows), and spacing of *G. sepium* and *C. spectabilis* on biomass production. Although *G. sepium* is considered to be somewhat acid tolerant [23], in highly acidic soils biomass production may be reduced. Consequently, an experiment was set up to determine the effect of different rates of lime application on *G. sepium* biomass production.

Materials and methods

Experiments were conducted at the International Rice Research Institute's acid upland research site at Claveria, Northern Mindanao, Philippines (8° 38' N, 124° 55' E, elevation 400 m). Claveria soils are moderately well-drained, silty clay loams with pH around 4. Soil analyses for sites where experiments were conducted are presented in Tables 1 and 2. The rainy season extends from May to February; and, although average annual rainfall is 2200 mm, periods when evaporation exceeds rainfall for 15 consecutive days or more are frequent (Figure 1).

Establishment experiment

In a complete factorial experiment (2X3X3), 18 treatments were replicated five times in a randomized complete block design. Factors included two sources of planting material, three planting patterns and three spacings. Each plot was a 4 m strip of hedgerow. Each hedgerow consisted of two rows of *G. sepium* and/or *C. spectabilis* spaced 50 cm apart. Between-hedgerow spacing was 4 m. Three spacings were used within-hedgerows; 25, 50, and 75 cm. Planting pattern in the mixed hedgerow treatments was alternating (i.e., one *G. sepium* alternated with one *C. spectabilis*).

The site was abandoned in 1981 and remained fallow until 1987 when the experimental area was plowed and harrowed twice using animal draught power. Seeds of *C. spectabilis* and *G. sepium* were collected locally in March, 1987 and germinated three weeks before planting in 7.5 X 15 cm polyethylene bags containing soil. *G. sepium* cuttings were gathered the day before planting and kept moist overnight; *C. spectabilis* cuttings were gathered on planting day. The bottoms of the polyethylene bags were removed at planting in July, 1987 to allow drainage. Cuttings, approximately 50 cm long and 3 cm in diameter, were planted approximately 20 cm deep at a 45° angle. Hedgerows were hand weeded 21 days after planting, and pruned (to 50 cm) in January 1988, July 1988, and March 1989. Based on total plot sampling, plant survival (%), plant height (cm), and total fresh biomass (kg), were recorded at each pruning. Harvested biomass was separated into green manure (leaves and green stems) and wood and weighed. For the mixed hedgerows, data were collected on individual species to allow each to be evaluated under both planting patterns. Biomass data were converted into biomass per tree to determine the effect of spacing on inter- and intraspecific competition.

Lime experiment

Treatments, which were replicated four times in a randomized complete block design, consisted of 0, 2, 4, 6, 8 and 12 t/ha of calcium carbonate (37% Ca and 0.15% Mg) broadcasted on 25 m^2 (5mX5m) plots and rototilled into the plow layer (top 10-15 cm) one day before planting. In each plot, 100 cuttings of *G. sepium*, approximately 50 cm long and 2.5 cm in diameter, were planted 20 cm deep. Between- and within-row spacing were 1 m and 25 cm, respectively. The area between the hedgerows was interrow cultivated and hand weeded 30 and 90 days after planting and was irrigated as needed during the establishment period (first 12 weeks). Fresh *G. sepium* biomass production was determined by pruning trees (to 50 cm) within a 9m^2 (3mX3m) area and weighing harvested biomass. Harvest dates include July, 1987 (6 months after planting (mp)), October, 1987 (9 mp), June, 1988 (17 mp), November, 1988 (22 mp), and April, 1989 (27 mp). To determine initial soil pH, 12 composite soil samples from the 0-15, 15-30, and 30-50 cm depths were analyzed (Table 2). Two samples from each plot at each depth were collected after the third harvest and analyzed for pH (Table 3).

Statistical analysis

Data were analyzed using the General Linear Model procedure of the Statistical Analytical System program (SAS) [32] and the International Rice Research Institute Statistical package (IRRISTAT). Data were transformed ($\log_{10}$(variable+1)) to satisfy the assumptions of

ANOVA. The Least Significant Difference (LSD) test and the Duncan's Multiple Range Test (DMRT) were used where appropriate.

Results and discussion

Establishment experiment

Average seedling survival ranged from 70 to 100%, whereas cutting survival ranged from 0% to 43% (Figure 2). Although planting materials were significantly different in terms of survival ($P < 0.01$), seedling survival between species was not. *G. sepium* cutting survival ranged from 0 to 43% whereas *C. spectabilis* cutting survival was less than 5% (data not presented).

Because of their high mortality, cuttings were omitted from the factorial analysis. Although spacing and planting pattern significantly affected cumulative biomass production (Table 4), the main treatment differences were between species (Table 5). On a per hectare basis, cumulative biomass production from *C. spectabilis* seedlings planted at 25 cm spacing, was 11.5 t/ha. Based on tissue analyses from the first harvest (Table 6), this represents 121.3 kg nitrogen, 8.8 kg phosphorus, 56.8 kg potassium, 9.5 kg magnesium, and 35.5 kg calcium. In contrast, *G. sepium* seedlings planted 25 cm apart contributed 13.9 kg N, 1.1 kg P, 13.7 kg K, 1.4 kg Mg, and 8.1 kg Ca per ha. Yamoah et al. [39] found similar results when comparing nutrient contributions from *C. spectabilis* and *G. sepium* to maize.

In terms of biomass per tree, both spacing and planting pattern significantly affected *C. spectabilis* seedling biomass production, whereas only spacing had an effect on *G. sepium* seedlings (Table 7). *C. spectabilis* biomass production was greater than that of *G. sepium* and mixing species further increased the difference (Table 8). Intraspecific competition, based on *C. spectabilis* biomass production, was increased as spacing was reduced; no such effect was observed with *G. sepium* (Table 8). Increasing *G. sepium* density to 10 plants per meter has been reported to increase biomass production [34].

Because cutting survival of *G. sepium* was low, this method of propagation in either hedgerow planting pattern in acid soils, may not be advisable. Survival of *G. sepium* cuttings improved at the higher planting density possibly because of increased shade on the soil surface. Shade conserves soil moisture which is critical during callus tissue development, and it may help to maintain lower soil temperature. Acceptable survival rates of *G. sepium* have been reported with larger cuttings (1m tall and 10-15 cm diameter) [24, 28] and when cuttings are planted in calcareous soils (Granert W., pers. communication). Levels of aluminum and iron and tolerance to these elements can influence cutting survival. Aluminum has also been reported to induce drought stress [2], which in turn increases cutting susceptibility to termite (*Macrotermes gilvus* [Hagen]) attack. In this experiment, cuttings suffered drought stress during the second week in July and from 15 August to 7 September, 1987 (Figure 1) and were subsequently attacked by termites.

Superior growth of *C. spectabilis* may result from its greater capacity to take up nutrients, particularly N, from lower soil horizons [16]. The capacity of *C. spectabilis* to take up N is reflected in the N content of the leafy biomass (Table 6). Ladha et al., [16] reported, however, that leaf N in *C. spectabilis* fluctuates with levels of plant available soil-N. Salazar et al., [29], reported that although *Cassia spp.* grew twice as tall as *G. sepium* in acid soil conditions, it had one third less N in the leaves.

Increased biomass production in the mixed hedgerows may be attributable to: a) reduced intraspecific competition for nutrients and moisture within *C. spectabilis*, and/or b) a sharing of fixed N. The reduction in intraspecific competition is evident when comparing *C. spectabilis* biomass production in the monocrop hedgerows at 50 cm spacing and the mixed hedgerows at 25 cm spacing treatments. Although *C. spectabilis* population densities were identical, biomass production per tree nearly doubled (1907 to 3559 g/tree) in the mixed hedgerows. This increase in *C. spectabilis* biomass production may be due to the following factors. Under Claveria conditions, *G. sepium* fixes approximately 50% of the N found in the leaves [16]. Secondly, since *G. sepium* produced less biomass, its demand on native soil N may have been less than that of *C. spectabilis*, thus enabling *C. spectabilis* to acquire more of the available soil-N when competing against *G. sepium* than against itself. In addition, N fixed by *G. sepium* may have been transferred to *C. spectabilis* via intermingling root systems. The twelfth hypothesis put forth by van Noordwijk and Dommergues, [36] suggests that combining N fixing and non-fixing species "may lead to the direct transfer of N to the non-nodulating plant". Similar suggestions have also been made for other intercropping systems [20, 22].

Although increased spacing of *C. spectabilis* resulted in increased biomass production per tree, total biomass production was greatest at the highest planting density (Table 5). This suggests that by March, 1989 soil nutrients were not limiting and increased biomass production per tree was not sufficient to compensate for the increased biomass production associated with increased density. By August, 1991, however, the leaves of *C. spectabilis* were chlorotic and considerable mortality was observed, suggesting that soil-N reserves may have been depleted. In a fertile soil however, uneven sharing of resources would likely lead to *G. sepium* being overwhelmed.

Thus, decisions regarding hedgerow species and pattern selection must take into account soil fertility. In infertile acid upland soils, mixing *G. sepium* and *C. spectabilis* at wider spacing is more appropriate, and since spacing necessitates less planting material, less labor may be required for planting and maintaining hedgerows.

Lime experiment

Significant treatment differences in fresh biomass production of *G. sepium* were observed in July, 1987 and June, 1988 ($P < 0.05$) and for the remaining harvest dates ($P < 0.01$) (Table 9). No significant differences were found between the three higher lime rates at any harvest date. Regression analysis indicated that biomass production (mean of first three harvest dates for each treatment) was positively correlated with soil pH (mean of all depths) ($Y=-0.5474+0.6614X$ $r=0.92$** and $Y=0.738(1.303)^X$ $r=0.92$**).

Biomass production at each of the last three harvest dates and on a cumulative basis was greatest in the 6 t/ha treatment (Table 9 and Figure 1). This rate may have reduced aluminum saturation to tolerable levels without having induced nutrient deficiencies. In Sitiung, Indonesia, liming soils (Al+H 2.21, 0.76 Ca, and 0.28 Mg cmol/kg (1 N KCl); 0.07 cmol/kg K and 0.9 ppm P (Mehlich I)) has been reported to reduce Al+H saturation levels, which resulted in increased survival and biomass production of *G. sepium* cuttings [7, 8]. In contrast, however, it has been reported that adding 50 g of lime to 18 kg of potted soil (pH 4.2, low exchangeable bases and exchangeable Al of less than 10% of CEC) had no significant effect on biomass production of either *Leucaena leucocephala* (Lam.) de Wit or *G. sepium* [33]. Adding 6 t of lime/ha to a similar soil in Claveria significantly reduced exchangeable aluminum which resulted in increased yield of cowpea (*Vigna unguiculata* (L.) Walp.) [11].

The drastic decline in biomass production in April, 1989 may have occurred as a result of one or more of the following; 1) the increase in *G. sepium* biomass production recorded in 1988 may have exhausted soil nutrients that were made available as a result of the lime application; and/or 2) *G. sepium* suffered extensive drought stress between November, 1988 and April, 1989. A typhoon in October, 1988 may also have damaged the trees, particularly those with rapid growth rates, as the greatest decline was observed in those treatments with high biomass production in June, and November, 1988.

Nutrient value

Data from this experiment were extrapolated to an alley cropping system where hedgerows, spaced 5 meters apart, consisted of two rows of *G. sepium* with between- and within-row spacings of 50 and 25 cm, respectively. Results suggest that if *G. sepium* cuttings respond similarly to liming when planted in monocropped hedgerows, then 1800 m of hedgerow/hectare (14,400 trees/ha) could be expected to produce almost 39 t/ha of additional fresh *G.*

sepium green manure over a two year period, if limed with 6 t/ha (Table 10). Similar *G. sepium* biomass production has been reported elsewhere [14, 26].

To lime 1800 m of hedgerow per ha at the rate of 6 t/ha, 1200 kg would be required. In 1987, the price of lime was $ U.S. 0.75 per 50 kg bag or $ U.S. 18.00/ha. Assuming labor to apply and incorporate the lime was one man-animal day, an additional $ U.S. 3.00 is included, making the total variable costs $ U.S. 21.00. *G. sepium* converted this expenditure into 207 kg of N. If *G. sepium* fixes approximately 50% of its N [16], then 103.5 kg N were actually added to the system. Adding 103.5 kg N in urea at $ U.S. 0.18/kg would cost $ U.S. 41.40/ha. The total value of incorporating an extra 39 tons of fresh *G. sepium* biomass is not limited to N, however. *G. sepium* also recycled 26 kg of P, 324 kg of K, 31 kg Mg and 186 kg of Ca from lower depths. Increasing availability of these nutrients could increase staple crop yield.

Although organic and chemical fertilizer sources differ in their nutrient release pattern, several authors have compared the two. Sanchez and Benites [31] reported that crop residues from a three year rice/cowpea cropping pattern were "equivalent to an annual fertilization rate of 6-7-199-33-13 kg ha^{-1} of N, P, K, Ca and Mg, respectively". In terms of uptake efficiency, Guevarra [10] reported that "the direct benefit from nitrogen added with the prunnings to the immediate maize crop is about 36%". Raintree and Turay [27] reported that "only one-third of the total N content of *Leucaena* mulch is effectively utilized by the associated alley crop". Torres [35] reported that "maize production increased by about 5 to 16 kgs for each kg of organic N added", whereas Prussner [25] reporting on work conducted in the Philippines, stated that "the effect of *Leucaena* green manure was the same as from NPK fertilizer applied at the rate of 90/40/40 and 80/30/30 kg/ha for maize and upland rice, respectively". Such claims are site and variety specific and should not be the basis upon which broad generalizations are made. Nevertheless, these reports do substantiate the fact that the nutrient value of the hedgerow biomass is significant and can help to maintain crop yields above subsistence levels.

Conclusions

Where rainfall distribution and acid soils are a problem, cuttings do not survive as well as seedlings. Seedlings of *C. spectabilis* are well adapted to acid soils and can produce almost 25 t/ha of fresh biomass in either planting pattern at dense spacing, as long as essential nutrients do not become limiting.

Mixing *G. sepium* and *C. spectabilis* increased cumulative biomass production by reducing intraspecific competition within *C. spectabilis* and by potentially sharing fixed N; *G. sepium*'s biomass production per se, however, was minimal. Other leguminous species should be explored to determine how well they complement *C. spectabilis* in mixed hedgerows. If farmers prefer monocropped *C. spectabilis* hedgerows, then care should be taken to prevent *C. spectabilis* from over-exploiting the soil-N pool. In low fertility areas, mixed hedgerows of *C. spectabilis* and *G. sepium* should be widely spaced.

In acid soils, biomass production of *G. sepium* can be increased by adding lime. The application of 6 t/ha of lime more than doubled *G. sepium* biomass production. Extrapolated to an alley cropping system, this additional biomass could increase N availability by almost

200 kg per ha over a two year period. In N-deficient soils, this could increase crop yields above those presently obtained, and potentially make alley cropping more attractive.

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Table 1. Soil analysis of experimental site for establishment trial, Claveria, Philippines, 1987.[1]

Depth	pH[2]	Org C	Tot N	CEC	Na	K	Mg	Ca	ExAl	P (Bray 2)
-cm-		%		m moles/kg						mg/kg
0-15	4.0	1.77	0.16	96	0.4	1.3	2.2	2.4	2.0	8.4
15-30	4.2	1.41	0.13	84	0.4	0.8	2.0	3.4	1.7	8.2
30-50	4.3	1.28	0.11	82	0.7	0.8	1.9	3.7	1.7	8.2

1 Values are means of 6 composited samples at each depth

2 Procedures followed in soil analyses are described in IRRI's Abstract of Analytical Methods for Soil Samples

Table 2. Soil analysis of experimental site for lime trial Claveria, Philippines, 1987[1].

Depth	pH[2]	Org C	Tot N	CEC	Na	K	Mg	Ca	ExAl	P (Bray 2)
-cm-		%		m moles/kg						mg/kg
0-15	4.2	1.64	0.18	106	0.4	2.9	3.2	5.8	0.8	11
15-30	4.5	1.54	0.18	99	0.5	2.9	4.1	7.9	0.3	11
30-50	4.6	1.36	0.15	96	0.7	2.8	4.5	10.3	0.3	11

[1] Values are means of 12 composited samples at each depth

[2] Procedures followed in soil analyses are described in IRRI's Abstract of Analytical Methods for Soil Samples

Table 3. Soil pH values[1] after third harvest on lime-treated plots, Claveria, Philippines, 1988[2].

Depth (cm)	Lime rate (t/ha) 0	2	4	6	8	12
	pH					
0-15	4.10	4.25	4.71	4.56	4.91	5.18
15-30	4.13	4.37	4.59	4.41	4.52	4.74
30-50	4.30	4.37	4.57	4.82	4.62	4.85

1 determined in $CaCl_2$
2 Treatment means of 4 replications

Table 4. Analysis of variance table of cumulative biomass production (kg/ha) of monocropped and mixed hedgerows of *C. spectabilis* and *G. sepium* seedlings at various spacing.[1]

SOURCE	DF		MEAN SQUARE
Replication	4		0.20143038 **[2]
Treatment	8		1.01393119 **
Spacing (Sp)		2	0.14478595 *
Pattern (Ptn)		2	3.90389277 **
Sp x Ptn		4	0.00352302 ns
ERROR	32		0.03183663
Total	44		

[1] data were $\log_{10}$ (X+1) transformed
[2] ** = significant at the 1% level; * = significant at the 5% level; ns = not significant;

Table 5. Effect of spacing and planting pattern on cumulative seedling biomass production, Philippines, 1988-89.

Treatment	*C. spectabilis* Monocrop	*G. sepium* Monocrop	Mixed Hedgerows
Spacing (cm)		Biomass (t/ha)	
25	24.2 a	2.9 b	25.8 a (24.9 + 0.9)[2]
50	13.8 a	2.0 b	15.6 a (14.9 + 0.7)
75	15.1 a	2.9 b	17.1 a (15.8 + 1.3)

[1] Means in a row followed by a common letter are not significantly different at the 5% level according to DMRT.

[2] *C. spectabilis* portion + *G. sepium* portion of total

Table 6. Nutrient composition of leafy biomass of *G. sepium* and *C. spectabilis* [1] from first harvest, Philippines, 1988[2].

	N	P	K	Mg	Ca	C	Cu	Mn	Zn	Fe	Na
	%						ppm				
G. sepium	3.27	0.27	3.23	0.32	1.91	43.3	9.1	94	55	574	167
C. spectabilis	3.31	0.24	1.55	0.26	0.97	47.5	8.5	168	29	262	105

[1] Dry matter was 32% and 25% for *C. spectabilis* and *G. sepium*, respectively

[2] Procedures followed in tissue analyses are described in IRRI's Abstract of Analytical Methods for Soil Samples

Table 7. Analysis of variance table for cumulative biomass production (g/tree) by species in seeded monocrop and mixed hedgerows, Philippines, 1988-89.

			C. spectabilis	*G. sepium*
SOURCE	DF		MEAN SQUARE[1]	MEAN SQUARE
Replication	4		0.168880709 **[2]	145540.20383 ns
Treatment	5		0.223825257 **	192463.50080 ns
Spacing (Sp)		2	0.169995376 **	400600.93900 *
Pattern (Ptn)		2	0.776638556 **	152311.12533 ns
Sp X Ptn		1	0.001248477 ns	4342.25033 ns
ERROR	19		0.011543621	72878.80488
TOTAL	28			

[1] data for *C. spectabilis* were $\log_{10}$ (X+1) transformed

[2] ** = significant at the 1% level; * = significant at the 5% level; ns = not significant;

Table 8. Cumulative biomass yield per tree for seeded mixed and monocropped *C. spectabilis* and *G. sepium* seedlings, Philippines, 1988-89.[1]

Treatment	*C. spectabilis*	*G. sepium*
	g/tree	
Mixed 75 cm	6384.4 a[2]	518.0 ab
Mixed 50 cm	4506.4 ab	178.4 b
Mixed 25 cm	3559.7 bc	125.4 b
Monocrop 75 cm	2990.6 c	625.0 a
Monocrop 50 cm	1907.7 d	366.8 ab
Monocrop 25 cm	1706.8 d	257.5 ab

1 means of 5 replications

2 Means sharing a common letter in a column, are not significantly different at the 5% level according to DMRT.

Table 9. Total biomass production of *Gliricidia sepium* with increasing lime application rates over five harvest dates, Philippines, 1987-89 [1].

Lime rate (t/ha)	Months after planting 6	9	17	22	27
	kg/m^2				
0	1.53 b[2]	0.99 d	1.10 c	1.58 c	0.54 b
2	1.61 b	1.17 c	1.96 bc	2.62 b	1.09 ab
4	1.67 b	1.20 bcd	1.83 bc	2.64 b	1.10 ab
6	1.94 ab	1.53 abc	3.32 a	3.88 a	1.64 a
8	1.89 ab	1.61 ab	2.77 ab	2.99 ab	1.49 a
12	2.27 a	1.81 a	2.88 ab	3.32 ab	1.58 a
CV (%)	17.9	20.1	39.3	23.2	32.1

[1] Treatment means of 4 replications.

[2] Means sharing a common letter in a column, are not significantly different at the 0.05 level based on LSD.

Table 10. Nitrogen contribution of *Gliricidia sepium* biomass converted into urea equivalent.

Months after planting (no.)	Biomass t/ha[a] (1)	Biomass t/ha[b] (2)	Dry Mat kg/ha[c] (1-2)	N kg[d]	Urea kg[e]
6	10.1	7.0	510.3	16.8	37.3
9	8.1	4.5	576.9	19.0	42.2
17	17.6	5.3	2008.5	66.3	147.3
22	20.8	7.4	2182.4	72.0	160.0
27	8.9	2.7	1004.3	33.1	73.6
Total	65.5	26.8	6282.4	207.3	460.4

a) Biomass production for the 6 t/ha of lime. Fresh biomass production per tree (X) was calculated and converted to per hectare as follows : (X) x 9 m^2 / 25 m^2 x 14,400, where 9 is harvest area, 25 is plot size and 14,400 is # trees/ha based on 18 double hedgerows/ha with between and within row spacing of 50 and 25 cm, respectively.

b) Biomass production for the control treatment. Note biomass conversion was identical to a).

c) Dry matter production was based on the leaf:wood ratio of 65:35 and a moisture content of 75%.

d) nitrogen content based on 3.3% nitrogen in *Gliricidia sepium*

e) urea is 45% nitrogen

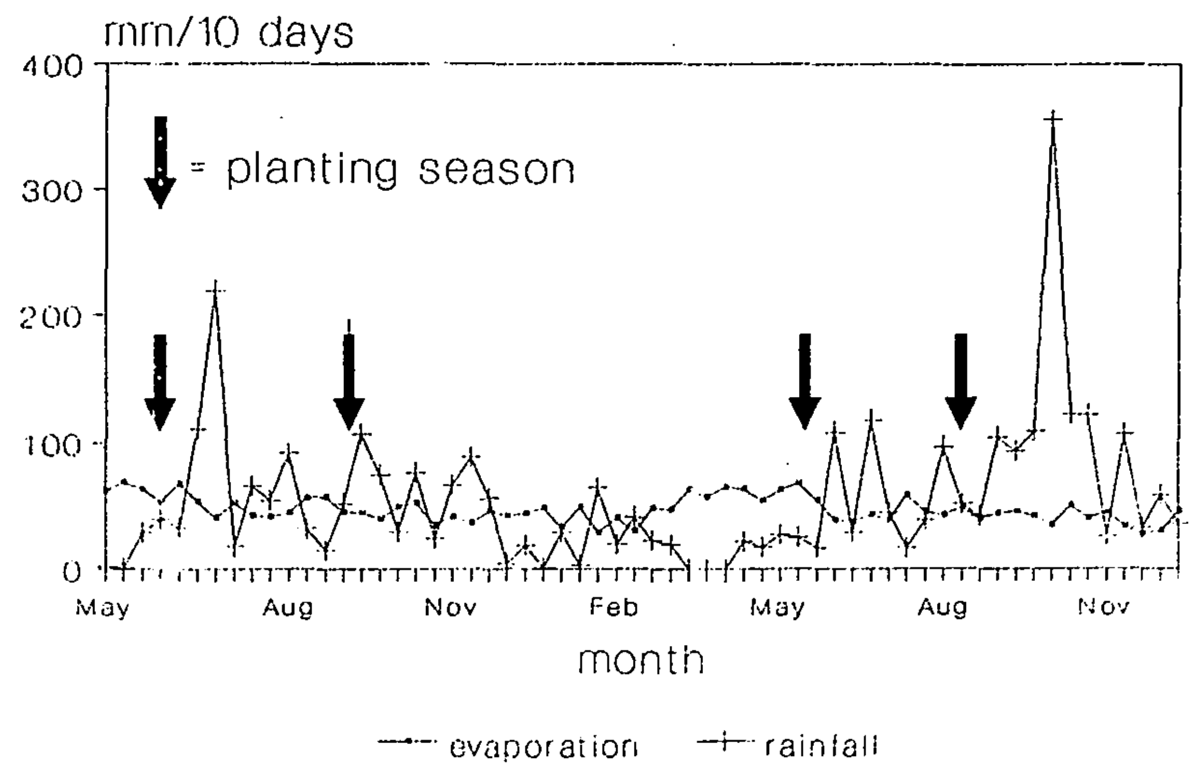

Figure 1. Rainfall and evaporation data from Claveria, Misamis Oriental, 1987-89.

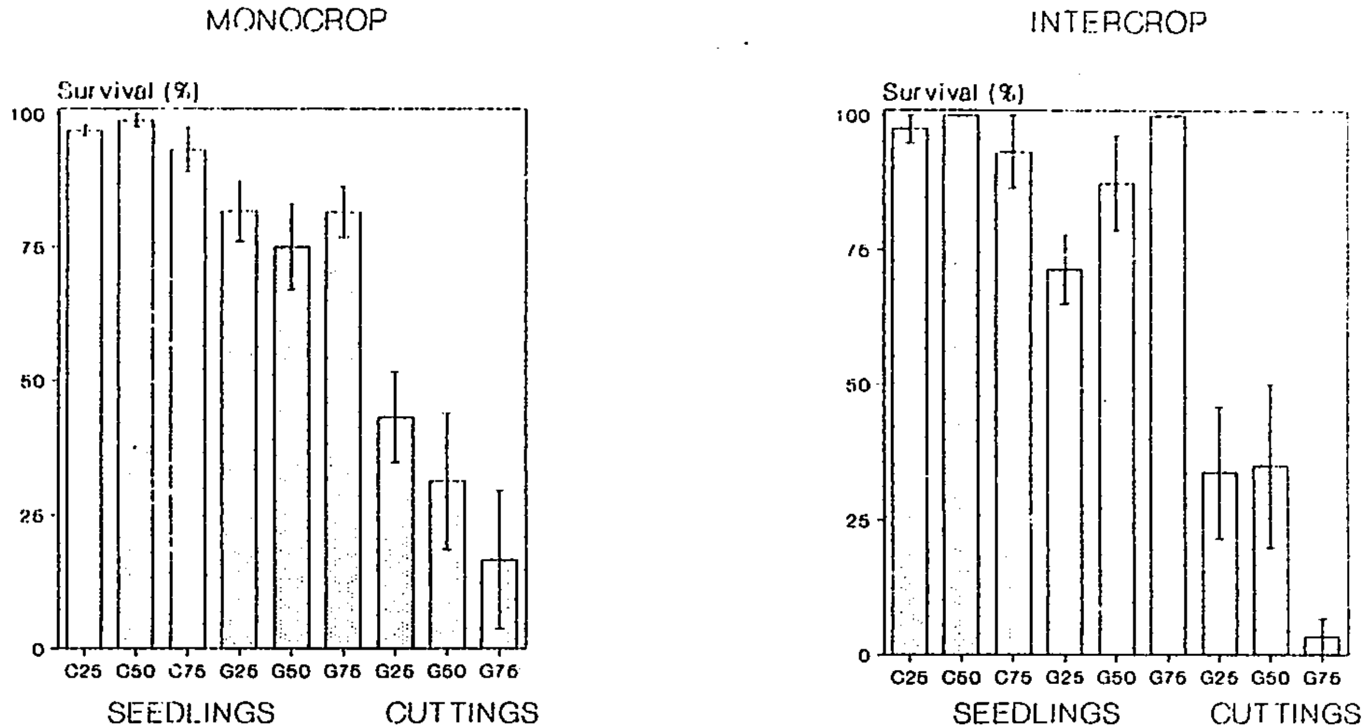

Figure 2. The effect of cropping and spacing on seedling and cutting survival (mean +/- standard error), Philippines, 1989. (C=*C. spectabilis*; G= *G. sepium* at 25, 50, 75 cm spacing)

Connecting text

Increasing crop productivity via alley cropping requires that hedgerow biomass be either mulched on the soil surface or incorporated into the soil. Whereas preferred mulches decompose slowly when applied on the soil surface, green manures should release nutrients during the crop cycle. *Gliricidia sepium* and *Cassia spectabilis* are two leguminous species which differ with respect to their nitrogen fixing ability; *G. sepium* is a fixing species, *C. spectabilis* is not. As a result, both species have different chemical properties which may influence their respective decomposition rates. The following experiment was conducted to evaluate which species would best serve as mulch based on each species' decomposition rate.

The decomposition rate of *Gliricidia sepium* and *Cassia spectabilis* and its influence on biomass management on an acid soil in Southern Philippines

Richard H. MacLean

Key words: green manure, mulch, alley cropping, grid method

Introduction

The main constraints to upland rice production are soil erosion and fertility depletion, weeds and drought. As a result, upland rice yields are the lowest of all rice ecologies (Yoshida, 1975). By carefully selecting hedgerow species, alley cropping can address some of these constraints. To improve upland rice yields, hedgerow biomass can be either green manured or mulched, where green manuring is the incorporation of fresh biomass into the upper soil horizon, whereas mulching is the broadcasting of the biomass on the soil surface. Although green manuring may increase nutrient availability, mulching can absorb raindrop impact, thus reducing the hazards of erosion. Mulching can also reduce weeds, ease drought stress and potentially improve soil physical properties. A preferred mulch is characterized by a high carbon:nitrogen ratio, complex nitrogenous compounds, and high lignin content. Low leaf moisture content is also desirable to minimize leaf shrinkage and maximize the mulch's ground cover capacity. Physical and chemical properties of the biomass may also affect decomposition rates.

Upland rice research at the International Rice Research Institute (IRRI) began in 1962 (IRRI, 1975). In 1984, an acid upland rice research site was established in Claveria, Misamis Oriental, in the Southern Philippines. Site rainfall for 1987-88 and soil properties are found in Figure 1 and Table 1, respectively.

Although many potential hedgerow species are found in Claveria, for soil fertility restoration by alley cropping, two leguminous species stand out. *Gliricidia sepium*

(Jacq.) Walp and *Cassia spectabilis* DC. are characterized with rapid growth rates, tolerance to continuous pruning, deep root systems, and ease of propagation (Kang et al., 1984). Intercropping both species may be advantageous since a green manure and a mulch can be produced simultaneously. Which species is best suited for mulching, however, requires consideration of the decomposition rates.

Although considerable work on decomposition has been done, few studies have evaluated organic mulch decomposition rates using simple methodologies useful to farmers and development workers in the field. The aim of this study was to determine the decomposition rates and mulch value of *G. sepium* and *C. spectabilis*. A simple methodology to calculate decomposition rates is presented.

Materials and methods

The experiment was set up in a randomized complete block design with three treatments replicated four times. Treatments consisted of biomass from each species and an equal mixture of both. Around the experimental area (3m x 3m), a 30 cm deep canal was maintained to reduce erosion. Plot size was 32 x 29 cm, onto which the equivalent of 10 t/ha fresh biomass was spread. A 32 x 29 cm piece of wire screen (0.5 cm^2 mesh) was placed approximately 2 cm above the biomass. To ensure wind did not disturb the biomass under the screen mesh, small (5 cm) bamboo stakes were placed around each plot. As the biomass decomposed, the area (the number of 0.5 cm^2 patches) of exposed soil was recorded, and painted using waterproof paint. This grid monitoring procedure was performed three times per week for five to six weeks. Screens were reused for three consecutive trials with different colored paint. Trials were carried out in July, October, and December 1987 and in May, June, July, August, and October 1988. Trials in June and July 1988 were rejected due to ant infestation.

Data were converted into percent area and cumulative percent area (Figure 2). The percent area data were analysed using the ANOVA procedure of Statistical Analytical Systems (SAS), followed by Duncan's Multiple Range Test (DMRT).

Results and discussion

Results indicate that when mulched, *G. sepium* decomposed quicker than *C. spectabilis*. Decomposition of *G. sepium* was 9, 18, 5, 36, 24, and 22 percent higher than *C. spectabilis* in the July, October, and December (1987) and the May, August, and October (1988) trials, respectively. After five weeks of decomposition, *G. sepium* ground cover was reduced by 31, 41, and 23 percent for the trials in 1987 and 60, 37, and 36 percent for those conducted in 1988, respectively (Figure 2). In contrast, *C. spectabilis* ground cover was reduced by 29, 23, 15, 25, 15, and 16 percent over the same periods. No significant differences in decomposition rate were observed between *C. spectabilis* and the species mixture.

This grid method of monitoring decomposition first evaluates leaf shrinkage and then decomposition. Leaf shrinkage is a function of moisture content and differences between species can be detected by the initial slope of the decomposition curves (Figure 2). Variation in initial slopes in 1987 are likely due to climatic conditions.

Clear differences in moisture content exist between the two species. Dry weight determination revealed that moisture content in *G. sepium* was 75% and *C. spectabilis* 68%. Since carbon:nitrogen ratios of both species are similar (Table 2), differences in decomposition rates are likely the result of differences in lignin content.

In the region of Claveria, the only pests that upland rice farmers attempt to control are weeds. Labor intensive methods such as hand weeding and interrow cultivation are the common practice (Elliot and Moody, 1987). An effective mulch must suppress weeds during the critical period, the first 40 days of the rice plant's growth. Results from this experiment indicate that *C. spectabilis* can provide adequate ground cover for approximately 40 days, and may therfore be of value in weed control in upland rice culture.

Evaporation in Claveria often exceeds rainfall for periods of 10 days or more (Figure 1). Drought can cause significant yield loss particularly during the reproductive stage (Gupta and O'Toole 1986), and consequently, a mulch that effectively covers the soil and reduces evaporation would provide a second benefit.

Conclusion

G. sepium biomass decomposes almost twice as fast as *C. spectabilis* biomass and consequently, may be ineffective at suppressing weeds and reducing drought in upland rice. When *G. sepium* and *C. spectabilis* are intercropped for green manure and mulch production, *G. sepium* should be incorporated and *C. spectabilis* mulched. The simple grid method presented, was found to be useful for evaluating hedgerow biomass decomposition and may help farmers and development workers select hedgerow species suited to farmers' needs.

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Table 1. Soil chemical characteristics of study site at Claveria, Philippines, 1987.[1]

Depth	pH	Org. C	Tot N	Na	K	Mg	Ca	P	ExAl
-cm-		-------%-------		---m.eq/100 g ads---					ppm
0-15	4.2	1.64	0.182	0.036	0.293	0.64	1.15	11	0.81
15-30	4.5	1.54	0.175	0.054	0.293	0.81	1.57	11	0.32

[1] Procedures followed in tissue analyses are described in IRRI's Abstract of Analytical Methods for Soil Samples

Table 2. Nutrient composition of *G. sepium* and *C. spectabilis* leafy biomass[1] from first harvest, Philippines, 1988.[2]

	N	P	K	Mg	Ca	C	Cu	Mn	Zn	Fe	Na
				%					ppm		
G. sepium	3.27	0.27	3.23	0.32	1.91	43.3	9.1	94	55	574	167
C. spectabilis	3.31	0.24	1.55	0.26	0.97	47.5	8.5	168	29	262	105

1 Dry matter was 32% and 25% for *C. spectabilis* and *G. sepium*, respectively

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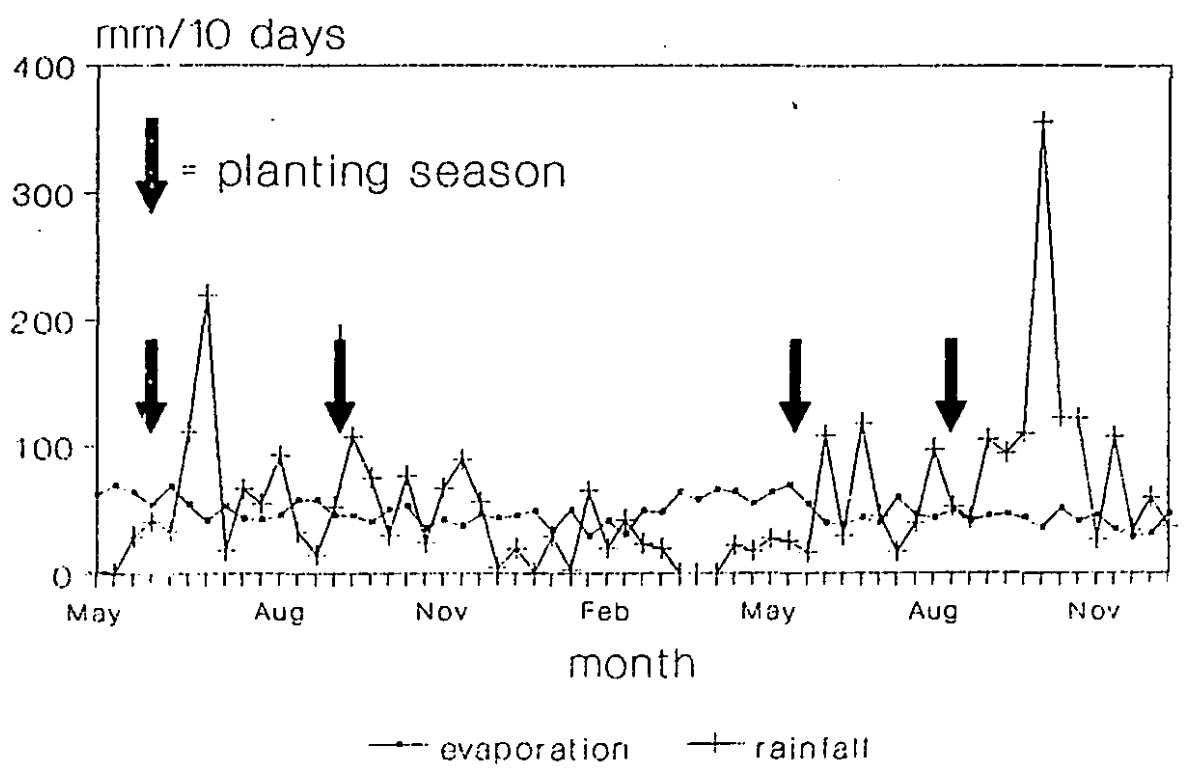

Figure 1. Rainfall and evaporation data from Claveria, Misamis Oriental, 1987-89.

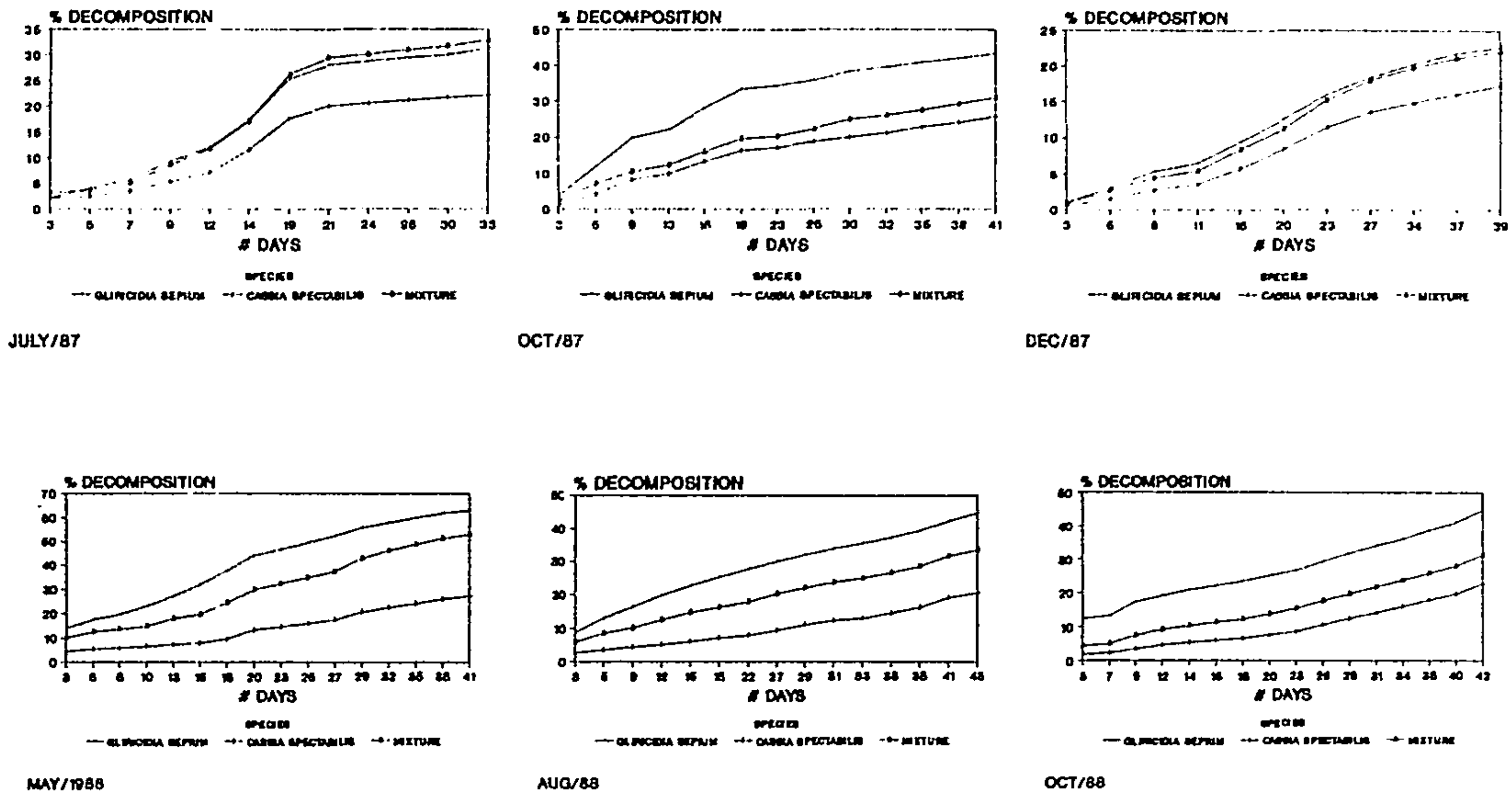

Figure 2. Decomposition rates of *Gliricidia sepium, Cassia spectabilis* and a mixture of both, 1987-88.

Connecting text

Data from the two previous experiments indicated that maximum hedgerow biomass production could be obtained if *Gliricidia sepium* and *Cassia spectabilis* were intercropped at 25 cm within hedgerow spacing and that, based on decomposition rates observed, *C. spectabilis* would better serve as a mulch. This information was used as the basis for hedgerow establishment in the main alley cropping experiment which was conducted in an effort to determine the effect of the system on an upland rice and maize cropping pattern.

The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on upland rice and maize production.

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Key words. green manuring, mulching, crop response, blast, drought, terracing, hedgerow-alley interface

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Abstract

Hedgerows of *G. sepium* and *C. spectabilis* were established on slopes ranging from 18 to 31% in an effort to reduce soil erosion and improve upland rice and maize production. Upland rice and maize responded more to soil incorporated *G. sepium* biomass than to mulched *C. spectabilis*. Incorporating hedgerow biomass equivalent to over 40 kg N per hectare however, did not increase upland rice productivity. Maize, planted during the drought-prone second season, responded more to mulching than did rice. Crop performance improved along the slope gradient. Hedgerow-crop competition was observed at the upper and lower interfaces of each alley. Terracing intensified hedgerow-crop competition at the upper interface by reducing the crop's effective rooting depth. Under prevailing climatic and soil conditions, mixed hedgerows of *C. spectabilis* and *G. sepium* initially produced approximately 7 t/ha of fresh biomass every 3 months. Four years after hedgerow establishment, however, *C. spectabilis* leaves were chlorotic and considerable mortality was observed, suggesting that *C. spectabilis* may be depleting soil-N reserves.

Introduction

Loggers and small scale farmers are exerting enormous pressures on the Philippine uplands in the quest to produce food, fuel and timber. In the uplands of the island of Mindanao, the main annual crops are upland rice (*Oryza sativa* L.) and maize (*Zea mays* L.), followed by cassava (*Manihot esculenta* Crantz.) and sweet potato (*Ipomea batatas* L.) [13]. Upland rice is grown without standing water in fields that are prepared and seeded under dry conditions. Because of its hydrophylic nature, upland rice cultivation is expanding beyond its ecological limits [7].

Constraints to upland rice production include soil erosion, drought, weeds and insect pests [2]. These constraints are interrelated. Drought stress increases as the water-holding humic fraction in the top soil is eroded [3]. Reduced soil moisture slows the nutrient delivery rate to roots [23] and consequently, the crop's ability to tolerate, compete and compensate is reduced. Since most (ca. 65%) upland soils have low water holding capacities and poor nutrient reserves, erosion and drought need to be addressed if increased crop production is to be achieved and sustained [2, 14, 17].

Agroforestry can overcome some of the constraints facing upland farmers. Deep rooted perennials, densely planted on the contour, can reduce soil erosion and drought stress by enhancing terrace formation, by promoting water infiltration, and by providing an organic mulch to reduce splash erosion and moisture evaporation [19]. Leguminous trees also recycle nutrients, contribute biologically fixed nitrogen, and provide fuel, fodder, and timber which is presently harvested from dwindling forests

[15]. One agroforestry system in which trees play a major role is alley cropping, defined as the intercropping of leguminous trees and shrubs as hedgerows between strips of food crops [9, 15]. Hedgerow systems are well suited to upland rice because with natural drainage, anaerobic soil conditions are not created (as in lowland rice culture) and as such, root growth of the hedgerow is not impeded. One advantage of alley cropping is that farmers can grow a crop, a green manure, a mulch and a source of animal fodder simultaneously [16].

A diagnostic survey conducted in 1987-88 at the International Rice Research Institute's upland rice research site in Claveria, Northern Mindanao, Philippines (8° 38' N, 124° 55' E, elevation 400 m) indicated that farmers considered soil erosion and declining soil fertility to be their main constraints to increased crop production [12]. An estimated 47% of the cropped area is already severely eroded [4]. Of those surveyed, 20% had implemented erosion control measures, ranging from diversion canals to grass strips across the slope. The survey also indicated that 20% of Claveria farmers fallowed their land, but less than 50% considered fallowing effective at restoring soil fertility to the extent that the subsequent crop benefitted [11].

The restorative potential of a fallow is a function of species composition, the amount of nutrients in the biomass, and the amount of biomass produced. These are governed by soil type, propagules present, amount of rainfall and duration of the fallow [22]. In Claveria, pioneer fallow species are mainly perennial grasses such as *Imperata cylindrica* (L.) Raeuschel., *Paspalum conjugatum* Berg., *Digitaria longiflora*

(Retz.) Pers., and *Axonopus compressus* (Jw.) Beauv.. These grasses suppress the growth of leguminous species, such as *Calapogonium mucunoides* Desv., *Centrosema pubecens* Benth., and *Mimosa spp.*, *Desmodium spp.*, and *Crotalaria spp.*, by intense competition and allelopathy. Consequently, succession and soil fertility restoration are impeded.

In cereal production systems, hedgerow biomass can either be green manured or mulched. Green manures and mulches, however, have distinct physical and chemical properties: effective green manures have a low carbon:nitrogen ratio and contain simple nitrogenous compounds that are easily broken down, thereby enhancing humification. In contrast, effective mulches have a high carbon:nitrogen ratio and complex nitrogenous compounds that decompose slowly [26]. Consequently, diversified hedgerows with function-specific species may be more effective than hedgerows with single 'multipurpose' tree species. Because *Gliricidia sepium* (Jacq.) Walp and *Cassia spectabilis* DC. (*Senna spectabilis* (DC.) Irwin and Barnaby) were abundant in Claveria, *G. sepium* was chosen as the green manure and *C. spectabilis*, a non-nodulating species [1, 18], served as the mulch.

Our objectives were to develop a mixed hedgerow system and to generate a biomass management strategy that could sustainably increase upland rice and maize yields above present levels. A secondary objective was to assess the effect of slope on rice and maize production.

Materials and methods

Site selection

Claveria has two distinct regions: lower (300-500 meters above sea level (masl)) and upper areas (500-900 masl), characterized by a rolling topography; over 70% of the area is between 3 and 60% slope [13, 21]. The main crops are maize, upland rice, and cassava in the lower region; and tomatoes, vegetables, maize, upland rice and coffee in upper Claveria [21].

In 1987, four areas ranging from 18 to 31% slope were selected in the lower region to evaluate the effect of alley cropping on rice and maize. The soil is classified as an acid clay Ultic Haplorthox and soil analyses for each experimental site are presented in Table 1. Sites A and B were 0.6 ha each, and sites C and D were 0.72 and 0.36 ha, respectively. Site preparation consisted of slashing vegetation and establishing contour lines using an A-frame [5].

Crops

At site A two rice crops were planted (June, 1987 and May, 1988), whereas at site B two rice crops (June, 1987 and May, 1988) were followed by two maize crops (Dec, 1987 and Nov, 1988). At site C-D, two maize crops (Nov, 1987 and 1988) and one rice crop (June, 1988) were grown. The rice cultivar was UPLRi5, which matures in 140 days, and the maize cultivar was IPB-1, a 105-day cultivar. Seeding rates were 90 and 20 kg/ha for rice and maize, respectively. No chemical control measures were taken, and one hand weeding was done in rice at approximately 50 days after emergence (DAE).

Hedgerows

Mixed hedgerows consisted of two rows of alternating *G. sepium* and *C. spectabilis* established by seed in May, 1987. Distance between hedgerows varied from 3 to 8 m (average 5 m), whereas between and within row tree spacing were 50 and 25 cm, respectively. Diversion canals (25 cm deep) were maintained on the upper side of each hedgerow to minimize soil movement between alleys. To reduce the likelihood of bunds being destroyed by heavy rains at the onset of the rainy season, weeds were allowed to grow to reinforce the bund until the hedgerows became established. Since hedgerows were planted in 1987, all hedgerow biomass applied to the 1987 crops was imported from the surrounding area. Hedgerows were first pruned (to 50 cm) one week before rice planting in May, 1988 and harvested hedgerow biomass was weighed and supplemented with imported biomass of the same type to provide sufficient material for selected treatments. During thc 1988 rice crop season, hedgerows were pruned at approximately 70 DAE to minimize shading; and biomass from each species was weighed and distributed to ensure that each plot received equal amounts of mulched biomass. Hedgerows were not pruned during the dry season and were mulched with crop residues after each harvest.

Design

At sites A and B, treatments were; 1) control (no biomass inputs), 2) mulch (10 t/ha of fresh *C. spectabilis*), 3) incorporate (10 t/ha of fresh *G. sepium*), 4) mulch plus incorporate (5 t/ha of fresh *C. spectabilis* mulch plus 5 t/ha of fresh *G. sepium* green manure) and 5) control without hedgerows. Treatments 1 to 4 were within the hedgerow system. The first four treatments were replicated three times in a completely randomized design at each site; plot size was 250 m^2 (5 m wide along the contour X 50 m long downslope). The control without hedgerow treatment was 35m X 50m, managed by the farmer and not replicated within each site. All data were collected by alley to assess slope effect on crop yield.

In the experiment conducted at sites C and D, treatments were replicated three times (twice at site C and once at site D) in a randomized complete block design. Treatments 2, 3 and 4 were identical to sites A and B except that the mulch plus incorporate treatment (treatment 4) was 20 t/ha - i.e., 10 t/ha of fresh *C. spectabilis* mulch plus 10 t/ha of fresh *G. sepium* green manure. Treatment 1 at site C-D had no hedgerows and plot size was 900 m^2 (22.5 m X 40 m). This treatment represented the conventional open-field farming practice.

Land Preparation

Fields were plowed and harrowed twice using a moulboard plow and a wooden tooth harrow. To eliminate tillage as a confounding factor in the statistical analysis, a third deep plowing (20 cm) was carried out in all plots at the time of green manure incorporation. Green manure soil incorporation began at the lower portion of each alley to maximize soil cover of the biomass and minimize nitrogen volatilization. Shallow furrows were made 25 cm apart for rice, whereas maize was dibbled in 50 cm rows with 25 cm within-row spacing. Mulching was done after crop emergence.

Agronomic data

To determine if either *G. sepium* or *C. spectabilis* is allelopathic to rice or maize, plant stand was monitored. Plant height (cm) and tiller number were also monitored. The sampling unit was 3 random 1 m samples per alley for the 1987 rice crop at sites A and B, and 5 plants per alley were sampled to determine plant height. For the 1987 rice crop at sites A and B, straw and grain yield were determined from a 7.5 m^2 crop cut per alley. The same variables were monitored in 1988 with the addition of panicle number, however, the sampling unit was increased to 5 m samples per alley and total harvest was taken rather than crop cut. The harvested grain was manually threshed and sun dried to 14% moisture. Identical variables were monitored during the 1987 maize and 1988 rice crop season at site C-D, with the addition of tassel and silk number in maize. The initial sampling unit was 5 random 1 m samples per alley. This was increased to 10 samples per alley in 1988. To evaluate the effect of hedgerow-crop competition on straw and grain yield, 4 random 0.5 m and 8 random 1 m sub-samples were taken at sites A and B and at site C-D, respectively from each of the two upper, middle and lower crop rows in each alley.

Statistical analysis

Data from control without hedgerow treatment at sites A and B were not replicated and therefore were not included in the analysis. Tests were conducted to verify if data satisfied ANOVA assumptions. Variables that required transformation were transformed using the logarithm base 10 and the square root of [variable +1]. The Shappiro-Wilks test in the Univariate procedure of the Statistical Analysis Systems (SAS) program was used to determine which transformation was most appropriate [25]. Both transformed and untransformed data were analyzed using the General Linear Model of SAS and analysis of variance used a repeated measures (sub-sampling) procedure with space (alleys) as the repeat. Only untransformed data are presented. Where variability impeded analysis of variance from detecting the effect of slope position on crop performance, agronomic variables by alley were averaged, arranged in decreasing order, ranked on a scale from 1 to 3, and tabulated in matrix format. A chi-square test was then performed to determine if the slope position effect was random. The proportion of each rank for each alley was then calculated and plotted.

Results

Rice 1987-1988

Because of heterogeneity of variance between sites and years, data could not be pooled either in time or space. Consequently, results are presented by site and year. Neither mulching nor green manuring affected plant stand. The incorporate and mulch plus incorporate treatments significantly increased tiller production in 1987 and 1988 at site A, and in 1988 at site B (Table 2). Green manuring significantly increased plant height, except in 1987 at site B. In 1988, however, significant increases in height were observed as early as 21 DAE. Panicle number also increased as a result of green manure incorporation.

Green manuring significantly increased rice straw and grain yield at site A in 1987 and 1988 (Table 3). Grain yield in the control was 0.09 t/ha in 1987 and 0.76 t/ha in 1988, whereas mulch plus incorporation increased yield to almost 1.3 t/ha and 1.5 t/ha in 1987 and 1988, respectively. Yield in the control without hedgerow treatment was generally higher than in the control with hedgerows, particularly in 1988 when the farmer applied chicken manure and fertilizer. The treatments only marginally increased rice yield at site B in 1987 and not at all in 1988.

At the interface, hedgerows competed intensely with rice for nutrients, water and light (Table 4). The middle rows consistently yielded more than either interface. In the incorporate treatment at site A, competition reduced grain yield in 1988 by 74 and 54% in the upper and lower rows, respectively.

Maize - 1987-1988

Plant stand was not affected by treatment. However, significant differences were observed in plant height by 18 DAE in 1987 at site C-D. The number of tassels and silks observed in 1987 was greater in the incorporate and mulch plus incorporate treatments. Stover and grain yield were also greater in the green manure treatments (Table 5). In 1987 at site C-D, grain yield was increased almost four fold to 2.56 t/ha in the mulch plus incorporation treatment. Even though drought caused crop failure in 1988, significant differences were observed in stover yield (data not presented). The 1987 maize crop at site C-D was planted between newly established hedgerows, and stover and grain yield increased at the interface. However, intense competition was observed by 1988.

Soil erosion

Although soil erosion was not measured per se, we observed that the hedgerows minimized soil movement between alleys and natural terraces were formed. Eighteen months after hedgerow establishment, approximately 0.5 m of soil was transported from the upper to the lower side of each alley (Table 6). The level of terracing was greater towards the bottom of the slope, except at site D, where the slope was concave. Although terracing by hedgerows may reduce soil erosion to tolerable levels, other problems may be created. As soil is transported from the upper portion of each alley, the upper crop rows must absorb required nutrients from deeper and potentially less fertile soil horizons. Comparing crop performance at the upper and lower hedgerow-alley interfaces confirms this (Table 4). Consequently, terracing confounds actual hedgerow-crop competition. Furthermore, terracing may be appropriate only where soil profiles are deep enough such that once terraces are formed, parent material from the sub-soil does not surface, as this can be detrimental to crop production because of a reduction in effective rooting depth.

Results indicate that crop performance improved along the fertility and moisture gradients created by the slope. Based on yield component ranking, terracing also appears to enhance crop production as the proportion of first and second ranks in each alley increased as terracing increased (Figure 1). Water will only flow down a slope when the rate of rainfall is greater than the rate of water infiltration into the soil [24]. As run-off proceeds downslope, it gains momentum and erosive power [27]. The convex shape of the slopes at sites A, B, and C may have increased momentum and run-off erosivity resulting in greater terracing observed towards the bottom of each respective slope (Table 6). In addition, if during terrace formation, the lower portion of the slope accumulated rainfall and run-off, then crop growth may have been superior at the bottom of the slope where nutirents and moisture were more favorable.

Discussion

Farmers were apprehensive about planting *G. sepium* and *C. spectabilis* because they feared, among other factors, the adverse effects of the biomass on crop germination, growth and yield. Since the agronomic parameters that were monitored were not affected, it would appear that neither *G. sepium* nor *C. spectabilis* was allelopathic to rice or maize. Mulching, however, did attract free ranging chickens that scratched the soil surface and caused young plants to be buried by the mulch, and temporarily set back crop growth.

Hedgerow performance

C. spectabilis produced more biomass than *G. sepium* (Table 7). In situ fresh biomass production was approximately 7 t/ha, and consequently the treatment level of 10 t/ha was optimistic. Intense inter-specific competition and acidic soils impeded *G. sepium* from producing as anticipated [20]. By August 1991, *C. spectabilis* leaves were chlorotic, and significant mortality was observed within the hedgerow, which suggested that intraspecific competition for N had increased over time and that densely planted *C. spectabilis* may be depleting soil-N reserves.

Crop response

With the additional pruning during the crop cycle, the mulch treatment contributed the most N (Table 8). However, incorporation caused a greater physiological response in both crops. Similar observations have been reported for maize [15, 29]. Green manuring may cause a greater crop response because of greater microbial activity and less N immobilization and volatilization [8]. Maize demonstrated a greater response to mulch than rice; and since maize was planted during the drought-prone second season, mulching's primary role may have been to reduce drought stress. If green manuring evokes a greater crop response than mulching, and no significant differences in yield or yield components were observed between the incorporate (82 kg N/ha) and mulch plus incorporate (41 kg N/ha) treatments, then crop response beyond 40 kg N may be minimal. Therefore, 10 t/ha of incorporated biomass per ha may have been excessive in terms of N.

Excessive N availability in upland rice can increase the crop's susceptibility to blast (*Pyricularia oryzae* Cav.), particularly during wet years. High N rates have been shown to increase the incidence of blast in upland rice [10]. The 1988 data at sites B, and C-D demonstrate the impact of blast on UPLRi5, a susceptible variety. Even though significant increases in tiller and panicle number and plant height were observed, treatments reduced or had no effect on harvest index (Table 3). Blast ratings per se were not taken. However, we observed considerably more empty grains in the alley cropped areas versus no hedgerows and in the green manured treatments specifically within the alley cropped areas. Nitrogen availability as a result of incorporation may have been excessive. The fact that blast was most severe and harvest index lowest at site C-D in the mulch plus incorporate treatment (treatment 4), confirms this. The second application of hedgerow biomass at approximately 70 DAE may have exacerbated the problem. Harvest index was also very low in the mulch treatment at site B. Because topography was variable at site B, alley widths in the mulched plots were narrow. This may have prolonged leaf wetness and promoted blast development. Yamoah and Burleigh [28] reported that although alley width between hedgerows of *Sesbania sesban* had no significant effect on a) the proportion of maize leaves infected with *Puccinia sorghii* Schw., b) the number of uredinia of *P.sorghii* per leaf or c) the area under diseased leaf progress curve, the presence of hedgerows significantly reduced these variables. Contrasting results are likely because of environmental prerequisites of each individual organism.

Because UPLRi5 matured in approximately 140 days, delaying the subsequent maize crop establishment, terminal drought reduced the effect of alley cropping on maize during the drought-prone second season. Since maize is a nitrophilic crop, however, the mixed hedgerow system and green manure treatments, particularly treatment 4, may be more suited to a maize/maize cropping pattern. These treatments also advanced crop maturity by approximately one week, which could reduce the risk of drought during the second crop.

Maize yield at site C-D in 1987 was above average. Rice yielded poorly the following season, implying that given fields may be more suited to some crops than others. Farmers are known to match crops and fields [6]. Farmers may not plant rice at the selected experimental sites where rice yields were low.

Hedgerow biomass production and crop nutrient requirements need to be fine-tuned such that crop yield is maximized without hedgerows of *C. spectabilis* depleting soil-N reserves. Reducing planting density of *C. spectabilis*, or selecting species with a higher C:N ratio, may reduce N demand on soil reserves and inter-specific competition. A reduction in the latter could result in increased biomass production of *G. sepium* such that crop needs would be met. Increased spacing has been reported to increase biomass production on a per tree basis [20]. Concentrating the biomass in the furrow rather than broadcasting it may also provide the crop with the required nutrients and reduce nutrient availability for weeds growing between crop rows.

Conclusions

Upland rice and maize yields were significantly increased when *G. sepium* biomass was incorporated. For upland rice however, caution must be exercised with respect to the amount of green manure incorporated. Excess N can increase the crop's susceptibility to blast. Maize demonstrated a greater response to *C. spectabilis* mulch than did rice. Since maize was grown in the 2nd season when drought stress was more severe, mulching may have served to reduce drought stress. Competition was observed at the crop-hedgerow interface and was intensified at the upper interface as a result of soil scouring as the terrace developed. *C. spectabilis* appears to be very well adapted to acid soils, however, if mixed hedgerows are envisioned, within-hedgerow spacing must be adjusted such that competition with other species is minimized and soil-N reserves are not depleted.

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Table 1. Soil properties of research sites, Claveria, Philippines, 1987[1].

	pH^2	Org C	Tot N	CEC	Na	K	Mg	Ca	P (Bray 2)
	-------%-------			-------m moles/kg------					-mg/kg--
Site A									
0-15 cm	4.2	1.87	0.18	109	0.6	1.1	3.8	9.0	8.4
15-30 cm	4.2	1.67	0.16	93	0.6	0.8	2.7	7.0	8.5
30-50 cm	4.3	1.47	0.13	86	0.8	0.9	2.7	7.0	8.6
Site B									
0-15 cm	4.7	2.02	0.21	127	0.3	4.0	2.3	26.0	14.0
15-30 cm	4.6	1.74	0.14	105	0.4	3.1	1.5	19.0	12.0
30-50 cm	4.4	1.43	0.17	87	0.5	2.6	1.3	12.0	11.0
Site C									
0-15 cm	4.6	2.98	0.26	134	1.2	5.8	6.5	15.0	8.4
15-30 cm	4.5	1.93	0.17	109	0.9	2.0	4.0	8.5	6.2
30-50 cm	4.5	1.41	0.15	96	0.6	1.3	2.6	7.5	5.7
Site D									
0-15 cm	4.4	2.16	0.19	109	0.6	2.6	3.7	7.5	7.8
15-30 cm	4.3	2.46	0.22	121	0.4	2.6	4.6	12.0	8.7
30-50 cm	4.4	0.96	0.10	80	0.5	0.8	1.5	6.0	6.6

[1] Soils were analyzed according to techniques described in the Abstract of analytical methods for soil samples. Analytical Soils Laboratory, IRRI.

[2] pH was determined in $CaCl_2$

Table 2. Tiller number, panicle number and plant height of rice, 1987-88 at sites A and B, Claveria, Philippines.

	TREATMENTS					
	T1[1]	T2	T3	T4	LSD	CWH[2]
<u>Site A</u>						
Rice/1987						
Tillers (no./m)	7.2 C[3]	14.2 B	25.9 A	28.3 A	5.8	13.0
Plant height (cm)	18.9 B	20.9 B	26.3 A	26.7 A	3.5	22.2
Rice/1988						
Tillers (no./m)	41.9 B	38.1 B	63.2 A	59.0 A	13.0	52.9
Plant height (cm)	22.6 B	22.3 B	30.0 A	28.6 A	1.5	29.0
Panicles (no./m)	6.3 B	13.6 B	38.2 A	32.0 A	14.7	56.5
<u>Site B</u>						
Rice/1988						
Tillers (no./m)	23.8 B	27.0 B	45.1 A	50.0 A	14.2	29.8
Plant height (cm)	31.3 C	30.6 C	37.2 A	34.1 B	2.7	36.8
Panicles (no./m)	9.1 B	8.4 B	27.8 A	28.4 A	5.3	8.8

[1] T1=control; T2=mulch (10 t/ha fresh *Cassia spectabilis*); T3=incorporate (10 t/ha fresh *Gliricidia sepium*); T4=mulch and incorporate (5 t/ha fresh *Gliricidia sepium* and 5 t/ha fresh *Cassia spectabilis*); CWH=control without hedgerows; Values are treatment means over 3 replications and number of alleys per treatment at each respective site;

[2] Note: data for control without hedgerow treatment are means of 9 subsamples taken from the area adjacent to the experimental site and serve only as a reference point since control without hedgerow treatment was not replicated.

[3] Means sharing a common letter in a row, are not significantly different at the 5% level according to LSD;

Table 3. The impact of biomass management on rice straw and grain yield, Claveria, Philippines, 1987-88.

Treatments	Site A						Site B						Site C-D		
	1987			1988			1987			1988			1988		
	Straw	Grain	HI[1]	Straw	Grain	HI	Straw	Grain	HI	Straw	Grain	HI	Straw	Grain	HI
	t/ha			t/ha			t/ha			t/ha			t/ha		
T1[2]	0.66 D[3]	0.09 C	0.14	2.62 B	0.76 B	0.29	2.78 B	0.83 B	0.30	3.08 B	0.61 BC	0.20	3.25	0.88	0.27
T2	2.34 C	0.31 C	0.13	3.91 A	1.04 B	0.27	4.86 A	1.17 A	0.24	3.33 B	0.47 C	0.14	3.65	0.94	0.25
T3	4.23 B	0.91 B	0.22	4.21 A	1.51 A	0.36	4.35 A	1.06 A	0.24	4.16 A	0.79 A	0.19	4.00	1.03	0.25
T4	6.27 A	1.27 A	0.20	4.10 A	1.48 A	0.36	5.18 A	1.23 A	0.24	4.10 A	0.72 AB	0.18	4.84	0.95	0.20
LSD	1.10	0.35		0.92	0.31		0.85	0.19		0.44	0.16		-	-	
FP[4]	2.41	0.23	0.01	3.08	1.15	0.37	3.17	0.84	0.26	2.46	0.53	0.22	-	-	

[1]Harvest index (grain/[grain + straw).

[2]T1 = control; T2 = mulch (10 t/ha fresh *Cassia spectabilis*); T3 = incorporate (10 t/ha fresh *Gliricidia sepium*); T4 = mulch and incorporate (5 t/ha fresh *Gliricidia sepium* and 5 t/ha fresh *Cassia spectabilis*); FP = farmer's practice. Values are treatment means over 3 replications and number of alleys per treatment.

[3]Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

[4]Note data for farmer's practice are means of 9 subsamples taken from area adjacent to experimental site and serve only as reference points as farmer's practice was not replicated.

Table 4. Upland rice straw and grain yield at the hedgerow-alley interface at sites A and B during 1988 wet season, Claveria, Philippines.

	TREATMENTS			
	T1[1]	T2	T3	T4
	t/ha			
<u>Straw yield</u>				
Site A				
Upper rows	1.54 B[2]	2.63 C	2.48 B	2.20 B
Middle rows	4.19 A	5.97 A	7.18 A	6.76 A
Lower rows	2.40 B	4.18 B	3.38 B	2.99 B
Site B				
Upper rows	1.81 C	2.13 C	2.24 C	2.29 C
Middle rows	3.83 A	4.16 A	6.53 A	6.26 A
Lower rows	2.95 B	3.07 B	3.67 B	3.94 B
<u>Grain yield</u>				
Site A				
Upper rows	0.24 B	0.57 B	0.68 C	0.74 C
Middle rows	1.18 A	1.85 A	2.61 A	2.21 A
Lower rows	0.50 B	0.80 B	1.22 B	1.14 B
Site B				
Upper rows	0.23 C	0.29 B	0.33 C	0.29 C
Middle rows	0.71 A	0.58 A	1.10 A	1.05 A
Lower rows	0.52 B	0.33 B	0.67 B	0.62 B

[1] T1=control; T2=mulch (10 t/ha fresh *Cassia spectabilis*); T3=incorporate (10 t/ha fresh *Gliricidia sepium*); T4=mulch and incorporate (5 t/ha fresh *Gliricidia sepium* and 5 t/ha fresh *Cassia spectabilis*); Values are treatment means over 3 replications and number of alleys per treatment at each respective site;
[2] Means sharing a common letter in a column within a parameter, are not significantly different at the 5% level according to LSD.

Table 5. Maize stover and grain yield (t/ha) at site C-D in 1987, Claveria, Philippines.

	STOVER	GRAIN
CONTROL	4.2 C[1]	0.7 C
MULCH	6.5 BC	1.3 B
INCORPORATE	7.6 B	1.7 B
MULCH+INCORPORATE	10.6 A	2.6 A

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 6. Terracing at the lower side of each hedgerow at each site, Claveria, Philippines, 1988.

	Site A	Site B	Site C	Site D
		cm		
Hedgerow # 1[1]	27.0	24.5	21.1	58.2
Hedgerow # 2	32.6	34.8	24.0	63.7
Hedgerow # 3	44.0	33.5	30.2	63.8
Hedgerow # 4	55.1	43.6	47.4	54.5
Hedgerow # 5	55.8	61.5	64.7	48.6
Hedgerow # 6	63.1	62.4	74.6	39.0
Hedgerow # 7	61.1	70.4	76.3	32.0
Hedgerow # 8		70.4	69.1	33.0
Hedgerow # 9		79.5		
Hedgerow # 10		58.3		
Average	48.4	53.4	50.2	49.1

[1] Hedgerow numbering begins at the top of the slope at each site

Table 7. In situ, hedgerow fresh biomass production at sites (A, B and C-D) Claveria, Philippines, 1988.

	May/1988			Aug/1988			Nov/1988		
	A	B	C-D	A	B	C-D	A	B	C-D
	t/ha								
G. sepium	2.3	2.6	2.4	2.0	3.1	2.6	0.8	1.5	2.0
C. spectabilis	3.8	3.4	6.7	4.0	4.8	3.5	4.1	8.7	6.0
Total	6.1	6.0	9.1	6.0	7.9	6.1	4.9	10.2	8.0

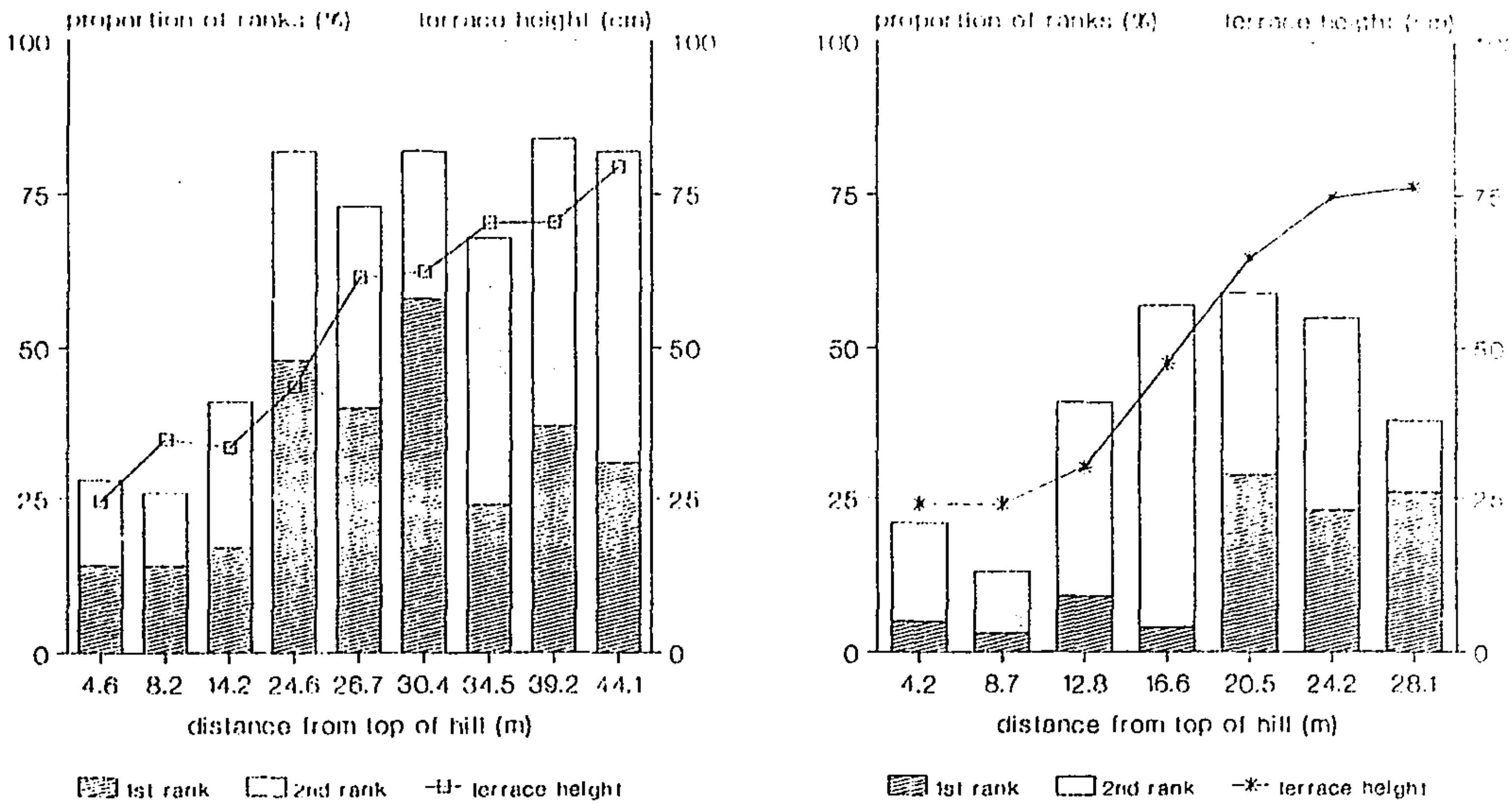

Fig. 1. The proportion of assigned ranks relative to position on slope and natural terrace formation Claveria, Philippines, 1987-88.

Connecting text

The focus of the previous paper was the impact of hedgerow biomass management on the agronomic aspects of both rice and maize and the extent to which alley cropping reduced two of the physical constraints; erosion by promoting terrace formation and fertility depletion by providing additional nutrients. In the following paper, the impact of the system on some of the biological constraints associated with upland rice and maize is examined.

The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on weeds and selected insect pests associated with upland rice and maize.

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Key words. green manuring, mulching, broadleafs, grasses, seedling maggot, stemborer, white grub

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Abstract

This experiment was designed to determine how management of *Gliricidia sepium* and *Cassia spectabilis* biomass affected weeds and selected insect pests associated with upland rice and maize. Although crop productivity was greatest when biomass of *G. sepium* was incorporated into the soil, this practice also resulted in increased broadleaf weeds. Mulching was associated with less grass weed biomass, suggesting that mulching may be an effective strategy to suppress grasses. Seedling maggot and stemborer damage was greatest in the green manured plots. Damage was most evident at depleted sites where the healthy manured crop was is sharp contrast to the less vigorous crop. No significant effect of green manure or mulch on white grubs was detected.

Introduction

Upland rice is grown without standing water on level and sloping land that is prepared and seeded under dry conditions. Upland rice yields are low because of a complex array of interacting physical and biological constraints (Arraudeau, 1986). Physical constraints include soil erosion, declining soil fertility, and drought. Weeds, insect pests, diseases and nematodes constitute the main biological constraints. To improve upland rice productivity, cropping systems that overcome these constraints must be designed.

Trees have long been and remain an integral component in many traditional agricultural systems (Sanger, 1977; Michon, 1983), but only recently has the potential of augmenting the role of trees been envisioned. "World food, energy and environmental problems are such that it is no longer scientifically prudent to ignore the conservation benefits and sustained yield potentials of age-old agroforestry practices" (Steppler and Raintree, 1983). Alley cropping, a system wherein crops are grown between hedgerows of leguminous trees, shrubs and grasses (Kang, 1985), is well suited to the upland rice agroecosystem. With natural drainage, anaerobic soil conditions are not created (as in lowland rice culture) and as such, tree root growth is not impeded. Benefits of alley cropping include: 1) the amelioration of soil physico-chemical and bio-ecological properties (Lal, 1989b; Lal, 1989c; Yamoah et al.,1986 a), 2) the reduction of soil erosion by contoured hedgerows and mulched biomass (Lal, 1989 a), 3) the uptake and recycling of leachates by deep rooted perennials (Glover and Beer, 1986; Kang et al., 1984), and 4) increased availability of fuelwood and/or fodder.

Alley cropping, an agroforestry system conceived primarily to alleviate physical constraints (Mulongoy and Akobundu, 1992; Ehui et al., 1990; Kang and Ghuman, 1989; Kang and Dugma, 1985; Huxley, 1986), is a form a agricultural diversification that if designed to do so, can also be a powerful tool against biological constraints. Any sound pest management strategy should include crop diversification and habitat management as fundamental components (Komerek, 1969; Litsinger et al., 1987; Litsinger and Moody, 1976).

Weeds

Weeds are the most universal constraint to crop production and their effective control is essential if upland rice yields are to improve (Moody, 1990). In depleted soils, yield losses due to weeds are extensive because a) the crop's ability to compete is reduced and b) weed populations shift from broadleaf to grass dominated communities (Moody, 1990). Because grasses are more difficult to control than broadleaf species (IRRI, 1974), the need to address the physical constraints, that influence fertility and hasten population shifts, is critical.

Alley cropping offers three alternative strategies to reduce weed-induced yield losses; green manuring, mulching and shading. By increasing nutrient availability, green manuring may increase the crop's competitive advantage against weeds. Over the long term, green manuring may improve soil physico-chemical properties (Lal,

1989) and consequently, alter weed species composition. Mulching, by smothering weeds and preventing their development, can reduce weed pressure and increase crop yields (Casting and Moody, 1976; Paller, 1983; Okigbo, 1965). Shade created by the hedgerow during the dry season may reduce the abundance of sensitive weed species, as reported for speargrass (*Imperata cylindrica* (L.) Raeuschel.) that was significantly reduced by hedgerows of *Leucaena leucocephala* (Lam.) de Wit and *Gliricidia sepium* (Jacq.) Walp. (Anoka et al., (1991). In addition, the intermediate hedgerow canopy may conserve soil moisture during the dry season and enable farmers to prepare their fields prior to the onset of the rainy season. Land preparation during the dry season has been reported to provide better weed control in the following crop (Castin and Moody, 1985) and to influence weed species composition (Altieri and Whitcomb, 1979).

Insects

Crop diversification may reduce insect pest damage (Root, 1973; Tahvanainen and Root, 1972; Way and Camnell, 1981). Most intercropping studies have recorded reduced damage by insects as a result of crop diversification (Risch et al., 1983). Alley cropping may adversely affect pests' host finding and colonization ability, growth rate and fecundity, survival of offspring and each generation's feeding duration, and provide suitable habitat for natural enemy populations (Altieri and Whitcomb,1979; Cromartie, 1981; Wigglesworth, 1968). Mulching the soil surface may effectively reduce crop apparency at the early vegetative stage by camouflaging the bare soil-plant contrast, vital to pests relying on visual stimuli during colonization (Cromartie, 1975; Smith, 1976). In addition, planting hedgerow species reported to have a repellent chemistry (Grainge et al., 1986) adjacent to host species may confuse insect pests relying on olfactory and gustatory cues (Altieri et al., 1977).

Objectives

The goal of this study was to develop a mixed hedgerow system using *Gliricidia sepium* (Jacq.) Walp. and *Cassia spectabilis* DC (synonym *Senna spectabilis* (DC.) Irwin and Barnaby). The specific objectives were to determine how best to manage the hedgerow biomass such that yields of upland rice and maize were sustained above farmers' present levels and to determine the effect of such strategies on the main insect pests and weed species associated with upland rice and maize.

Materials and methods

Experiments were conducted at the International Rice Research Institute's acid upland research site at Claveria, Northern Mindanao, Philippines (8° 38' N, 124° 55' E, elevation 400 m). Although the area receives an average of 2200 mm of rain between May and February, drought periods are frequent (Figure 1).

Site selection

Claveria has two distinct regions: lower (300-500 meters above sea level (masl)) and upper areas (500-900 masl); over 70% of the area is between 3 and 60% slope (IRRI, 1985; Magbanua and Garrity, 1988). In 1987, four areas ranging from 18 to 31% slope were selected to evaluate the effect of alley cropping on rice and maize, the main crops in the lower region (Magbanua and Garrity, 1988). Soil analyses for each experimental site are presented in Table 1. Sites A and B represent depleted and fertile sites, respectively. Both were 0.6 ha each, and sites C and D were 0.72 and 0.36 ha, respectively. Site preparation consisted of slashing vegetation and establishing hedgerow contour lines using an A-frame (Celestino, 1985).

Hedgerows

Each hedgerow was mixed and consisted of two rows of alternating *G. sepium* and *C. spectabilis* established by seed in May, 1987. Distance between hedgerows averaged 5 m; between and within row tree spacing were 50 and 25 cm, respectively. All biomass of *G. sepium* and *C. spectabilis* applied to the 1987 crops was imported from the surrounding area as hedgerows were newly established. Hedgerows were first pruned (to 50 cm) one week before rice planting in May, 1988 and again at approximately 70 DAE to minimize shading. No pruning was carried out during the dry season and hedgerows were mulched with crop residues after each harvest.

Design

At sites A and B, treatments were; 1) control (no biomass inputs), 2) mulch (10 t/ha of fresh *C. spectabilis*), 3) incorporate (10 t/ha of fresh *G. sepium*), 4) mulch plus incorporate (5 t/ha of fresh *C. spectabilis* mulch plus 5 t/ha of fresh *G. sepium* green manure) and 5) control without hedgerows. Within the hedgerow system, treatments 1 to 4 were replicated three times in a completely randomized design at each site; plot size was 250 m^2 (5 m wide along the contour X 50 m long downslope), whereas treatment 5 was 35 m wide X 50 m downslope and not replicated within each site. All data were collected by alley.

Experiments at site C-D were established in a randomized complete block design with two blocks at site C and one block at site D. Plot size was 900 m^2 (22.5 m wide along the contour X 40 m downslope). Treatments 2, 3 and 4 were identical to sites A and B except that the mulch plus incorporate treatment (treatment 4) was 20 t/ha - i.e., 10 t/ha of fresh *C. spectabilis* mulch plus 10 t/ha of fresh *G. sepium* green manure. Treatment 1 at site C-D had no hedgerows representing the conventional open-field farming practice and was replicated within each block.

Land Preparation

Fields were plowed and harrowed twice using a moulboard plow and a wooden tooth harrow. To eliminate tillage as a confounding factor in the statistical analysis, a third deep plowing (20 cm) was carried out in all plots at the time of green manure incorporation. Rice was hand drilled in shallow furrows 25 cm apart, whereas maize was hand dibbled in 50 cm rows with 25 cm within-row spacing. Mulch was applied after crop emergence.

Crops

At site A two rice crops were planted (June, 1987 and May, 1988), whereas at site B two rice crops (June, 1987 and May, 1988) were followed by two maize crops (Dec, 1987 and Nov, 1988). At site C-D, two maize crops (Nov, 1987 and 1988) and one rice crop (June, 1988) were grown. The rice cultivar was UPLRi5, which matures in

140 days and the maize cultivar, IPB-1, was a 105-day cultivar. Seeding rates were 90 and 20 kg/ha for rice and maize, respectively. No chemical control measures for insect pests were taken. In the alley cropping system, rice was hand weeded once at approximately 50 days after emergence (DAE), whereas no weeding was done in maize. Weeding in the control without hedgerow treatment at sites A and B is described in Table 2. At site C-D, all treatments were weeded at the same time.

Agronomic data

Straw and grain yield were determined from a 7.5 m^2 crop cut per alley in each treatment in the 1987 rice crop at sites A and B. In the 1987 maize crop at sites B and C-D, and in all crops in 1988, total harvest of each alley was taken. Harvested grain was manually threshed and sun dried to 14% moisture.

Weed data

At sites A and B, data were collected at 30 DAE and at harvest during the 1987 rice crop, and at 20 and 40 DAE and at harvest in the 1988 rice crop. In 1988, numbers of each species were also counted. Weeds were sampled from two 0.25 m^2 quadrats in each alley of each treatment at sites A and B. At site C-D, sampling was increased to eight 0.25 m^2 quadrats per alley at 40 DAE and at harvest for both 1987 and 1988 maize crops. Weed data for the 1988 rice crop were collected at 20 and 40 DAE and at harvest. All weeds were classified by species, oven dried at 85° C for 24 hours and weighed. Weed species were then categorised as either broadleaf or grass.

Insect pest data

Seedling maggot data (eggs and dead hearts) were gathered at 7, 14 and 21 DAE. The sampling unit at sites A and B was 3 linear meters (lm) of each alley per treatment in 1987 and increased to 5 lm per alley in the 1988 rice crop and in both maize crops at site B. At site C-D, 5 lm per alley were sampled in the 1987 maize crop, but this was increased to 10 lm per alley in the 1988 rice and maize crops.

White grubs (primarily *Holotrichia mindanaoana* Brenske and *Leucopholis irrorata* (Chevrolat)) were sampled by digging to a depth of 30 cm at approximately 40 and 80 DAE in each of the rice crops at sites A and B. At site C-D, data were gathered at 40 DAE. The sampling unit in the 1987 rice crop at sites A and B was 1.2 lm (3 X 0.4 m) of each alley per treatment, but was increased to 3 lm (4 X 0.5 m + 1 X 1 m) of each alley in 1988. For the C-D site, 6 lm per alley were sampled (8 X 0.5 m + 2 X 1 m). Only alley totals are presented.

Stemborer (*Sesamia inferens* (Walker)) data was obtained by a) counting the number of dead hearts observed, and b) by plant dissection in search of larvae. If larvae were found, plant stand for that sampling unit was recorded and percent damaged plants calculated. The sampling unit was 3 and 5 lm per alley in each treatment in the 1987 and 1988 rice crops of both sites A and B, respectively and 10 lm per alley for site C-D. Dead heart sampling was done at 40 and 80 DAE for both rice crops, and the percent damage was determined at approximately 50, 60 and 70 DAE in the 1987 rice crop at sites A and B.

Assessing cornborer *(Ostrinia furnacalis* Guenee) and earworm *(Heleothis armigera* Huebner) damage was done by counting the number of plants exhibiting cornborer entry points and the characteristic earworm feeding holes within a 5 and 10 lm sampling unit per alley in each treatment at sites B and C-D, respectively.

Statistical analysis

Since treatment 5 was not replicated within sites A or B, it was not included in the analysis. Tests were conducted to verify if data satisfied ANOVA assumptions. Transformations when required consisted of the logarithm base 10 and the square root of [variable +1]. The Shappiro-Wilks test in the Univariate procedure of the Statistical Analysis Systems (SAS) program was used to determine which transformation was most appropriate (SAS, 1988). Only untransformed data are presented. Within the General Linear Model of SAS, the analysis of variance with a repeated measures procedure was used; alleys served as the repeat. Because of heterogeneity of variance between sites and years, data could not be pooled either in time or space. In an effort to synthesize the data, treatment means were arranged in decreasing order, ranked, and tabulated in matrix format. A chi-square test was then performed to determine if treatment effect was random.

RESULTS

Site A

Weeds

The main weed species at site A were *Digitaria setigera* (L.) Scop., *Paspalum conjugatum* Berg., *P. scrobiculatum* L., *Pennisetum polystachyon* (L.) Schult. and *Axonopus compressus* (Jw.) Beauv.. Total weed biomass was not significantly affected by treatments at any collection date except at harvest of the 1988 rice crop. At 30 DAE in 1987, total weed dry weight was 8.4, 5.1, 8.4, 7.3 and 7.5 g/m^2 in the control, mulch, incorporate, mulch plus incorporate and control without hedgerow treatments, respectively. Data from the 1988 harvest indicate that the mulch and mulch plus incorporate treatments significantly ($P < 0.01$) suppressed grassy weed growth (Table 3). Grasses did not respond to green manuring (treatment 3) in 1987 but did so in 1988, a wet year. When grasses were reduced, broadleaf biomass increased and broadleaf response was greater in the mulch plus incorporate treatment (Table 4). Treatments also appear to have influenced the relative proportion of biomass produced by broadleaf and grass species. Of the total weed biomass produced (average of all collection dates), grasses constituted 82.4, 70.7, 76.3 and 59.2% in the control, mulch, incorporate and mulch plus incorporate treatments, respectively. Grasses constituted 27.4% of total weeds in the control without hedgerow treatment.

Insects

The main insect pests of upland rice and maize in Claveria are seedling maggot (*Atherigona oryzae* Malloch) and white grubs (primarily *H. mindanaoana* and *L. irrorata*). Less significant are the pink stemborer, *S. inferens*, and the root aphid, *Tetraneura nigriabdominalis* (Sasaki) (Litsinger, 1988). For maize, the oriental cornborer, *O. furnacalis* and the earworm, *H. armigera* are also problem pests.

Significantly ($P < 0.05$) more seedling maggot eggs were observed in the treatments within the hedgerow system at all collection dates except for the mulch treatment at 7 DAE in 1987 (Table 5). More eggs were generally found in the green manure treatments, i.e., the incorporate and mulch plus incorporate treatments. The numbe: of seedling maggot dead hearts observed was also significantly ($P < 0.05$) increased, particularly in the incorporate and mulch plus incorporate treatments in 1987 (Table 6). The number of eggs oviposited per plant was also significantly ($P < 0.01$) greater in the green manure treatments; at 14 DAE in 1987, 0.13, 0.17, 0.32, 0.25 and 0.14 eggs per plant were observed in the control, mulch, incorporate, mulch plus incorporate, and control without hedgerow treatments, respectively. Comparing treatments 1 and 5 enables the effect of the hedgerow system to be determined. The data suggest that hedgerows did not influence the number of seedling maggot eggs oviposited nor the number of dead hearts observed, although more dead hearts were observed in treatment 5 at 21 DAE in 1988.

Data at 40 DAE in 1987 and 1988 suggest that mulching may increase white grub numbers, however only in 1988 were treatments significant ($P < 0.01$) (Table 7). At 80 DAE more grubs were found in treatments 2 to 4. Fewer larvae were observed in the alley cropped area than in the control without hedgerows treatment in 1987, but this trend was not observed in 1988.

Significantly ($P < 0.01$) more stemborer dead hearts were observed in the incorporate and mulch plus incorporate plots at 40 DAE in 1987 (Table 8). Hedgerows did not appear to affect stemborer colonization in 1987, however, fewer dead hearts were generally observed within the hedgerow system in 1988. Percent infestation at 60 DAE was also greater in the mulch plus incorporate plots where 0, 0.1, 0.4, 0.7, and 0% of the plants had larvae tunnelling the culm in the control, mulch, incorporate, mulch plus incorporate, and control without hedgerow treatments, respectively.

Yield

Rice straw and grain yield were significantly increased in the green manure treatments in 1987 and 1988 at site A ($P < 0.01$) (Table 9). Grain yield in the control was negligible in 1987 and 0.76 t/ha in 1988, whereas in the mulch plus incorporate treatment yield was increased to almost 1.3 t/ha and 1.5 t/ha in 1987 and 1988, respectively. Yield in treatment 5 was generally higher than in treatment 1, particularly in 1988, when inorganic fertilizer and chicken manure were applied to this treatment.

Site B

Weeds

The main weed species at site B were *Mimosa invisa* Mart., *Calapagonium mucunoides* Desv., *Borreria* spp. and *P. scrobiculatum*. Significant ($P < 0.07$) treatment differences in broadleaf dry weight were observed at 30 DAE in 1987 and at 20 and 40 DAE in 1988 (Table 10). Broadleaf biomass was effectively reduced at 30 DAE in 1987 in treatments 3 and 4. This suppression did not carry over until harvest, however (Table 11). A proportion of the reduction in broadleaf biomass production at 30 DAE in 1987 is attributed to a significant reduction in *M. invisa* ($P < 0.01$). *M. invisa* dry weight at 30 DAE was 3.29, 2.69, 1.21, 1.1 and 3.1 g/m^2 in the control, mulch, incorporate, mulch plus incorporate and control without hedgerow treatments, respectively. In 1988, significantly ($P < 0.05$) less broadleaf growth was observed in the mulch and mulch plus incorporate treatments at 20 DAE, whereas at 40 DAE, only in the mulch treatment were differences significant ($P < 0.01$). In contrast to 1987, broadleaf biomass production was increased in treatment 3 at all collection dates in 1988 (Tables 10 and 11). At harvest in 1988, broadleaf dry weight was significantly less ($P < 0.07$) in the control than in the other treatments (Table 11), primarily because of an increase of *Borreria* spp. biomass in the treated plots (data not presented). Grass dry weight was not significantly affected by any of the biomass treatments. The increase in broadleaf biomass in treatments 2 to 4 at harvest in 1988 may have caused the grasses to be suppressed as a result of competition. Weed abundance was significantly reduced ($P < 0.05$) in the mulch treatment at 20 and 40

DAE in 1988 (Table 12). Based on control data at 30 DAE in 1987, 89% of the weed biomass was broadleaf in nature; by the 1988 rice harvest, broadleafs represented 34%.

Insects

Although more seedling maggot eggs were observed in the incorporate and mulch plus incorporate treatments in 1987, differences were significant ($P < 0.02$) only in 1988 (Table 13). Significant treatment differences ($P < 0.05$) were also obtained in the number of seedling maggot dead hearts observed at 7 and 14 DAE in 1987 and at 14 and 21 DAE in 1988 (Table 14). Generally, hedgerows appear to have increased the number of eggs oviposited, particularly in the incorporate and mulch plus incorporate treatments. No significant treatment effect was detected on white grub abundance at any collection date (Table 15), however, more larvae were observed in the mulch and mulch plus incorporate treatments. Similar to site A, more larvae were observed in the no hedgerow treatment at 40 DAE in 1987.

Stemborer dead hearts were significantly ($P < 0.05$) increased at 40 DAE in 1987 and 1988. The number of dead hearts observed at 40 DAE was 10.6, 12.3, 12.1, 16.0 and 9.5 per m in 1987 and 1.4, 1.8, 2.4, 3.6, and 2.6 per m in 1988 in the control, mulch, incorporate, mulch plus incorporate and control without hedgerow treatments, respectively. Percent infestation was also significantly ($P < 0.05$) increased. At 47 DAE, damage was 0.19, 0.67, 1.44, 1.21 and 0.5% in the control, mulch, incorporate, mulch plus incorporate and control without hedgerow treatments, respectively.

No significant treatment effect on straw or grain yield was observed at site B (Table 9). Although plant height and number of tillers and panicles were increased in 1988, blast severity (*Pyricularia oryzae* Cav.) during grain filling was greater in the treatments 3 and 4 and consequently, no yield advantage was obtained (MacLean et al., 1992).

Site C-D

The main weeds at site C-D were *Borreria laevis* (Lam.) Griseb., *B. ocymoides* (Burm.f.) DC, *Ageratum conyzoides* L., *M. invisa*, *Rottboellia cochinchinensis* (Lour.) W.D. Clayton, and *Pennisetum polystachyon* (L.) Schult.. In the 1987 maize crop, fewer broadleaf weeds were observed in the mulch treatment, followed by the mulch plus incorporate treatment at 40 DAE and at harvest (Table 16). Broadleaf weed biomass was greater in the incorporate treatment at both collection dates. Grass weed dry weight was lower at 40 DAE in treatments 2 to 4, and in the mulch and mulch plus incorporate treatments at harvest.

Fewer seedling maggot eggs and dead hearts were observed at 18 DAE in the 1987 maize crop in the hedgerow system. The number of eggs and dead hearts was 0.28, 0.03, 0.11 and 0.09 and 0.19, 0.02, 0.09, and 0.06 m^{-1} in the control, mulch, incorporate, and mulch plus incorporate treatments, respectively. Number of neither white grub, cornborer nor earworm were significantly affected by treatments at any collection date (data not presented).

Significant treatment differences ($P < 0.01$) were obtained in maize stover and grain yield in 1987 (Table 17). The greatest increase was observed in the mulch plus incorporate treatment where stover yield more than doubled and grain yield quadrupled.

In the 1988 rice crop, broadleaf and grass weed weight and abundance at 40 DAE were less in the mulch and mulch plus incorporate treatments. In contrast, significantly ($P < 0.01$) more broadleaf and less grass biomass and abundance were observed the incorporate treatment (Table 18). Neither the mulch nor the mulch plus incorporate treatments effectively suppressed broadleaf biomass or abundance until harvest (Table 19). In fact, 25 and 75% more broadleaf biomass was observed in treatments 2 and 4 respectively, at harvest. In the incorporate treatment, a 50% increase in number of broadleaf individuals resulted in a doubling of biomass. Dry weight and abundance of grass species were reduced in treatments 2 to 4 at harvest, particularly in the mulch plus incorporate treatment.

Fewer seedling maggot eggs and dead hearts were observed in the mulch treatment at all collection dates in the 1988 rice crop. Differences however, were significant ($P < 0.08$) only at 7 and 21 DAE and 7 DAE for eggs and dead hearts, respectively (Tables 20 and 21). Neither the number of eggs nor the number dead hearts were substantially increased in the incorporate or mulch plus incorporate treatments as was the case at sites A and B. Treatments did not significantly affect white grub abundance. In the 1988 rice crop at 40 DAE, 1.3, 1.2, 0.7 and 0.5 larvae per m were observed in treatments 1 to 4, respectively. Significantly ($P < 0.08$) greater stemborer activity was observed in the green manured plots. At 70 DAE, there were 2.0, 2.2, 2.6, and 3.2 dead hearts per m in the control, mulch, incorporate and mulch plus incorporate treatments, respectively.

Growth of the rice crop at site C-D was superior in the hedgerow system throughout the vegetative phase, particularly in treatments 3 and 4. The green manured rice, however, was severely attacked by blast and no yield advantage was observed (Table 9) (MacLean et al., 1992).

Discussion

Weeds

Mulching *C. spectabilis* biomass, with or without *G. sepium* green manure reduced total weed biomass. In general, however, mulching alone appears to have been the more effective treatment, as is evident from Tables 16 and 18. In 1987 and 1988, broadleaf biomass was reduced by nearly 50% at 40 DAE by the application of 10 t/ha of *C. spectabilis* biomass. In contrast, incorporating 10 t/ha of *G. sepium* increased broadleaf biomass by 22 and 137% in 1987 and 1988, respectively. Green manuring 10 t/ha of *G. sepium* and mulching 10 t/ha of *C. spectabilis* was not as effective at controlling broadleafs as mulching alone. The difference in broadleaf biomass between treatments 2 and 4 is likely because of improved fertility. Weed weights, and yield losses attributable to weeds, have been reported to be greater at higher fertility levels (Moody, 1990; Moody 1981). Castin and Moody (1977) reported that increased levels of broadcasted N led to increased weed biomass in maize.

In permanently cultivated upland rice, grasses often constitute a large proportion of the weed population, specifically where fertility decline has induced a shift from broadleafs to grasses (Moody, 1990). Data presented here suggest that grasses were affected by mulching and that they differ from broadleafs in the degree to which they respond to increased nutrients. Because grass biomass was higher in the treatments without mulch, it would appear that mulching was the primary factor responsible for reduced grassy weed growth.

By mulching *C. spectabilis* biomass and incorporating *G. sepium* biomass, it was hoped that the mulch would suppress weeds and that the increased nutrient availability from the green manure would promote a shift in the weed population towards easier to control broadleafs, and increase the crop's competitive advantage against weeds. However, because the green manure was broadcast, broadleaf weeds growing between crop rows also benefitted. More effective weed control may have been obtained had the green manure been concentrated in the furrow. Banding inorganic fertilizer is a recommended practice in many crops. In addition, a greater suppression of weeds would most likely have been observed had the carbon:nitrogen ratio of *C. spectabilis* been higher. *C. spectabilis* is a non-fixing legume but can uptake considerable quantities of N (Ladha et al., 1992) and consequently, its decomposition rate may be increased as a result.

Reducing yield losses associated with weeds by alley cropping is unlike suppressing weeds via intercropping per se. In alley cropping, emphasis is placed on production and management of the hedgerow biomass. Easily decomposed biomass is incorporated to increase nutrient availability and promote crop growth, whereas slow decomposing biomass is used as a mulch to suppress weeds and reduce the likelihood or severity of drought. The weed suppressing capacity of an intercrop is governed by several factors which include "the component crops and cultivars selected, the density and component proportions used, the spatial and temporal arrangement of components, and the fertility and moisture status of the soil" (Moody and Shetty, 1981). These factors will determine the level of crop-weed competition, the primary mechanism by which weeds are reduced in intercropping (Moody and Shetty, 1981). It is important to note, however, that crops can be intercropped within an alley cropping system as well.

Insects

Seedling maggot and stemborer

Soils at site A were chemically and structurally poor and consequently, the effect of green manuring on crop growth was more evident at site A (MacLean et al., 1992). Where fertility had been depleted, more seedling maggot eggs and dead hearts were observed in the conspicuous green manured plots. We hypothesize that the visual and chemical apparency of the crop in the green manured plots attracted gravid females resulting in increased oviposition and subsequent dead hearts. Such an attraction was not observed at site B in 1987 because chemical cues emitted from plants in the treated plots may have been masked by emissions from equally vigorous plants in the control treatment. Native soil fertility at site B declined as a result of the two consecutive crops in 1987; and as a result, the 1988 rice crop in the control treatment was stunted and showed signs of chlorosis. In 1988, significantly more seedling maggot eggs were observed in the green manured treatments. It seems likely that the contrast between healthy, vigorous plants and stunted, chlorotic plants can be distinguished by ovipositing females.

Oviposition behavior studies on the sorghum shootfly (*Atherigona soccata* Rondani) have shown that under field conditions, susceptible sorghum cultivars and suitable oviposition sites on the host plant can be detected by gravid females (Unithan, 1990; Ogwaro, 1978; Blum, 1968) by means of chemical cues emitted by the plant (Delobel, 1982). Vision has also been reported to be an important mechanism in host selection (Delobel, 1982). If green manuring alters the crop's chemical composition, cues emitted may also be modified, thus making the crop more apparent to the pest. However, conflicting reports regarding the effect of manuring on severity of shootfly attack have been made. Ponnaiya, (1951) reported that although manuring increased crop vigor, shootfly incidence was not affected. Starks, (1970) maintains that oviposition preference was increased in manured plots. Venugopal et al., (1977) reported that favorable conditions for pest incidence developed when improved sorghum varieties were intensely fertilized. Reddy et al, (1981) reported that severity of attack by *A. soccata* was greatest in fertilized fields however, when either ammonia, ammonium nitrate or urea was added to fish meal baits, fewer shootflies were caught per trap. Results from this study suggest that when a seedling maggot fly is presented with manured and non-manured plants, a preference for the healthier, more vigorous manured plants is demonstrated.

Some controversy exists with respect to the effect of mixing plant species over time and space on the behavior of seedling maggot flies. Based on field studies, Raina et al., 1983 found no significant reduction in oviposition when sorghum was intercropped with maize, a non-host of *A. soccata*. Venugopal et al., (1977) reported that shootfly damage increased when sorghum was intercropped with black-gram, ground nut, green-gram and lab-lab. In this study, the 1987 data suggest that the pest was more active when hedgerows were present. This, however, appears to be associated more with biomass management and fertility than with alley cropping per se, as the differences between treatments with or without green manure are greater than with or without hedgerows. Since planting was early and in synchrony with farmers in 1988, seedling maggot population levels were low. During the critical growth stage in 1987, adult population levels were approximately 50 flies per trap, whereas in 1988 less than 10 flies per trap were caught (IRRI, 1990). Under low adult population levels, there does not appear to be any advantage or disadvantage to alley cropping with respect to seedling maggot. Oviposition behavior has been reported to be a function of population density (Blum, 1969).

As with seedling maggots, more stemborer dead hearts were observed in the incorporate and mulch plus incorporate treatments, suggesting that fertility may affect the larvae's ability to cause a deadheart. The effect of fertility on the number of deadhearts observed may rest with rapid growth and the crop's physiological response to improved nutrition. We speculate that larvae were able to cause more than one deadheart in the treated plots because plants were growing well and since population levels were low, there was little competition for tillers between larvae. This was not observed in the control treatment because few tillers were being produced, thus competition between larvae was increased. What was anticipated was that internode elongation and culm thickening would be promoted by increased nitrogen and potassium availability, respectively (Yoshida, 1981). Rapid growth will shorten the period during which the crop is susceptible and thickening of the leaf sheath will reduce the larvae's ability to penetrate the central shoot. Enabling the crop to escape damage and increasing the crop's tolerance to the pest are two effective mechanisms in pest management.

White grubs

It is impossible to draw any conclusions with respect to white grub populations as no treatment pattern of response emerged over the course of this study because of site and year variability. In Claveria, several white grub species are found, some characterized with a one and others with a two year life cycle (Litsinger, pers. comm.). This may account for some of the variability observed. Nevertheless, one can speculate that in drought prone soils, white grub abundance may be increased by mulching, as improved soil moisture retention may enhance egg survival. In addition, the continuous addition of organic matter to the soil may improve soil structure and tilth making it more attractive to ovipositing females.

G. sepium has been reported to have insecticidal properties (Grainge, 1986) and to be a suitable green manure (Kang et al., 1984). Consequently, it was anticipated that its incorporation into the plough layer might deter white grubs from feeding on crop roots, either by releasing antagonistic secondary metabolites during decomposition or by serving as a nutritious alternative food source. The data, however, do not support this.

Conclusions

The greatest increase in upland rice and maize productivity was observed when *G. sepium* was broadcast and incorporated into the soil. Broadleaf weeds were also significantly increased by such a practice and, consequently, concentrating *G. sepium* biomass into the furrow may be preferrable. Data suggest that grasses do not respond to increased nutrient availability to the same degree as do broadleafs. Mulching with *C. spectabilis* was the most effective treatment for suppressing grasses. However, because *C. spectabilis* has a high N uptake capacity it may not be an ideal mulch. Species with a higher carbon:nitrogen ratio and a slower decomposition rate may more effectively suppress weeds. Oviposition by seedling maggot flies was greatest in the green manured plots and the increased number of eggs resulted in increased dead hearts. Stemborer dead hearts were also greatest in the manured plots. Damage caused by seedling maggots and stemborers was particularly evident in depleted soils where the visual and chemical apparency of the manured crop made it stand out against the adjacent less vigorous plants. No significant treatment effect was detected for white grub.

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Table 1. Soil properties of research sites, Claveria, Philippines, 1987[1].

	pH[2]	Org C	Tot N	CEC	Na	K	Mg	Ca	P (Bray 2)
		-------%-------		-------m moles/kg------					-mg/kg--
Site A									
0-15 cm	4.2	1.87	0.18	109	0.6	1.1	3.8	9.0	8.4
15-30 cm	4.2	1.67	0.16	93	0.6	0.8	2.7	7.0	8.5
30-50 cm	4.3	1.47	0.13	86	0.8	0.9	2.7	7.0	8.6
Site B									
0-15 cm	4.7	2.02	0.21	127	0.3	4.0	2.3	26.0	14.0
15-30 cm	4.6	1.74	0.14	105	0.4	3.1	1.5	19.0	12.0
30-50 cm	4.4	1.43	0.17	87	0.5	2.6	1.3	12.0	11.0
Site C									
0-15 cm	4.6	2.98	0.26	134	1.2	5.8	6.5	15.0	8.4
15-30 cm	4.5	1.93	0.17	109	0.9	2.0	4.0	8.5	6.2
30-50 cm	4.5	1.41	0.15	96	0.6	1.3	2.6	7.5	5.7
Site D									
0-15 cm	4.4	2.16	0.19	109	0.6	2.6	3.7	7.5	7.8
15-30 cm	4.3	2.46	0.22	121	0.4	2.6	4.6	12.0	8.7
30-50 cm	4.4	0.96	0.10	80	0.5	0.8	1.5	6.0	6.6

[1] Soils were analyzed according to techniques described in the Abstract of analytical methods for soil samples. Analytical Soils Laboratory, IRRI.

[2] pH was determined in $CaCl_2$

Table 2. Weed control practiced by farmers in the control without hedgerow treatment at sites A and B, Claveria, Philippines.

	Site A	
	Rice 1987	Rice 1988
Interow cultivation	35 DAE	20 and 50 DAE
Hand weeding	none	50 DAE
	Site B	
	Rice 1987	Rice 1988
Interow cultivation	30 DAE	40 DAE
Hand weeding	30 DAE	40 DAE

Table 3. Grassy weed dry weight (g/m^2) in the 1987 and 1988 rice crops at site A, Claveria, Philippines.

	1987		1988	
	30 DAE	HARVEST	40 DAE	HARVEST
CONTROL	7.2	26.2	6.5	60.1 A[1]
MULCH	3.4	20.5	6.7	40.9 B
INCORPORATE	6.8	24.6	8.8	86.1 A
MULCH+INCORPORATE	4.4	20.5	4.5	44.6 B
NO HEDGEROW	1.6	2.0	1.2	12.4

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 4. Broadleaf weed dry weight (g/m^2) in the 1988 rice crop at site A, Claveria, Philippines.

	40 DAE	HARVEST
CONTROL	1.9	3.7 C[1]
MULCH	0.9	26.0 AB
INCORPORATE	3.8	16.6 B
MULCH+INCORPORATE	2.6	35.5 A
NO HEDGEROW	2.6	31.0

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 5. Number of seedling maggot eggs (m^{-1}) at 7, 14 and 21 days after emergence (DAE) in 1987 and 1988 rice crops at site A, Claveria, Philippines.

	1987		1988		
	7	14	7	14	21
CONTROL	8.8 B[1]	5.7 C	1.6 D	0.8 B	0.5 C
MULCH	10.5 B	7.6 B	3.0 C	2.5 A	0.9 B
INCORPORATE	15.5 A	16.3 A	4.7 B	2.7 A	0.9 B
MULCH+INCORPORATE	14.8 A	12.0 A	6.3 A	2.8 A	1.4 A
NO HEDGEROW	7.6	4.3	2.0	0.8	1.4

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 6. Number of seedling maggot dead hearts (m^{-1}) at 7, 14 and 21 days after emergence (DAE) in 1987 and 1988 rice crops at site A, Claveria, Philippines.

	1987		1988		
	7	14	7	14	21
CONTROL	6.9 C[1]	6.7 B	0.9 C	1.6 B	0.6 C
MULCH	7.6 BC	9.2 AB	3.0 B	6.9 A	1.8 B
INCORPORATE	10.0 AB	12.8 A	3.7 B	6.7 A	1.7 B
MULCH+INCORPORATE	10.2 A	11.0 A	6.5 A	7.5 A	2.9 A
NO HEDGEROW	5.9	4.6	1.9	2.2	5.3

1 Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 7. Number of white grub larvae (m^{-1}) at 40 and 80 DAE at site A in 1987 and 1988, Claveria, Philippines.

	1987		1988	
	40	80	40	80
CONTROL	9.5	2.8	1.0 D[1]	1.5
MULCH	11.7	3.7	3.2 B	2.9
INCORPORATE	8.5	4.8	1.7 C	3.6
MULCH+INCORPORATE	10.3	6.8	6.0 A	4.2
NO HEDGEROW	29.8	13.8	1.2	0.4

1 Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 8. Number of stemborer dead hearts (m^{-1}) at 40 and 80 DAE and 60 and 80 DAE in 1987 and 1988, respectively at site A, Claveria, Philippines.

	1987		1988	
	40	80	60	80
CONTROL	5.5 C[1]	0.0 C	0.6	1.2
MULCH	9.2 B	0.3 BC	0.7	1.3
INCORPORATE	12.3 B	0.7 AB	2.4	1.5
MULCH+INCORPORATE	16.3 A	1.0 A	0.9	1.6
NO HEDGEROW	5.8	0.0	1.7	2.4

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 9 The impact of biomass management on rice straw and grain yield, Claveria, Philippines, 1987-88.

Treatments	Site A						Site B						Site C-D		
	1987			1988			1987			1988			1988		
	Straw	Grain	HI[1]	Straw	Grain	HI	Straw	Grain	HI	Straw	Grain	HI	Straw	Grain	HI
	t/ha			t/ha			t/ha			t/ha			t/ha		
T1[2]	0.66 D[3]	0.09 C	0.14	2.62 B	0.76 B	0.29	2.78 B	0.83 B	0.30	3.08 B	0.61 BC	0.20	3.25	0.88	0.27
T2	2.34 C	0.31 C	0.13	3.91 A	1.04 B	0.27	4.86 A	1.17 A	0.24	3.33 B	0.47 C	0.14	3.65	0.94	0.26
T3	4.23 B	0.91 B	0.22	4.21 A	1.51 A	0.36	4.35 A	1.06 A	0.24	4.16 A	0.79 A	0.19	4.00	1.03	0.26
T4	6.27 A	1.27 A	0.20	4.10 A	1.48 A	0.36	5.18 A	1.23 A	0.24	4.10 A	0.72 AB	0.18	4.84	0.95	0.20
LSD	1.10	0.35		0.92	0.31		0.85	0.19		0.44	0.16		-	-	
FP[4]	2.41	0.23	0.01	3.08	1.15	0.37	3.17	0.84	0.26	2.46	0.53	0.22	-	-	

[1]Harvest index (grain/(grain + straw).

[2]T1 = control; T2 = mulch (10 t/ha fresh *Cassia spectabilis*); T3 = incorporate (10 t/ha fresh *Gliricidia sepium*); T4 = mulch and incorporate (5 t/ha fresh *Gliricidia sepium* and 5 t/ha fresh *Cassia spectabilis*); FP = farmer's practice. Values are treatment means over 3 replications and number of alleys per treatment.

[3]Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

[4]Note data for farmer's practice are means of 9 subsamples taken from area adjacent to experimental site and serve only as reference points as farmer's practice was not replicated.

Table 10. Broadleaf weed dry weight (g/m^2) in the 1987 and 1988 rice crops at site B, Claveria, Philippines.

	1987	1988	
	30	20	40
CONTROL	8.3 AB[1]	2.5 B	8.7 A
MULCH	8.6 A	0.7 D	1.3 B
INCORPORATE	3.8 BC	4.2 A	11.6 A
MULCH+INCORPORATE	2.5 C	1.4 C	8.9 A
NO HEDGEROW	10.7	3.0	3.8

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 11. Broadleaf and grass weed dry weight (g/m^2) at harvest in the 1987 and 1988 rice crops at site B, Claveria, Philippines.

	BROADLEAF		GRASSES	
	1987	1988	1987	1988
CONTROL	29.2	20.5 B[1]	10.8	39.5
MULCH	22.6	41.4 A	9.9	14.3
INCORPORATE	38.7	51.3 A	10.6	17.5
MULCH+INCORPORATE	34.7	41.6 A	14.4	12.6
NO HEDGEROW	-	35.6	-	16.4

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 12. Total weed abundance (no./m^2) in the 1988 rice crop at site B, Claveria, Philippines.

	20 DAE	40 DAE
CONTROL	27.8 A[1]	38.3 A
MULCH	11.4 C	14.2 B
INCORPORATE	21.0 AB	34.4 A
MULCH+INCORPORATE	16.3 BC	31.0 A
NO HEDGEROW	36.2	61.1

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 13. Number of seedling maggot eggs (m^{-1}) at 7 and 14 days after emergence (DAE) in 1987 and 1988 rice crops at site B, Claveria, Philippines.

	1987		1988	
	7	14	7	14
CONTROL	21.0	20.1	0.4 B[1]	2.4 B
MULCH	17.1	17.8	0.9 A	2.4 B
INCORPORATE	25.8	22.6	0.4 B	3.4 A
MULCH+INCORPORATE	24.1	23.5	0.7 AB	3.7 A
NO HEDGEROW	13.6	12.3	0.2	1.4

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 14. Number of seedling maggot dead hearts (m^{-1}) at 7, 14 and 21 days after emergence (DAE) in 1987 and 1988 rice crops at site B, Claveria, Philippines.

	1987		1988	
	7	14	14	21
CONTROL	8.5 B[1]	11.1 AB	1.1 C	2.8 AB
MULCH	8.9 B	10.4 B	1.4 BC	2.1 B
INCORPORATE	14.9 A	13.7 A	2.4 A	3.4 A
MULCH+INCORPORATE	10.3 AB	13.0 AB	1.9 AB	3.5 A
NO HEDGEROW	7.0	8.5	1.0	1.6

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 15. Number of white grub larvae (m^{-1}) at 40 and 80 DAE at site B in 1987 and 1988, Claveria, Philippines.

	1987		1988
	40	80	40
CONTROL	0.5	0.3	0.8
MULCH	0.5	0.5	1.4
INCORPORATE	0.3	0.8	0.9
MULCH+INCORPORATE	0.6	0.7	1.7
NO HEDGEROW	2.0	0.5	1.0

Table 16. Broadleaf and grass weed biomass (g/m^2) at site C-D at 40 days after emergence (DAE) and harvest of 1987 maize crop, Claveria, Philippines.

	BROADLEAFS		GRASSES	
	40 DAE	HARVEST	40 DAE	HARVEST
CONTROL	8.5	40.3	12.9	55.1
MULCH	4.7	31.4	10.0	46.3
INCORPORATE	10.4	74.1	9.9	55.1
MULCH+INCORPORATE	7.1	36.1	8.2	19.1

Table 17. Maize stover and grain yield (t/ha) at site C-D in 1987, Claveria, Philippines.

	STOVER	GRAIN
CONTROL	4.2 C[1]	0.7 C
MULCH	6.5 BC	1.3 B
INCORPORATE	7.6 B	1.7 B
MULCH+INCORPORATE	10.6 A	2.6 A

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 18. Biomass (g/m^2) and number of individuals (/m^2) of broadleaf and grass species at site C-D at 40 DAE of 1988 rice crop, Claveria, Philippines.

	BROADLEAFS		GRASSES	
	weight	number	weight	number
CONTROL	10.6 B[1]	103.2 AB	8.4 A	57.4
MULCH	4.6 B	48.0 C	1.9 B	12.5
INCORPORATE	25.1 A	158.4 A	6.3 A	17.4
MULCH+INCORPORATE	9.2 B	68.9 BC	1.3 B	6.5

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 19. Biomass (g/m^2) and number of individuals ($/m^2$) of broadleaf and grass species at site C-D at harvest of 1988 rice crop, Claveria, Philippines.

	BROADLEAFS		GRASSES	
	weight	number	weight	number
CONTROL	40.0	45.2	102.0 A[1]	15.5 A
MULCH	50.6	40.8	35.4 AB	9.1 A
INCORPORATE	80.5	73.0	57.0 A	10.3 A
MULCH+INCORPORATE	69.6	51.9	23.2 B	5.0 B

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 20. Number of seedling maggot eggs (m^{-1}) at 7, 14 and 21 days after emergence (DAE) in the 1988 rice crops at site C-D, Claveria, Philippines.

	7	14	21
CONTROL	6.8 AB[1]	7.3	6.7 A
MULCH	2.7 B	3.5	2.5 B
INCORPORATE	8.4 A	8.0	7.1 A
MULCH+INCORPORATE	7.0 A	5.7	4.2 AB

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

Table 21. Number of seedling maggot dead hearts (m^{-1}) at 7, 14 and 21 days after emergence (DAE) in the 1988 rice crops at site C-D, Claveria, Philippines.

	7	14	21
CONTROL	4.2 A[1]	6.7	4.4
MULCH	2.6 B	5.2	2.5
INCORPORATE	5.5 A	6.6	5.7
MULCH+INCORPORATE	6.3 A	6.8	3.4

[1] Means sharing a common letter in a column, are not significantly different at the 5% level according to LSD.

GENERAL CONCLUSIONS

This thesis comprises three section. In the first section, various parameters were evaluated to obtain optimum establishment of hedgerows of *Gliricidia sepium* and *Cassia spectabilis* in an acid upland soil. Results indicate that seedlings survived better than cuttings and that by intercropping the two species, an increase in biomass of *C. spectabilis* could be obtained as a result of a decrease in intra-specific competition. Well adapted to acid soils, *C. spectabilis* is a non-fixing leguminous species that can produce a significant amount of biomass with a high N content. Consequently, at high planting densities, *C. spectabilis* may deplete the soil N pool. More research on hedgerow species and planting pattern is needed, particularly on diversified hedgerow systems. In the first section, the effect of lime on biomass production of *G. sepium* was also determined. The application of 6 t/ha of lime resulted in a doubling of biomass production, thus increasing N availability be approximately 200 kg/ha over a two-year period. Also, justification of the choice of species and function based on decomposition rates was discussed in this section. If the species selected for hedgerows are to perform their task as anticipated, then a working knowledge of their chemical and physical properties is required. A simple, yet effective method to determine decomposition rates under local conditions was developed. Results indicate that although *C. spectabilis* has a similar carbon:nitrogen ratio to that of *G. sepium*, it decomposes slower and consequently is better suited as a mulch.

The second portion of the thesis attempts to quantify the effects of three biomass management strategies on various agronomic parameters, and to compare results with present farming practices. In addition, efforts were made to determine if alley cropping could, in fact, overcome some of the physical constraints associated with upland rice and maize cultivation on slopes between 18 and 30%. The effect of competition at the hedgerow-alley interface was also examined. Lastly, an attempt to document the influence of slope on crop productivity was made. Results indicate that incorporating green manure of *G. sepium* caused the greatest response in upland rice and maize. Rice, however, did not respond to more than the equivalent of 40 kg N/ha in leguminous biomass and, consequently, incorporating 10 t/ha of hedgerow biomass may not be necessary. Furthermore, 10 t/ha of biomass may increase the crop's susceptibility to blast. More research is needed to determine how to synchronize pruning schedules with crop nutrient demand such that the risk of disease is minimized. It appears that maize grown in the drought prone second season responded more to mulching than did rice, suggesting that mulching may reduce the incidence of terminal drought. However, mulching a species with a higher carbon:nitrogen ratio than *C. spectabilis* may be more effective.

Although crop yield was significantly increased by incorporating green manure from the hedgerow, competition was observed at the hedgerow-crop interface. Rice growing in the centre of the alley consistently performed better than at either the upper or lower interface. In addition, rice at the upper interface appeared to have suffered additional nutrient stress as a result of terracing, i.e., terracing appears to intensify competition at the upper hedgerow-crop interface by reducing the crop's effective rooting depth. On convex and concave slopes, contrasting terracing patterns were observed. On convex slopes, terracing increased as one proceeded down the slope. The opposite was observed on concave slopes. At the selected sites, terraces averaged 0.5 m high 18 months after hedgerows were established. Although crop performance improved along fertility and moisture gradients, and appeared to follow the terracing pattern observed, such extensive terracing may only be appropriate where soil profiles are deep enough such that once terraces are formed, parent material from the sub-soil does not surface. Research on agroforestry systems tailored to such environments is essential.

In the last section, an attempt was made to determine how the treatments affected weeds and selected insect pests associated with upland rice and maize. Although crop productivity was increased by green manuring, so were pests. Increased broadleaf weed dry weight was observed in the green manured plots indicating that broadleafs acquired a portion of the added nutrients released from the broadcast green manure. Concentrating the green manure into the furrow may overcome this problem. Mulching is an appropriate strategy in the uplands as such a practice can reduce splash erosion, reduce the likelihood of drought, and as the data suggest, suppress grasses. More effective control of grasses may have been achieved, however, if a species with a higher carbon:nitrogen ration had been applied. The resulting more vigorous crop in the green manured plots attracted more seedling maggot flies and stemborer females, which resulted in increased damage. An in-depth assessment of the consequences of improved nutrition on pest population dynamics needs to be conducted.

This study has demonstrated that alley cropping with y and x can overcome some of the physical constraints associated with upland rice and maize. Because of the problems encountered with nitrogen management, however, such a system may be more suited to maize than upland rice. In addition, the labor required to harvest, apply, incorporate and mulch hedgerow biomass appears to intimidate many upland rice farmers. Developing low management systems that include grasses and fruit, fuel, and timber producing trees, along with upland rice, may be more appropriate. These types of systems may achieve the desired erosion control and provide the farmer with needed income that can be allocated according to his/her priorities.

APPENDICES

Statistical analyses in chronological order by site and by crop

APPENDIX INDEX

Appendix 1 is the format approval from the Department and Faculty. Appendices 2 to 7 relate to the first manuscript entitled "Biomass production of *Gliricidia sepium* and *Cassia spectabilis* as monocropped and mixed hedgerows".

Appendices 8 to 229 relate to the third and fourth manuscripts entitled "The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on upland rice and maize production" and "The effect of alley cropping *Gliricidia sepium* and *Cassia spectabilis* on weeds and selected insect pests associated with upland rice and maize", respectively. These appendices have been arranged by site, by year, and by crop in chronological order of collection date.

APPENDIX 1

Extracted from ...

Mc Gill University
Faculty of Graduate Studies and Research

GUIDELINES CONCERNING THESIS PREPARATION

"7. MANUSCRIPTS AND AUTHORSHIP

The Candidate has the option, subject to the approval of the Department, of including as part of the thesis the text of an original paper, or papers, suitable for submission to learned journals for publication. In this case the thesis must still conform to all other requirements explained in Guidelines Concerning Thesis Preparation. Additional material (experimental and design data as well as descriptions of equipment) must be provided in sufficient detail to allow a clear and precise judgement to be made of the importance and originality of the research reported. Abstract, full introduction and conclusion must be included, and where more than one manuscript appears, connecting texts and common abstracts, introduction and conclusions are required. A mere collection of manuscripts is not acceptable; nor can reprints of published papers be accepted.

While the inclusion of manuscripts co-authored by the Candidate and others is not prohibited by Mc Gill, the Candidate is warned to make an explicit statement on who contributed to such work and to what extent, and Supervisors and others will have to bear witness to the accuracy of such claims before the Oral Committee. It should also be noted that the task of the External Examiner is made much more difficult in such cases, and it is in the Candidate's interest to make authorship responsibilities perfectly clear."

Appendix 2. Analysis of variance table for the impact of various lime rates on *Gliricidia sepium* biomass production in July 1987, Claveria, Philippines

Dependent Variable: TOTBIO1C

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	259.0000000	32.3750000	3.78	0.0128
Error	15	128.6250000	8.5750000		
Corrected Total	23	387.6250000			

R-Square	C.V.	Root MSE	TOTBIO1C Mean
0.668172	17.88281	2.928310	16.3750000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	123.8750000	24.7750000	2.89	0.0506
REP	3	135.1250000	45.0416667	5.25	0.0112

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	123.8750000	24.7750000	2.89	0.0506
REP	3	135.1250000	45.0416667	5.25	0.0112

Appendix 3. Analysis of variance table for the impact of various lime rates on *Gliricidia sepium* biomass production in October 1987, Claveria, Philippines

Dependent Variable: TOTBIO2C

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	205.8333333	25.7291667	4.11	0.0089
Error	15	93.8229167	6.2548611		
Corrected Total	23	299.6562500			

R-Square	C.V.	Root MSE	TOTBIO2C Mean
0.686898	20.10832	2.500972	12.4375000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	159.2187500	31.8437500	5.09	0.0063
REP	3	46.6145833	15.5381944	2.48	0.1005

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	159.2187500	31.8437500	5.09	0.0063
REP	3	46.6145833	15.5381944	2.48	0.1005

Appendix 4. Analysis of variance table for the impact of various lime rates on *Gliricidia sepium* biomass production in June 1988 Claveria, Philippines

Dependent Variable: TOTBIO3C

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	1596.975000	199.621875	2.99	0.0324
Error	15	1002.952533	66.863502		
Corrected Total	23	2599.927533			

R-Square	C.V.	Root MSE	TOTBIO3C Mean
0.614238	39.33777	8.177011	20.7866667

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	1098.290633	219.658127	3.29	0.0335
REP	3	498.684367	166.228122	2.49	0.1003

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	1098.290633	219.658127	3.29	0.0335
REP	3	498.684367	166.228122	2.49	0.1003

Appendix 5. Analysis of variance table for the impact of various lime rates on *Gliricidia sepium* biomass production in November 1988 Claveria, Philippines

Dependent Variable: TOTBIO4C

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	1005.649300	125.706162	3.57	0.0161
Error	15	527.648563	35.176571		
Corrected Total	23	1533.297863			

R-Square	C.V.	Root MSE	TOTBIO4C Mean
0.655873	23.21438	5.930984	25.5487500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	974.3991875	194.8798375	5.54	0.0044
REP	3	31.2501125	10.4167042	0.30	0.8276

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	974.3991875	194.8798375	5.54	0.0044
REP	3	31.2501125	10.4167042	0.30	0.8276

Appendix 6. Analysis of variance table for the impact of various lime rates on *Gliricidia sepium* biomass production in April 1989 Claveria, Philippines

Dependent Variable: TOTBIO5C

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	578.7895833	72.3486979	5.79	0.0018
Error	15	187.3369792	12.4891319		
Corrected Total	23	766.1265625			

R-Square	C.V.	Root MSE	TOTBIO5C Mean
0.755475	32.10900	3.533997	11.0062500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	260.7834375	52.1566875	4.18	0.0141
REP	3	318.0061458	106.0020486	8.49	0.0016

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	260.7834375	52.1566875	4.18	0.0141
REP	3	318.0061458	106.0020486	8.49	0.0016

Appendix 7. Analysis of variance table for regression of *Gliricidia sepium* biomass production against soil pH at different depths, Claveria, Philippines, 1987[1]

SV	df	SS	MS	F
Rep	3	4.032670	1.344223	4.60*
TRT	3	7.326668	1.465334	5.01**
Control vs Trt	1	3.456111	3.4561111	< 1
Among trt	4	3.870558	0.967640	4.07**
Error	15	4.383611	0.292241	
Total	23			

[1]Note: data were pooled over the 0-15 and 15-30 cm depths

Appendix 8. Analysis of variance table for plant stand at 7 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	79804.77778	2574.34767	1.36	0.1800
Error	40	75857.00000	1896.42500		
Corrected Total	71	155661.77778			

R-Square	C.V.	Root MSE	PS Mean
0.512681	30.33527	43.54796	143.555556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5931.44444	1977.14815	1.04	0.3842
REP(TRT)	8	11141.00000	1392.62500	0.73	0.6607
ALLEY	5	21717.11111	4343.42222	2.29	0.0638
TRT*ALLEY	15	41015.22222	2734.34815	1.44	0.1753

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5931.44444	1977.14815	1.42	0.3068

Appendix 9. Analysis of variance table for transformed seedling maggot eggs at 7 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	7.73955247	0.24966298	6.68	0.0001
Error	40	1.49580881	0.03739522		
Corrected Total	71	9.23536129			

R-Square	C.V.	Root MSE	SME1 Mean
0.838035	13.23251	0.193378	1.46138918

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.55115297	0.51705099	13.83	0.0001
REP(TRT)	8	0.39105480	0.04888185	1.31	0.2679
ALLEY	5	4.49043616	0.89808723	24.02	0.0001
TRT*ALLEY	15	1.30690855	0.08712724	2.33	0.0168

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.55115297	0.51705099	10.58	0.0037

Appendix 10. Analysis of variance table for transformed seedling maggot dead hearts at 7 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	6.33712442	0.20442337	9.57	0.0001
Error	40	0.85450940	0.02136274		
Corrected Total	71	7.19163382			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.881180	10.95043	0.146160	1.33474136

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.99409030	0.33136343	15.51	0.0001
REP(TRT)	8	0.25319999	0.03165000	1.48	0.1946
ALLEY	5	3.54819974	0.70963995	33.22	0.0001
TRT*ALLEY	15	1.54163439	0.10277563	4.81	0.0001

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.99409030	0.33136343	10.47	0.0038

Appendix 11. Analysis of variance table for transformed seedling maggot eggs per plant at 7 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.20974741	0.00676605	7.58	0.0001
Error	40	0.03570434	0.00089261		
Corrected Total	71	0.24545174			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.854536	30.87851	0.029877	0.09675517

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.02437919	0.00812640	9.10	0.0001
REP(TRT)	8	0.00910587	0.00113823	1.28	0.2836
ALLEY	5	0.16739779	0.03347956	37.51	0.0001
TRT*ALLEY	15	0.00886455	0.00059097	0.66	0.8043

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.02437919	0.00812640	7.14	0.0119

Appendix 12. Analysis of variance table for plant stand at 14 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	60856.54167	1963.11425	1.51	0.1095
Error	40	52015.11111	1300.37778		
Corrected Total	71	112871.65278			

R-Square	C.V.	Root MSE	PS Mean
0.539166	25.51719	36.06075	141.319444

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	15925.26389	5308.42130	4.08	0.0128
REP(TRT)	8	15678.88889	1959.86111	1.51	0.1855
ALLEY	5	5723.56944	1144.71389	0.88	0.5031
TRT*ALLEY	15	23528.81944	1568.58796	1.21	0.3069

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	15925.26389	5308.42130	2.71	0.1155

Appendix 13. Analysis of variance table for transformed seedling maggot eggs at 14 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	14.96403247	0.48271072	10.89	0.0001
Error	40	1.77318172	0.04432954		
Corrected Total	71	16.73721419			

R-Square	C.V.	Root MSE	SME1 Mean
0.894058	16.34495	0.210546	1.28813982

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.01504293	1.00501431	22.67	0.0001
REP(TRT)	8	0.45701044	0.05712631	1.29	0.2769
ALLEY	5	10.48340988	2.09668198	47.30	0.0001
TRT*ALLEY	15	1.00856922	0.06723795	1.52	0.1453

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.01504293	1.00501431	17.59	0.0007

Appendix 14. Analysis of variance table for transformed seedling maggot dead hearts at 14 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	8.82514646	0.28468214	7.49	0.0001
Error	40	1.51985217	0.03799630		
Corrected Total	71	10.34499863			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.853083	14.40186	0.194926	1.35348101

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.74595538	0.58198513	15.32	0.0001
REP(TRT)	8	0.27241380	0.03405173	0.90	0.5288
ALLEY	5	5.70794003	1.14158801	30.04	0.0001
TRT*ALLEY	15	1.09883725	0.07325582	1.93	0.0495

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.74595538	0.58198513	17.09	0.0008

Appendix 15. Analysis of variance table for transformed seedling maggot eggs per plant at 14 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.29630311	0.00955816	9.02	0.0001
Error	40	0.04238940	0.00105973		
Corrected Total	71	0.33869251			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.874844	40.53337	0.032554	0.08031301

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.04150518	0.01383506	13.06	0.0001
REP(TRT)	8	0.00971495	0.00121437	1.15	0.3551
ALLEY	5	0.20805654	0.04161131	39.27	0.0001
TRT*ALLEY	15	0.03702644	0.00246843	2.33	0.0168

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.04150518	0.01383506	11.39	0.0029

Appendix 16. Analysis of variance table for plant stand at 27 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	84079.77778	2712.25090	1.49	0.1166
Error	40	72768.00000	1819.20000		
Corrected Total	71	156847.77778			

R-Square	C.V.	Root MSE	PS Mean
0.536060	23.23661	42.65208	183.555556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8991.11111	2997.03704	1.65	0.1937
REP(TRT)	8	39205.33333	4900.66667	2.69	0.0180
ALLEY	5	10923.94444	2184.78889	1.20	0.3263
TRT*ALLEY	15	24959.38889	1663.95926	0.91	0.5555

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8991.111111	2997.037037	0.61	0.6263

Appendix 17. Analysis of variance table for tillers at 27 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	98262.22222	3169.74910	4.60	0.0001
Error	40	27591.77778	689.79444		
Corrected Total	71	125854.00000			

R-Square	C.V.	Root MSE	TIL Mean
0.780764	33.24549	26.26394	79.0000000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	47280.11111	15760.03704	22.85	0.0001
REP(TRT)	8	33170.88889	4146.36111	6.01	0.0001
ALLEY	5	11481.83333	2296.36667	3.33	0.0132
TRT*ALLEY	15	6329.38889	421.95926	0.61	0.8477

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	47280.11111	15760.03704	3.80	0.0582

Appendix 18. Analysis of variance table for transformed seedling maggot dead hearts at 27 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	8.01069187	0.25840942	6.90	0.0001
Error	40	1.49865096	0.03746627		
Corrected Total	71	9.50934283			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.842402	16.78557	0.193562	1.15314561

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.32932710	0.10977570	2.93	0.0451
REP(TRT)	8	5.51712391	0.68964049	18.41	0.0001
ALLEY	5	1.21088605	0.24217721	6.46	0.0002
TRT*ALLEY	15	0.95335480	0.06355699	1.70	0.0915

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.32932710	0.10977570	0.16	0.9208

Appendix 19. Analysis of variance table for plant height at 27 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	634.5309722	20.4687410	5.72	0.0001
Error	40	143.1888889	3.5797222		
Corrected Total	71	777.7198611			

R-Square	C.V.	Root MSE	AVEPH Mean
0.815886	10.91985	1.892015	17.3263889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	467.5104167	155.8368056	43.53	0.0001
REP(TRT)	8	63.0777778	7.8847222	2.20	0.0478
ALLEY	5	41.6706944	8.3341389	2.33	0.0602
TRT*ALLEY	15	62.2720833	4.1514722	1.16	0.3403

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	467.5104167	155.8368056	19.76	0.0005

Appendix 20. Analysis of variance table for transformed total weed dry weight at 30 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	2.73864350	0.08834334	1.22	0.2708
Error	40	2.88601911	0.07215048		
Corrected Total	71	5.62466261			

	R-Square	C.V.	Root MSE	TOTAL1 Mean
	0.486899	47.27221	0.268608	0.56821626

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.50257221	0.16752407	2.32	0.0897
REP(TRT)	8	1.01406819	0.12675852	1.76	0.1151
ALLEY	5	0.24721115	0.04944223	0.69	0.6373
TRT*ALLEY	15	0.97479195	0.06498613	0.90	0.5693

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.50257221	0.16752407	1.32	0.3333

Appendix 21. Analysis of variance table for transformed broadleaf weed dry weight at 30 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	2.26529103	0.07307390	2.95	0.0007
Error	40	0.98997316	0.02474933		
Corrected Total	71	3.25526419			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.695885	70.22566	0.157319	0.22401953

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.11706057	0.03902019	1.58	0.2100
REP(TRT)	8	0.50311721	0.06288965	2.54	0.0244
ALLEY	5	1.32899507	0.26579901	10.74	0.0001
TRT*ALLEY	15	0.31611818	0.02107455	0.85	0.6186

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.11706057	0.03902019	0.62	0.6212

Appendix 22. Analysis of variance table for transformed grass weed dry weight at 30 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	4.19513024	0.13532678	1.67	0.0627
Error	40	3.23521712	0.08088043		
Corrected Total	71	7.43034736			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.564594	66.23204	0.284395	0.42939167

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.87232952	0.29077651	3.60	0.0216
REP(TRT)	8	1.15889547	0.14486193	1.79	0.1077
ALLEY	5	0.96647999	0.19329600	2.39	0.0548
TRT*ALLEY	15	1.19742525	0.07982835	0.99	0.4860

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.87232952	0.29077651	2.01	0.1916

Appendix 23. Analysis of variance table for plant stand at 40 days after emergence of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	26989.43056	870.62679	1.67	0.0643
Error	40	20908.55556	522.71389		
Corrected Total	71	47897.98611			

R-Square	C.V.	Root MSE	PS Mean
0.563477	24.19714	22.86294	94.4861111

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	606.04167	202.01389	0.39	0.7633
REP(TRT)	8	3487.44444	435.93056	0.83	0.5783
ALLEY	5	12286.90278	2457.38056	4.70	0.0018
TRT*ALLEY	15	10609.04167	707.26944	1.35	0.2178

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	606.0416667	202.0138889	0.46	0.7157

Appendix 24. Analysis of variance table for tillers at 40 days after emergence of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	77886.76389	2512.47625	12.49	0.0001
Error	40	8049.22222	201.23056		
Corrected Total	71	85935.98611			

R-Square	C.V.	Root MSE	TIL Mean
0.906335	25.00273	14.18558	56.7361111

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	47936.70833	15978.90278	79.41	0.0001
REP(TRT)	8	4129.44444	516.18056	2.57	0.0233
ALLEY	5	20592.90278	4118.58056	20.47	0.0001
TRT*ALLEY	15	5227.70833	348.51389	1.73	0.0834

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	47936.70833	15978.90278	30.96	0.0001

Appendix 25. Analysis of variance table for plant height at 40 days after emergence of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1217.482083	39.273616	2.74	0.0015
Error	40	573.794444	14.344861		
Corrected Total	71	1791.276528			

R-Square	C.V.	Root MSE	AVEPH Mean
0.679673	16.34777	3.787461	23.1680556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	814.6793056	271.5597685	18.93	0.0001
REP(TRT)	8	166.6722222	20.8340278	1.45	0.2054
ALLEY	5	41.6956944	8.3391389	0.58	0.7140
TRT*ALLEY	15	194.4348611	12.9623241	0.90	0.5664

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	814.6793056	271.5597685	13.03	0.0019

Appendix 26. Analysis of variance table for transformed stemborer dead hearts at 40 days after emergence of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	9.79660318	0.31601946	8.45	0.0001
Error	40	1.49599728	0.03739993		
Corrected Total	71	11.29260046			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.867524	19.19916	0.193391	1.00728672

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.86955724	0.95651908	25.58	0.0001
REP(TRT)	8	0.50500923	0.06312615	1.69	0.1315
ALLEY	5	5.61315463	1.12263093	30.02	0.0001
TRT*ALLEY	15	0.80888208	0.05392547	1.44	0.1753

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.86955724	0.95651908	15.15	0.0012

Appendix 27. Analysis of variance table for transformed white grubs at 40 days after emergence of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: WG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	4.76962584	0.15385890	2.13	0.0124
Error	40	2.88717022	0.07217926		
Corrected Total	71	7.65679606			

R-Square	C.V.	Root MSE	WG1 Mean
0.622927	26.95107	0.268662	0.99685073

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.29309974	0.09769991	1.35	0.2708
REP(TRT)	8	1.08216248	0.13527031	1.87	0.0915
ALLEY	5	2.60920790	0.52184158	7.23	0.0001
TRT*ALLEY	15	0.78515572	0.05234371	0.73	0.7450

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.29309974	0.09769991	0.72	0.5664

Appendix 28. Analysis of variance table for plant stand and tillers at 80 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	109531.0972	3533.2612	4.41	0.0001
Error	40	32052.7778	801.3194		
Corrected Total	71	141583.8750			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.773613	23.94720	28.30759	118.208333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	36583.48611	12194.49537	15.22	0.0001
REP(TRT)	8	2571.22222	321.40278	0.40	0.9133
ALLEY	5	60071.45833	12014.29167	14.99	0.0001
TRT*ALLEY	15	10304.93056	686.99537	0.86	0.6127

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	36583.48611	12194.49537	37.94	0.0001

Appendix 29. Analysis of variance table for plant height at 80 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1716.733889	55.378513	3.45	0.0001
Error	40	642.518889	16.062972		
Corrected Total	71	2359.252778			

R-Square	C.V.	Root MSE	AVEPH Mean
0.727660	14.34939	4.007864	27.9305556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1349.178333	449.726111	28.00	0.0001
REP(TRT)	8	12.034444	1.504306	0.09	0.9992
ALLEY	5	32.751111	6.550222	0.41	0.8405
TRT*ALLEY	15	322.770000	21.518000	1.34	0.2250

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1349.178333	449.726111	298.96	0.0001

Appendix 30. Analysis of variance table for stemborer dead hearts at 80 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1.75572908	0.05663642	1.76	0.0467
Error	40	1.28905826	0.03222646		
Corrected Total	71	3.04478733			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.576634	129.1457	0.179517	0.13900370

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.78830656	0.26276885	8.15	0.0002
REP(TRT)	8	0.09827212	0.01228401	0.38	0.9244
ALLEY	5	0.43927847	0.08785569	2.73	0.0328
TRT*ALLEY	15	0.42987193	0.02865813	0.89	0.5807

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.78830656	0.26276885	21.39	0.0004

Appendix 31. Analysis of variance table for transformed white grubs at 80 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: WG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	7.83116234	0.25261814	3.03	0.0005
Error	40	3.33069763	0.08326744		
Corrected Total	71	11.16185997			

R-Square	C.V.	Root MSE	WG1 Mean
0.701600	46.23460	0.288561	0.62412340

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.24230156	0.41410052	4.97	0.0050
REP(TRT)	8	2.00013835	0.25001729	3.00	0.0098
ALLEY	5	2.94734472	0.58946894	7.08	0.0001
TRT*ALLEY	15	1.64137771	0.10942518	1.31	0.2391

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.24230156	0.41410052	1.66	0.2524

Appendix 32. Analysis of variance table for transformed percent stemborer damaged plants at 50 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SBL_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.42139110	0.01359326	1.60	0.0796
Error	40	0.33901961	0.00847549		
Corrected Total	71	0.76041071			

R-Square	C.V.	Root MSE	SBL_PS1 Mean
0.554163	136.5379	0.092062	0.06742630

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.18602887	0.06200962	7.32	0.0005
REP(TRT)	8	0.01926043	0.00240755	0.28	0.9674
ALLEY	5	0.06329330	0.01265866	1.49	0.2136
TRT*ALLEY	15	0.15280851	0.01018723	1.20	0.3098

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.18602887	0.06200962	25.76	0.0002

Appendix 33. Analysis of variance table for transformed percent stemborer damaged plants at 60 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SBL_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.73417601	0.02368310	2.12	0.0130
Error	40	0.44720489	0.01118012		
Corrected Total	71	1.18138090			

R-Square	C.V.	Root MSE	SBL_PS1 Mean
0.621456	123.4182	0.105736	0.08567301

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.39160481	0.13053494	11.68	0.0001
REP(TRT)	8	0.08993809	0.01124226	1.01	0.4472
ALLEY	5	0.08785930	0.01757186	1.57	0.1902
TRT*ALLEY	15	0.16477380	0.01098492	0.98	0.4902

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.39160481	0.13053494	11.61	0.0028

Appendix 34. Analysis of variance table for transformed percent stemborer damaged plants at 70 days after emergence in the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: SBL_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.89611513	0.02890694	4.63	0.0001
Error	40	0.24997546	0.00624939		
Corrected Total	71	1.14609060			

R-Square	C.V.	Root MSE	SBL_PS1 Mean
0.781889	96.86041	0.079053	0.08161546

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.42593550	0.14197850	22.72	0.0001
REP(TRT)	8	0.11822064	0.01477758	2.36	0.0347
ALLEY	5	0.11850333	0.02370067	3.79	0.0066
TRT*ALLEY	15	0.23345568	0.01556371	2.49	0.0109

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.42593550	0.14197850	9.61	0.0050

Appendix 35. Analysis of variance table for grain yield of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: GY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	22800961.65	735514.89	5.58	0.0001
Error	40	5269055.41	131726.39		
Corrected Total	71	28070017.06			

R-Square	C.V.	Root MSE	GY Mean
0.812289	56.20338	362.9413	645.764167

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	15867666.73	5289222.24	40.15	0.0001
REP(TRT)	8	1673539.08	209192.38	1.59	0.1592
ALLEY	5	2069647.71	413929.54	3.14	0.0174
TRT*ALLEY	15	3190108.13	212673.88	1.61	0.1132

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	15867666.73	5289222.24	25.28	0.0002

Appendix 37. Analysis of variance table for straw yield of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: STRAW

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	371282425.3	11976852.4	7.53	0.0001
Error	40	63645941.4	1591148.5		
Corrected Total	71	434928366.7			

R-Square	C.V.	Root MSE	TL Mean
0.853663	37.37503	1261.407	3375.00000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	315305406.7	105101802.2	66.05	0.0001
REP(TRT)	8	16401478.3	2050184.8	1.29	0.2770
ALLEY	5	14215367.1	2843073.4	1.79	0.1376
TRT*ALLEY	15	25360173.1	1690678.2	1.06	0.4183

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	315305406.7	105101802.2	51.26	0.0001

Appendix 36. Analysis of variance table for transformed total weed dry weight at harvest of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	3.47826159	0.11220199	1.18	0.3039
Error	40	3.78815016	0.09470375		
Corrected Total	71	7.26641174			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.478677	26.10412	0.307740	1.17889355

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.01677878	0.00559293	0.06	0.9809
REP(TRT)	8	1.03341993	0.12917749	1.36	0.2417
ALLEY	5	1.28925141	0.25785028	2.72	0.0329
TRT*ALLEY	15	1.13881147	0.07592076	0.80	0.6690

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.01677878	0.00559293	0.04	0.9871

Appendix 37. Analysis of variance table for transformed total weed dry weight at harvest of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	5.03549038	0.16243517	0.85	0.6791
Error	40	7.65579875	0.19139497		
Corrected Total	71	12.69128913			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.396767	64.28424	0.437487	0.68055109

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.36022412	0.12007471	0.63	0.6016
REP(TRT)	8	1.26794951	0.15849369	0.83	0.5831
ALLEY	5	1.18678961	0.23735792	1.24	0.3086
TRT*ALLEY	15	2.22052715	0.14803514	0.77	0.6973

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.36022412	0.12007471	0.76	0.5485

Appendix 38. Analysis of variance table for transformed total weed dry weight at harvest of the 1987 rice crop at site A, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	3.58825911	0.11575029	0.77	0.7778
Error	40	6.04917753	0.15122944		
Corrected Total	71	9.63743664			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.372325	40.98086	0.388882	0.94893628

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.54651526	0.18217175	1.20	0.3205
REP(TRT)	8	0.75936704	0.09492088	0.63	0.7496
ALLEY	5	1.12241804	0.22448361	1.48	0.2165
TRT*ALLEY	15	1.15995877	0.07733058	0.51	0.9195

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.54651526	0.18217175	1.92	0.2050

Appendix 39. Analysis of variance table for plant stand at 7 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	168744.5556	5443.3728	2.28	0.0074
Error	40	95685.4444	2392.1361		
Corrected Total	71	264430.0000			

R-Square	C.V.	Root MSE	PS Mean
0.638145	13.30267	48.90947	367.666667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	60931.11111	20310.37037	8.49	0.0002
REP(TRT)	8	54091.22222	6761.40278	2.83	0.0139
ALLEY	5	27520.50000	5504.10000	2.30	0.0628
TRT*ALLEY	15	26201.72222	1746.78148	0.73	0.7401

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	60931.11111	20310.37037	3.00	0.0949

Appendix 40. Analysis of variance table for transformed seedling maggot eggs at 7 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	4.96391359	0.16012624	4.88	0.0001
Error	40	1.31195870	0.03279897		
Corrected Total	71	6.27587229			

R-Square	C.V.	Root MSE	SME1 Mean
0.790952	14.84185	0.181105	1.22023116

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.26695846	1.08898615	33.20	0.0001
REP(TRT)	8	0.40852430	0.05106554	1.56	0.1689
ALLEY	5	0.61387704	0.12277541	3.74	0.0071
TRT*ALLEY	15	0.67455379	0.04497025	1.37	0.2086

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.26695846	1.08898615	21.33	0.0004

Appendix 41. Analysis of variance table for transformed seedling maggot dead hearts at 7 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	8.18626146	0.26407295	10.07	0.0001
Error	40	1.04891872	0.02622297		
Corrected Total	71	9.23518018			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.886421	14.26242	0.161935	1.13539689

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	6.00475324	2.00158441	76.33	0.0001
REP(TRT)	8	0.36622661	0.04577833	1.75	0.1176
ALLEY	5	0.71732921	0.14346584	5.47	0.0006
TRT*ALLEY	15	1.09795240	0.07319683	2.79	0.0049

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	6.00475324	2.00158441	43.72	0.0001

Appendix 42. Analysis of variance table for transformed seedling maggot eggs per plant at 7 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.00781470	0.00025209	4.42	0.0001
Error	40	0.00227930	0.00005698		
Corrected Total	71	0.01009400			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.774193	35.26440	0.007549	0.02140592

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00474962	0.00158321	27.78	0.0001
REP(TRT)	8	0.00049654	0.00006207	1.09	0.3905
ALLEY	5	0.00109160	0.00021832	3.83	0.0063
TRT*ALLEY	15	0.00147694	0.00009846	1.73	0.0842

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00474962	0.00158321	25.51	0.0002

Appendix 43. Analysis of variance table for plant stand at 14 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	101777.9861	3283.1608	1.71	0.0545
Error	40	76651.3333	1916.2833		
Corrected Total	71	178429.3194			

R-Square	C.V.	Root MSE	PS Mean
0.570411	12.02116	43.77537	364.152778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	11820.15278	3940.05093	2.06	0.1214
REP(TRT)	8	42411.33333	5301.41667	2.77	0.0156
ALLEY	5	25478.56944	5095.71389	2.66	0.0363
TRT*ALLEY	15	22067.93056	1471.19537	0.77	0.7031

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	11820.15278	3940.05093	0.74	0.5557

Appendix 44. Analysis of variance table for plant height at 14 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	108.3554167	3.4953360	2.91	0.0008
Error	40	48.0444444	1.2011111		
Corrected Total	71	156.3998611			

R-Square	C.V.	Root MSE	AVEPH Mean
0.692810	7.813502	1.095952	14.0263889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	75.66930556	25.22310185	21.00	0.0001
REP(TRT)	8	7.80888889	0.97611111	0.81	0.5957
ALLEY	5	13.34069444	2.66813889	2.22	0.0709
TRT*ALLEY	15	11.53652778	0.76910185	0.64	0.8235

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	75.66930556	25.22310185	25.84	0.0002

Appendix 45. Analysis of variance table for transformed seedling maggot eggs at 14 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	4.94103503	0.15938823	10.76	0.0001
Error	40	0.59272479	0.01481812		
Corrected Total	71	5.53375982			

R-Square	C.V.	Root MSE	SME1 Mean
0.892889	12.27943	0.121730	0.99133050

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.77721633	0.92573878	62.47	0.0001
REP(TRT)	8	1.31507381	0.16438423	11.09	0.0001
ALLEY	5	0.43247044	0.08649409	5.84	0.0004
TRT*ALLEY	15	0.41627446	0.02775163	1.87	0.0574

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.77721633	0.92573878	5.63	0.0226

Appendix 46. Analysis of variance table for transformed seedling maggot dead hearts at 14 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	7.33799841	0.23670963	13.58	0.0001
Error	40	0.69741804	0.01743545		
Corrected Total	71	8.03541645			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.913207	9.666220	0.132043	1.36602900

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5.35564633	1.78521544	102.39	0.0001
REP(TRT)	8	1.09418343	0.13677293	7.84	0.0001
ALLEY	5	0.70074470	0.14014894	8.04	0.0001
TRT*ALLEY	15	0.18742396	0.01249493	0.72	0.7533

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5.35564633	1.78521544	13.05	0.0019

Appendix 48. Analysis of variance table for transformed seedling maggot eggs per plant at 14 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.00370341	0.00011946	6.57	0.0001
Error	40	0.00072702	0.00001818		
Corrected Total	71	0.00443043			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.835903	34.03617	0.004263	0.01252573

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00144667	0.00048222	26.53	0.0001
REP(TRT)	8	0.00145546	0.00018193	10.01	0.0001
ALLEY	5	0.00029288	0.00005858	3.22	0.0154
TRT*ALLEY	15	0.00050840	0.00003389	1.86	0.0586

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00144667	0.00048222	2.65	0.1202

Appendix 49. Analysis of variance table for plant stand at 21 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	152579.4306	4921.9171	1.48	0.1190
Error	40	132592.4444	3314.8111		
Corrected Total	71	285171.8750			

R-Square	C.V.	Root MSE	PS Mean
0.535044	13.17115	57.57440	437.125000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	29331.81944	9777.27315	2.95	0.0442
REP(TRT)	8	57402.22222	7175.27778	2.16	0.0516
ALLEY	5	18014.79167	3602.95833	1.09	0.3824
TRT*ALLEY	15	47830.59722	3188.70648	0.96	0.5096

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	29331.81944	9777.27315	1.36	0.3219

Appendix 50. Analysis of variance table for plant height at 21 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	168.3554167	5.4308199	5.04	0.0001
Error	40	43.0711111	1.0767778		
Corrected Total	71	211.4265278			

R-Square	C.V.	Root MSE	AVEPH Mean
0.796283	7.247346	1.037679	14.3180556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	63.36597222	21.12199074	19.62	0.0001
REP(TRT)	8	22.58222222	2.82277778	2.62	0.0208
ALLEY	5	54.92402778	10.98480556	10.20	0.0001
TRT*ALLEY	15	27.48319444	1.83221296	1.70	0.0903

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	63.36597222	21.12199074	7.48	0.0104

Appendix 51. Analysis of variance table for transformed seedling maggot dead eggs at 21 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1.91762352	0.06185882	2.97	0.0007
Error	40	0.83264771	0.02081619		
Corrected Total	71	2.75027122			

R-Square	C.V.	Root MSE	SME1 Mean
0.697249	20.49045	0.144278	0.70412398

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.30901725	0.43633908	20.96	0.0001
REP(TRT)	8	0.23816270	0.02977034	1.43	0.2141
ALLEY	5	0.04246336	0.00849267	0.41	0.8404
TRT*ALLEY	15	0.32798020	0.02186535	1.05	0.4288

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.30901725	0.43633908	14.66	0.0013

Appendix 52. Analysis of variance table for transformed seedling maggot dead hearts at 21 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	4.45490407	0.14370658	11.67	0.0001
Error	40	0.49236904	0.01230923		
Corrected Total	71	4.94727311			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.900477	12.16222	0.110947	0.91222625

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.51085622	1.17028541	95.07	0.0001
REP(TRT)	8	0.47204731	0.05900591	4.79	0.0003
ALLEY	5	0.05564904	0.01112981	0.90	0.4879
TRT*ALLEY	15	0.41635151	0.02775677	2.25	0.0205

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.51085622	1.17028541	19.83	0.0005

Appendix 53. Analysis of variance table for transformed seedling maggot eggs per plant at 21 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	0.00041159	0.00001328	4.51	0.0001
Error	40	0.00011789	0.00000295		
Corrected Total	71	0.00052948			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.777352	36.98874	0.001717	0.00464123

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00024002	0.00008001	27.15	0.0001
REP(TRT)	8	0.00008992	0.00001124	3.81	0.0021
ALLEY	5	0.00000697	0.00000139	0.47	0.7942
TRT*ALLEY	15	0.00007468	0.00000498	1.69	0.0932

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00024002	0.00008001	7.12	0.0120

Appendix 54. Analysis of variance table for plant stand at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	65146.72222	2101.50717	1.58	0.0855
Error	40	53108.77778	1327.71944		
Corrected Total	71	118255.50000			

R-Square	C.V.	Root MSE	PS Mean
0.550898	15.71163	36.43788	231.916667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7340.27778	2446.75926	1.84	0.1549
REP(TRT)	8	14303.88889	1787.98611	1.35	0.2495
ALLEY	5	21186.50000	4237.30000	3.19	0.0162
TRT*ALLEY	15	22316.05556	1487.73704	1.12	0.3705

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7340.277778	2446.759259	1.37	0.3203

Appendix 55. Analysis of variance table for tillers at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	10017.76389	323.15367	2.28	0.0072
Error	40	5659.11111	141.47778		
Corrected Total	71	15676.87500			

R-Square	C.V.	Root MSE	TIL Mean
0.639015	42.54346	11.89444	27.9583333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5123.819444	1707.939815	12.07	0.0001
REP(TRT)	8	1373.555556	171.694444	1.21	0.3161
ALLEY	5	1626.625000	325.325000	2.30	0.0629
TRT*ALLEY	15	1893.763889	126.250926	0.89	0.5776

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5123.819444	1707.939815	9.95	0.0045

Appendix 56. Analysis of variance table for plant height at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1098.519861	35.436125	3.56	0.0001
Error	40	397.856667	9.946417		
Corrected Total	71	1496.376528			

R-Square	C.V.	Root MSE	AVEPH Mean
0.734120	12.19185	3.153794	25.8680556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	860.8415278	286.9471759	28.85	0.0001
REP(TRT)	8	29.0366667	3.6295833	0.36	0.9329
ALLEY	5	95.1040278	19.0208056	1.91	0.1138
TRT*ALLEY	15	113.5376389	7.5691759	0.76	0.7098

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	860.8415278	286.9471759	79.06	0.0001

Appendix 57. Analysis of variance table for transformed white grub at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TWG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	7.73923088	0.24965261	9.55	0.0001
Error	40	1.04597028	0.02614926		
Corrected Total	71	8.78520117			

R-Square	C.V.	Root MSE	TWG1 Mean
0.880940	18.56991	0.161707	0.87080316

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5.05231019	1.68410340	64.40	0.0001
REP(TRT)	8	0.55465919	0.06933240	2.65	0.0196
ALLEY	5	0.18055627	0.03611125	1.38	0.2520
TRT*ALLEY	15	1.95170523	0.13011368	4.98	0.0001

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5.05231019	1.68410340	24.29	0.0002

Appendix 58. Analysis of variance table for transformed total weed dry weight at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	3.73987646	0.12064118	1.10	0.3876
Error	40	4.40027413	0.11000685		
Corrected Total	71	8.14015059			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.459436	55.03175	0.331673	0.60269358

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.18860264	0.06286755	0.57	0.6371
REP(TRT)	8	0.78223170	0.09777896	0.89	0.5345
ALLEY	5	1.20762072	0.24152414	2.20	0.0738
TRT*ALLEY	15	1.56142140	0.10409476	0.95	0.5247

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.18860264	0.06286755	0.64	0.6087

Appendix 59. Analysis of variance table for transformed broadleaf weed dry weight at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	3.92102809	0.12648478	3.05	0.0005
Error	40	1.65955009	0.04148875		
Corrected Total	71	5.58057819			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.702620	95.01475	0.203688	0.21437500

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.34483670	0.11494557	2.77	0.0540
REP(TRT)	8	0.59881837	0.07485230	1.80	0.1049
ALLEY	5	1.80296237	0.36059247	8.69	0.0001
TRT*ALLEY	15	1.17441066	0.07829404	1.89	0.0553

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.34483670	0.11494557	1.54	0.2786

Appendix 60. Analysis of variance table for transformed grass weed dry weight at 40 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	5.96619189	0.19245780	1.69	0.0601
Error	40	4.56797506	0.11419938		
Corrected Total	71	10.53416695			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.566366	73.79849	0.337934	0.45791451

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.21536964	0.07178988	0.63	0.6008
REP(TRT)	8	1.45238513	0.18154814	1.59	0.1587
ALLEY	5	2.93602606	0.58720521	5.14	0.0010
TRT*ALLEY	15	1.36241107	0.09082740	0.80	0.6754

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.21536964	0.07178988	0.40	0.7599

Appendix 61. Analysis of variance table for plant stand and tillers at 60 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1073608.431	34632.530	2.95	0.0007
Error	40	469699.556	11742.489		
Corrected Total	71	1543307.986			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.695654	19.47171	108.3628	556.513889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	695741.3750	231913.7917	19.75	0.0001
REP(TRT)	8	147127.1111	18390.8889	1.57	0.1659
ALLEY	5	60956.4028	12191.2806	1.04	0.4087
TRT*ALLEY	15	169783.5417	11318.9028	0.96	0.5078

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	695741.3750	231913.7917	12.61	0.0021

Appendix 62. Analysis of variance table for plant height at 60 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	6521.073194	210.357200	2.71	0.0017
Error	40	3109.546667	77.738667		
Corrected Total	71	9630.619861			

R-Square	C.V.	Root MSE	AVEPH Mean
0.677119	20.01515	8.816953	44.0513889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3876.098194	1292.032731	16.62	0.0001
REP(TRT)	8	669.293333	83.661667	1.08	0.3990
ALLEY	5	1511.215694	302.243139	3.89	0.0058
TRT*ALLEY	15	464.465972	30.964398	0.40	0.9715

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3876.098194	1292.032731	15.44	0.0011

Appendix 63. Analysis of variance table for transformed stemborer dead hearts at 60 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	6.91647688	0.22311216	3.31	0.0002
Error	40	2.69414627	0.06735366		
Corrected Total	71	9.61062315			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.719670	39.25492	0.259526	0.66112948

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.42990884	0.47663628	7.08	0.0006
REP(TRT)	8	3.23450155	0.40431269	6.00	0.0001
ALLEY	5	0.98863221	0.19772644	2.94	0.0238
TRT*ALLEY	15	1.26343428	0.08422895	1.25	0.2774

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.42990884	0.47663628	1.18	0.3769

Appendix 64. Analysis of variance table for plant stand and tillers at 66 days atfer emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	919897.9444	29674.1272	6.75	0.0001
Error	40	175817.5556	4395.4389		
Corrected Total	71	1095715.5000			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.839541	13.07870	66.29811	506.916667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	662312.0556	220770.6852	50.23	0.0001
REP(TRT)	8	87849.7778	10981.2222	2.50	0.0266
ALLEY	5	31134.6667	6226.9333	1.42	0.2392
TRT*ALLEY	15	138601.4444	9240.0963	2.10	0.0310

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	662312.0556	220770.6852	20.10	0.0004

Appendix 65. Analysis of variance table for plant height at 66 days atfer emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	3342.975465	107.837918	5.80	0.0001
Error	40	744.034822	18.600871		
Corrected Total	71	4087.010287			

R-Square	C.V.	Root MSE	AVEPH Mean
0.817951	10.87999	4.312873	39.6404167

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1748.899460	582.966487	31.34	0.0001
REP(TRT)	8	525.374844	65.671856	3.53	0.0035
ALLEY	5	909.991712	181.998342	9.78	0.0001
TRT*ALLEY	15	158.709449	10.580630	0.57	0.8810

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1748.899460	582.966487	8.88	0.0063

Appendix 66. Analysis of variance table for transformed stemborer dead hearts at 66 days atfer emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	3.39239816	0.10943220	2.51	0.0033
Error	40	1.74520362	0.04363009		
Corrected Total	71	5.13760178			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.660308	85.35713	0.208878	0.24471086

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.79750521	0.59916840	13.73	0.0001
REP(TRT)	8	0.41870168	0.05233771	1.20	0.3239
ALLEY	5	0.32405601	0.06481120	1.49	0.2161
TRT*ALLEY	15	0.85213526	0.05680902	1.30	0.2460

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.79750521	0.59916840	11.45	0.0029

Appendix 67. Analysis of variance table for plant stand and tillers at 80 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	47944.77778	1546.60573	2.78	0.0013
Error	40	22258.33333	556.45833		
Corrected Total	71	70203.11111			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.682944	10.11937	23.58937	233.111111

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5524.11111	1841.37037	3.31	0.0296
REP(TRT)	8	11689.00000	1461.12500	2.63	0.0206
ALLEY	5	20949.27778	4189.85556	7.53	0.0001
TRT*ALLEY	15	9782.38889	652.15926	1.17	0.3313

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5524.111111	1841.370370	1.26	0.3513

Appendix 68. Analysis of variance table for plant height at 80 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	5154.000972	166.258096	5.32	0.0001
Error	40	1250.617778	31.265444		
Corrected Total	71	6404.618750			

R-Square	C.V.	Root MSE	AVEPH Mean
0.804732	10.49974	5.591551	53.2541667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2924.808194	974.936065	31.18	0.0001
REP(TRT)	8	343.922222	42.990278	1.38	0.2369
ALLEY	5	1633.442917	326.688583	10.45	0.0001
TRT*ALLEY	15	251.827639	16.788509	0.54	0.9033

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2924.808194	974.936065	22.68	0.0003

Appendix 69. Analysis of variance table for transformed white grub at 80 days after emergence of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTWG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	6.50409883	0.20980964	2.26	0.0080
Error	40	3.71881919	0.09297048		
Corrected Total	71	10.22291801			

R-Square	C.V.	Root MSE	TOTWG1 Mean
0.636227	34.83858	0.304911	0.87520966

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.94587864	0.64862621	6.98	0.0007
REP(TRT)	8	1.78391667	0.22298958	2.40	0.0324
ALLEY	5	0.36756870	0.07351374	0.79	0.5627
TRT*ALLEY	15	2.40673481	0.16044899	1.73	0.0847

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.94587864	0.64862621	2.91	0.1010

Appendix 70. Analysis of variance table for straw dry weight of top two rows at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TRDW

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	70876828.78	2286349.32	1.17	0.3192
Error	40	78334245.67	1958356.14		
Corrected Total	71	149211074.44			

R-Square	C.V.	Root MSE	TRDW Mean
0.475011	63.28526	1399.413	2211.27778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	12543049.11	4181016.37	2.13	0.1110
REP(TRT)	8	23094807.00	2886850.88	1.47	0.1973
ALLEY	5	9132692.11	1826538.42	0.93	0.4702
TRT*ALLEY	15	26106280.56	1740418.70	0.89	0.5812

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	12543049.11	4181016.37	1.45	0.2995

Appendix 71. Analysis of variance table for straw dry weight of middle two rows at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: MRDW

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	326966581.2	10547309.1	2.98	0.0007
Error	40	141665806.4	3541645.2		
Corrected Total	71	468632387.7			

R-Square	C.V.	Root MSE	MRDW Mean
0.697704	31.22787	1881.926	6026.43056

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	94689096.3	31563032.1	8.91	0.0001
REP(TRT)	8	26921627.6	3365203.4	0.95	0.4875
ALLEY	5	136770301.2	27354060.2	7.72	0.0001
TRT*ALLEY	15	68585556.2	4572370.4	1.29	0.2525

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	94689096.26	31563032.09	9.38	0.0054

Appendix 72. Analysis of variance table for straw dry weight of bottom two rows at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: BRDW

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	144325337.4	4655656.0	0.95	0.5528
Error	40	195817642.3	4895441.1		
Corrected Total	71	340142979.8			

R-Square	C.V.	Root MSE	BRDW Mean
0.424308	68.39340	2212.564	3235.05556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	30143815.78	10047938.59	2.05	0.1219
REP(TRT)	8	50468375.00	6308546.87	1.29	0.2769
ALLEY	5	20034841.44	4006968.29	0.82	0.5438
TRT*ALLEY	15	43678305.22	2911887.01	0.59	0.8613

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	30143815.78	10047938.59	1.59	0.2658

Appendix 73. Analysis of variance table for total straw dry weight at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTDW

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	65310709.11	2106797.07	4.23	0.0001
Error	40	19904276.89	497606.92		
Corrected Total	71	85214986.00			

R-Square	C.V.	Root MSE	TOTDW Mean
0.766423	19.00187	705.4126	3712.33333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	29203170.56	9734390.19	19.56	0.0001
REP(TRT)	8	11377032.44	1422129.06	2.86	0.0130
ALLEY	5	16610380.67	3322076.13	6.68	0.0001
TRT*ALLEY	15	8120125.44	541341.70	1.09	0.3970

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	29203170.56	9734390.19	6.84	0.0134

Appendix 74. Analysis of variance table for grain yield of top two rows at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: GYTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	5734402.603	184980.729	2.34	0.0060
Error	40	3164622.335	79115.558		
Corrected Total	71	8899024.938			

R-Square	C.V.	Root MSE	GYTR Mean
0.644385	50.36080	281.2749	558.519444

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2645614.822	881871.607	11.15	0.0001
REP(TRT)	8	1111681.629	138960.204	1.76	0.1152
ALLEY	5	795056.460	159011.292	2.01	0.0980
TRT*ALLEY	15	1182049.692	78803.313	1.00	0.4776

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2645614.822	881871.607	6.35	0.0165

Appendix 75. Analysis of variance table for grain yield of middle two rows at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: GYMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	75161852.17	2424575.88	3.52	0.0001
Error	40	27562074.57	689051.86		
Corrected Total	71	102723926.75			

R-Square	C.V.	Root MSE	GYMR Mean
0.731688	42.27893	830.0915	1963.36903

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	19982516.52	6660838.84	9.67	0.0001
REP(TRT)	8	7683266.25	960408.28	1.39	0.2289
ALLEY	5	40426798.32	8085359.66	11.73	0.0001
TRT*ALLEY	15	7069271.08	471284.74	0.68	0.7843

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	19982516.52	6660838.84	6.94	0.0129

Appendix 76. Analysis of variance table for grain yield of bottom two rows at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: GYBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	10091319.63	325526.44	2.27	0.0075
Error	40	5725698.55	143142.46		
Corrected Total	71	15817018.18			

R-Square	C.V.	Root MSE	GYBR Mean
0.638004	41.41321	378.3417	913.577500

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5924786.695	1974928.898	13.80	0.0001
REP(TRT)	8	2159852.505	269981.563	1.89	0.0894
ALLEY	5	250037.834	50007.567	0.35	0.8796
TRT*ALLEY	15	1756642.600	117109.507	0.82	0.6523

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5924786.695	1974928.898	7.32	0.0111

Appendix 77. Analysis of variance table for total grain yield at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTGY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	18555209.10	598555.13	6.35	0.0001
Error	40	3768497.58	94212.44		
Corrected Total	71	22323706.68			

R-Square	C.V.	Root MSE	TOTGY Mean
0.831189	25.62278	306.9404	1197.92000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7042228.781	2347409.594	24.92	0.0001
REP(TRT)	8	1328649.016	166081.127	1.76	0.1137
ALLEY	5	9138137.832	1827627.566	19.40	0.0001
TRT*ALLEY	15	1046193.472	69746.231	0.74	0.7303

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7042228.781	2347409.594	14.13	0.0015

Appendix 78. Analysis of variance table for transformed total weed dry weight at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	2.55208307	0.08232526	2.89	0.0009
Error	40	1.14083926	0.02852098		
Corrected Total	71	3.69292232			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.691074	10.92032	0.168882	1.54648957

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.34156244	0.11385415	3.99	0.0141
REP(TRT)	8	0.41922981	0.05240373	1.84	0.0984
ALLEY	5	1.23480852	0.24696170	8.66	0.0001
TRT*ALLEY	15	0.55648230	0.03709882	1.30	0.2467

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.34156244	0.11385415	2.17	0.1692

Appendix 79. Analysis of variance table for transformed total broadleaf weed dry weight at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	12.90905159	0.41642102	6.54	0.0001
Error	40	2.54634403	0.06365860		
Corrected Total	71	15.45539562			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.835246	30.00205	0.252307	0.84096437

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8.12229076	2.70743025	42.53	0.0001
REP(TRT)	8	1.40487771	0.17560971	2.76	0.0159
ALLEY	5	1.65022856	0.33004571	5.18	0.0009
TRT*ALLEY	15	1.73165456	0.11544364	1.81	0.0672

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8.12229076	2.70743025	15.42	0.0011

Appendix 80. Analysis of variance table for transformed total broadleaf weed dry weight at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	4.64432656	0.14981699	2.38	0.0052
Error	40	2.52195218	0.06304880		
Corrected Total	71	7.16627875			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.648081	18.20961	0.251095	1.37891590

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.53131137	0.51043712	8.10	0.0002
REP(TRT)	8	0.32059338	0.04007417	0.64	0.7430
ALLEY	5	1.93745642	0.38749128	6.15	0.0003
TRT*ALLEY	15	0.85496539	0.05699769	0.90	0.5660

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.53131137	0.51043712	12.74	0.0021

Appendix 81. Analysis of variance table for transformed total abundance at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1.32220848	0.04265189	1.82	0.0375
Error	40	0.93745682	0.02343642		
Corrected Total	71	2.25966530			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.585135	9.388136	0.153090	1.63067065

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.23357723	0.07785908	3.32	0.0292
REP(TRT)	8	0.29325007	0.03665626	1.56	0.1666
ALLEY	5	0.52500283	0.10500057	4.48	0.0025
TRT*ALLEY	15	0.27037835	0.01802522	0.77	0.7017

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.23357723	0.07785908	2.12	0.1754

Appendix 82. Analysis of variance table for transformed broadleaf abundance at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	13.19066393	0.42550529	4.04	0.0001
Error	40	4.20889521	0.10522238		
Corrected Total	71	17.39955914			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.758103	33.26322	0.324380	0.97519113

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7.29703887	2.43234629	23.12	0.0001
REP(TRT)	8	1.21914902	0.15239363	1.45	0.2070
ALLEY	5	3.68956776	0.73791355	7.01	0.0001
TRT*ALLEY	15	0.98490828	0.06566055	0.62	0.8375

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7.29703887	2.43234629	15.96	0.0010

Appendix 83. Analysis of variance table for transformed grass abundance at harvest of the 1988 rice crop at site A, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	1.95793318	0.06315913	1.34	0.1892
Error	40	1.88283503	0.04707088		
Corrected Total	71	3.84076821			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.509776	15.06641	0.216958	1.44001257

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.78907805	0.26302602	5.59	0.0027
REP(TRT)	8	0.21350768	0.02668846	0.57	0.7984
ALLEY	5	0.25750439	0.05150088	1.09	0.3787
TRT*ALLEY	15	0.69784305	0.04652287	0.99	0.4848

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.78907805	0.26302602	9.86	0.0046

Appendix 84. Analysis of variance table for plant stand at 7 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	83786.17593	1948.51572	1.26	0.1970
Error	64	98869.25926	1544.83218		
Corrected Total	107	182655.43519			

R-Square	C.V.	Root MSE	PS Mean
0.458712	38.39079	39.30435	102.379630

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	17650.91667	5883.63889	3.81	0.0141
REP(TRT)	8	19257.40741	2407.17593	1.56	0.1553
ALLEY	8	18722.35185	2340.29398	1.51	0.1697
TRT*ALLEY	24	28155.50000	1173.14583	0.76	0.7701

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	17650.91667	5883.63889	2.44	0.1389

Appendix 85. Analysis of variance table for transformed seedling maggot eggs at 7 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.95793738	0.04553343	1.68	0.0298
Error	64	1.73808034	0.02715751		
Corrected Total	107	3.69601773			

R-Square	C.V.	Root MSE	SME1 Mean
0.529742	9.217898	0.164795	1.78777567

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.51802828	0.17267609	6.36	0.0008
REP(TRT)	8	0.56959418	0.07119927	2.62	0.0151
ALLEY	8	0.29503498	0.03687937	1.36	0.2321
TRT*ALLEY	24	0.57527994	0.02397000	0.88	0.6223

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.51802828	0.17267609	2.43	0.1407

Appendix 86. Analysis of variance table for transformed seedling maggot dead hearts at 7 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.69162238	0.06259587	2.26	0.0015
Error	64	1.77263844	0.02769748		
Corrected Total	107	4.46426083			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.602927	11.31603	0.166426	1.47070710

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.01333613	0.33777871	12.20	0.0001
REP(TRT)	8	0.72494310	0.09061789	3.27	0.0035
ALLEY	8	0.42333841	0.05291730	1.91	0.0736
TRT*ALLEY	24	0.53000475	0.02208353	0.80	0.7263

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.01333613	0.33777871	3.73	0.0607

Appendix 87. Analysis of variance table for transformed seedling maggot eggs per plant at 7 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.23523061	0.00547048	2.76	0.0001
Error	64	0.12668054	0.00197938		
Corrected Total	107	0.36191116			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.649968	20.32862	0.044490	0.21885531

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.05231752	0.01743917	8.81	0.0001
REP(TRT)	8	0.03851178	0.00481397	2.43	0.0231
ALLEY	8	0.08384986	0.01048123	5.30	0.0001
TRT*ALLEY	24	0.06055146	0.00252298	1.27	0.2188

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.05231752	0.01743917	3.62	0.0646

Appendix 88. Analysis of variance table for plant stand at 14 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	58966.62037	1371.31675	1.71	0.0250
Error	64	51262.29630	800.97338		
Corrected Total	107	110228.91667			

R-Square	C.V.	Root MSE	PS Mean
0.534947	27.87560	28.30147	101.527778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8878.32407	2959.44136	3.69	0.0162
REP(TRT)	8	21897.70370	2737.21296	3.42	0.0025
ALLEY	8	11446.66667	1430.83333	1.79	0.0962
TRT*ALLEY	24	16743.92593	697.66358	0.87	0.6367

Tests of Hypotheses using the Anova MS for TRT*ALLEY as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8878.324074	2959.441358	4.24	0.0154

Appendix 89. Analysis of variance table for transformed seedling maggot eggs at 14 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.32304664	0.03076853	1.28	0.1842
Error	64	1.54090981	0.02407672		
Corrected Total	107	2.86395645			

R-Square	C.V.	Root MSE	SME1 Mean
0.461965	8.732381	0.155167	1.77691202

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.31074236	0.10358079	4.30	0.0079
REP(TRT)	8	0.24518809	0.03064851	1.27	0.2734
ALLEY	8	0.21731701	0.02716463	1.13	0.3568
TRT*ALLEY	24	0.54979918	0.02290830	0.95	0.5374

Tests of Hypotheses using the Anova MS for TRT*ALLEY as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.31074236	0.10358079	4.52	0.0119

Appendix 90. Analysis of variance table for transformed seedling maggot dead hearts at 14 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.95369406	0.02217893	1.53	0.0609
Error	64	0.92881130	0.01451268		
Corrected Total	107	1.88250536			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.506609	7.775038	0.120469	1.54942737

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.24044419	0.08014806	5.52	0.0020
REP(TRT)	8	0.20837280	0.02604660	1.79	0.0945
ALLEY	8	0.14795538	0.01849442	1.27	0.2727
TRT*ALLEY	24	0.35692169	0.01487174	1.02	0.4509

Tests of Hypotheses using the Anova MS for TRT*ALLEY as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.24044419	0.08014806	5.39	0.0056

Appendix 91. Analysis of variance table for transformed seedling maggot eggs per plant at 14 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.15759108	0.00366491	1.68	0.0295
Error	64	0.13974320	0.00218349		
Corrected Total	107	0.29733428			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.530013	22.15397	0.046728	0.21092297

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.02444258	0.00814753	3.73	0.0155
REP(TRT)	8	0.04483942	0.00560493	2.57	0.0171
ALLEY	8	0.04142175	0.00517772	2.37	0.0265
TRT*ALLEY	24	0.04688733	0.00195364	0.89	0.6073

Tests of Hypotheses using the Anova MS for TRT*ALLEY as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.02444258	0.00814753	4.17	0.0164

Appendix 92. Analysis of variance table for plant stand at 26 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	162185.8148	3771.7631	2.79	0.0001
Error	64	86579.8519	1352.8102		
Corrected Total	107	248765.6667			

R-Square	C.V.	Root MSE	PS Mean
0.651962	25.24019	36.78057	145.722222

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	39224.62963	13074.87654	9.66	0.0001
REP(TRT)	8	82500.14815	10312.51852	7.62	0.0001
ALLEY	8	12007.83333	1500.97917	1.11	0.3689
TRT*ALLEY	24	28453.20370	1185.55015	0.88	0.6301

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	39224.62963	13074.87654	1.27	0.3490

Appendix 93. Analysis of variance table for tillers at 26 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	62889.13889	1462.53811	3.09	0.0001
Error	64	30333.77778	473.96528		
Corrected Total	107	93222.91667			

R-Square	C.V.	Root MSE	TIL Mean
0.674610	40.71412	21.77074	53.4722222

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	20811.58333	6937.19444	14.64	0.0001
REP(TRT)	8	28100.22222	3512.52778	7.41	0.0001
ALLEY	8	4765.50000	595.68750	1.26	0.2819
TRT*ALLEY	24	9211.83333	383.82639	0.81	0.7114

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	20811.58333	6937.19444	1.97	0.1964

Appendix 94. Analysis of variance table for plant height at 26 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	237.1247222	5.5145284	2.76	0.0001
Error	64	127.7051852	1.9953935		
Corrected Total	107	364.8299074			

R-Square	C.V.	Root MSE	AVEPH Mean
0.649960	9.481019	1.412584	14.8990741

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	63.77064815	21.25688272	10.65	0.0001
REP(TRT)	8	88.38814815	11.04851852	5.54	0.0001
ALLEY	8	5.53740741	0.69217593	0.35	0.9439
TRT*ALLEY	24	79.42851852	3.30952160	1.66	0.0561

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	63.77064815	21.25688272	1.92	0.2043

Appendix 95. Analysis of variance table for transformed seedling maggot dead hearts at 26 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	4.29441201	0.09987005	2.18	0.0022
Error	64	2.92810956	0.04575171		
Corrected Total	107	7.22252157			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.594586	18.18509	0.213896	1.17621896

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.39391214	0.13130405	2.87	0.0432
REP(TRT)	8	2.21924533	0.27740567	6.06	0.0001
ALLEY	8	0.62257125	0.07782141	1.70	0.1153
TRT*ALLEY	24	1.05868328	0.04411180	0.96	0.5221

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.39391214	0.13130405	0.47	0.7094

Appendix 96. Analysis of variance table for transformed total weed dry weight at 30 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	5.97541790	0.13896321	2.31	0.0011
Error	64	3.84182456	0.06002851		
Corrected Total	107	9.81724246			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.608666	46.30145	0.245007	0.52915659

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.55373184	0.51791061	8.63	0.0001
REP(TRT)	8	1.18063482	0.14757935	2.46	0.0218
ALLEY	8	1.35613292	0.16951662	2.82	0.0095
TRT*ALLEY	24	1.88491833	0.07853826	1.31	0.1961

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.55373184	0.51791061	3.51	0.0691

Appendix 97. Analysis of variance table for transformed broadleaf weed dry weight at 30 days after emergence of the 1987 rice crop at site B. Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	6.53145648	0.15189434	2.54	0.0003
Error	64	3.82254508	0.05972727		
Corrected Total	107	10.35400156			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.630815	52.05145	0.244392	0.46951938

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.13562727	0.71187576	11.92	0.0001
REP(TRT)	8	1.08851023	0.13606378	2.28	0.0327
ALLEY	8	1.14587659	0.14323457	2.40	0.0250
TRT*ALLEY	24	2.16144238	0.09006010	1.51	0.0982

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.13562727	0.71187576	5.23	0.0273

Appendix 98. Analysis of variance table for transformed grass weed dry weight at 30 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.81964972	0.04231744	1.80	0.0165
Error	64	1.50827356	0.02356677		
Corrected Total	107	3.32792328			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.546782	111.0787	0.153515	0.13820361

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.17831183	0.05943728	2.52	0.0656
REP(TRT)	8	0.60561800	0.07570225	3.21	0.0040
ALLEY	8	0.31739053	0.03967382	1.68	0.1197
TRT*ALLEY	24	0.71832936	0.02993039	1.27	0.2220

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.17831183	0.05943728	0.79	0.5350

Appendix 99. Analysis of variance table for transformed *Mimosa invisa* dry weight at 30 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: MI1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.04305314	0.07076868	2.25	0.0016
Error	64	2.01587591	0.03149806		
Corrected Total	107	5.05892905			

R-Square	C.V.	Root MSE	MI1 Mean
0.601521	71.24244	0.177477	0.24911685

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.82559777	0.27519926	8.74	0.0001
REP(TRT)	8	0.31319531	0.03914941	1.24	0.2893
ALLEY	8	0.93271968	0.11658996	3.70	0.0013
TRT*ALLEY	24	0.97154038	0.04048085	1.29	0.2114

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.82559777	0.27519926	7.03	0.0124

Appendix 100. Analysis of variance table for plant stand at 40 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	33817.06481	786.44337	3.31	0.0001
Error	64	15203.92593	237.56134		
Corrected Total	107	49020.99074			

R-Square	C.V.	Root MSE	PS Mean
0.689849	28.27598	15.41303	54.5092593

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2963.13889	987.71296	4.16	0.0094
REP(TRT)	8	2260.07407	282.50926	1.19	0.3196
ALLEY	8	17855.57407	2231.94676	9.40	0.0001
TRT*ALLEY	24	10738.27778	447.42824	1.88	0.0234

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2963.138889	987.712963	3.50	0.0697

Appendix 101. Analysis of variance table for tillers at 40 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	18581.95370	432.13846	1.90	0.0099
Error	64	14587.70370	227.93287		
Corrected Total	107	33169.65741			

R-Square	C.V.	Root MSE	TIL Mean
0.560209	28.12703	15.09745	53.6759259

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1871.58333	623.86111	2.74	0.0507
REP(TRT)	8	1693.62963	211.70370	0.93	0.4992
ALLEY	8	3783.40741	472.92593	2.07	0.0513
TRT*ALLEY	24	11233.33333	468.05556	2.05	0.0118

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1871.583333	623.861111	2.95	0.0985

Appendix 102. Analysis of variance table for plant height at 40 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	408.4685185	9.4992679	1.26	0.1983
Error	64	482.6214815	7.5409606		
Corrected Total	107	891.0900000			

R-Square	C.V.	Root MSE	AVEPH Mean
0.458392	14.61977	2.746081	18.7833333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	9.9470370	3.3156790	0.44	0.7254
REP(TRT)	8	146.0718519	18.2589815	2.42	0.0237
ALLEY	8	100.6133333	12.5766667	1.67	0.1237
TRT*ALLEY	24	151.8362963	6.3265123	0.84	0.6762

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	9.94703704	3.31567901	0.18	0.9059

Appendix 103. Analysis of variance table for transformed stemborer dead hearts at 40 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.31410065	0.05381629	1.69	0.0280
Error	64	2.03931993	0.03186437		
Corrected Total	107	4.35342058			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.531559	15.28480	0.178506	1.16786568

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.38271360	0.12757120	4.00	0.0112
REP(TRT)	8	0.24278522	0.03034815	0.95	0.4808
ALLEY	8	0.83151340	0.10393918	3.26	0.0035
TRT*ALLEY	24	0.85708843	0.03571202	1.12	0.3486

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.38271360	0.12757120	4.20	0.0463

Appendix 104. Analysis of variance table for transformed percent stemborer damaged plants at 40 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SBL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.63246404	0.08447591	1.28	0.1835
Error	64	4.22761458	0.06605648		
Corrected Total	107	7.86007862			

R-Square	C.V.	Root MSE	SBL1 Mean
0.462141	32.95850	0.257015	0.77981257

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.38021527	0.12673842	1.92	0.1354
REP(TRT)	8	0.41994377	0.05249297	0.79	0.6093
ALLEY	8	0.64677829	0.08084729	1.22	0.2998
TRT*ALLEY	24	2.18552671	0.09106361	1.38	0.1549

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.38021527	0.12673842	2.41	0.1418

Appendix 105. Analysis of variance table for transformed white grub at 40 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: WG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.93987023	0.04511326	0.95	0.5615
Error	64	3.03094506	0.04735852		
Corrected Total	107	4.97081529			

R-Square	C.V.	Root MSE	WG1 Mean
0.390252	174.1517	0.217620	0.12496007

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.04424737	0.01474912	0.31	0.8170
REP(TRT)	8	0.13830715	0.01728839	0.37	0.9351
ALLEY	8	0.90934395	0.11366799	2.40	0.0248
TRT*ALLEY	24	0.84797177	0.03533216	0.75	0.7849

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.04424737	0.01474912	0.85	0.5031

Appendix 106. Analysis of variance table for transformed percent stemborer damaged plants at 50 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SBL_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.60890722	0.08392807	2.19	0.0022
Error	64	2.45798656	0.03840604		
Corrected Total	107	6.06689378			

R-Square	C.V.	Root MSE	SBL_PS1 Mean
0.594853	96.74056	0.195975	0.20257747

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.11024584	0.37008195	9.64	0.0001
REP(TRT)	8	0.35175616	0.04396952	1.14	0.3464
ALLEY	8	1.27646132	0.15955767	4.15	0.0005
TRT*ALLEY	24	0.87044389	0.03626850	0.94	0.5461

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.11024584	0.37008195	8.42	0.0074

Appendix 107. Analysis of variance table for transformed percent stemborer damaged plants at 60 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SBL_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.95319813	0.06867903	4.35	0.0001
Error	64	1.01081475	0.01579398		
Corrected Total	107	3.96401288			

R-Square	C.V.	Root MSE	SBL_PS1 Mean
0.745002	79.57855	0.125674	0.15792460

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.01095929	0.33698643	21.34	0.0001
REP(TRT)	8	0.33905873	0.04238234	2.68	0.0131
ALLEY	8	0.85867492	0.10733437	6.80	0.0001
TRT*ALLEY	24	0.74450519	0.03102105	1.96	0.0169

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.01095929	0.33698643	7.95	0.0087

Appendix 108. Analysis of variance table for transformed percent stemborer damaged plants at 70 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: SBL_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.63092432	0.03792847	1.81	0.0156
Error	64	1.34397828	0.02099966		
Corrected Total	107	2.97490260			

R-Square	C.V.	Root MSE	SBL_PS1 Mean
0.548228	105.7962	0.144913	0.13697335

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.46179908	0.15393303	7.33	0.0003
REP(TRT)	8	0.23367571	0.02920946	1.39	0.2176
ALLEY	8	0.26324839	0.03290605	1.57	0.1525
TRT*ALLEY	24	0.67220114	0.02800838	1.33	0.1802

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.46179908	0.15393303	5.27	0.0268

Appendix 109. Analysis of variance table for plant stand at 80 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	12028.84259	279.74053	1.51	0.0677
Error	64	11891.40741	185.80324		
Corrected Total	107	23920.25000			

R-Square	C.V.	Root MSE	PS Mean
0.502873	22.68677	13.63097	60.0833333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1857.212963	619.070988	3.33	0.0249
REP(TRT)	8	2882.592593	360.324074	1.94	0.0691
ALLEY	8	4183.166667	522.895833	2.81	0.0097
TRT*ALLEY	24	3105.870370	129.411265	0.70	0.8365

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1857.212963	619.070988	1.72	0.2402

Appendix 110. Analysis of variance table for tillers at 80 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	134139.5185	3119.5237	2.75	0.0001
Error	64	72579.3333	1134.0521		
Corrected Total	107	206718.8519			

R-Square	C.V.	Root MSE	TIL Mean
0.648898	23.63821	33.67569	142.462963

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8445.51852	2815.17284	2.48	0.0688
REP(TRT)	8	6418.00000	802.25000	0.71	0.6839
ALLEY	8	93018.85185	11627.35648	10.25	0.0001
TRT*ALLEY	24	26257.14815	1094.04784	0.96	0.5214

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8445.518519	2815.172840	3.51	0.0691

Appendix 111. Analysis of variance table for transformed panicles at 80 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: PA1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	7.46798625	0.17367410	1.46	0.0818
Error	64	7.59020849	0.11859701		
Corrected Total	107	15.05819474			

R-Square	C.V.	Root MSE	PA1 Mean
0.495942	93.40753	0.344379	0.36868457

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.37219247	0.12406416	1.05	0.3783
REP(TRT)	8	1.79322637	0.22415330	1.89	0.0769
ALLEY	8	2.22806304	0.27850788	2.35	0.0279
TRT*ALLEY	24	3.07450437	0.12810435	1.08	0.3901

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.37219247	0.12406416	0.55	0.6601

Appendix 112. Analysis of variance table for plant height at 80 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3173.755833	73.808275	1.94	0.0078
Error	64	2430.680741	37.979387		
Corrected Total	107	5604.436574			

R-Square	C.V.	Root MSE	AVEPH Mean
0.566293	12.58154	6.162742	48.9824074

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	134.577315	44.859105	1.18	0.3240
REP(TRT)	8	168.699259	21.087407	0.56	0.8102
ALLEY	8	2086.117407	260.764676	6.87	0.0001
TRT*ALLEY	24	784.361852	32.681744	0.86	0.6497

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	134.5773148	44.8591049	2.13	0.1750

Appendix 113. Analysis of variance table for transformed white grub at 80 days after emergence of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: WG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.41748230	0.07947633	2.27	0.0014
Error	64	2.23708444	0.03495444		
Corrected Total	107	5.65456674			

R-Square	C.V.	Root MSE	WG1 Mean
0.604376	116.9021	0.186961	0.15992958

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.26079675	0.08693225	2.49	0.0684
REP(TRT)	8	0.27131994	0.03391499	0.97	0.4671
ALLEY	8	1.66538205	0.20817276	5.96	0.0001
TRT*ALLEY	24	1.21998355	0.05083265	1.45	0.1190

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.26079675	0.08693225	2.56	0.1277

Appendix 114. Analysis of variance table for straw yield of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: Straw

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	147999239.6	3441842.8	3.63	0.0001
Error	64	60600754.2	946886.8		
Corrected Total	107	208599993.8			

R-Square	C.V.	Root MSE	Straw Mean
0.709488	22.67217	973.0811	4291.96315

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	91606895.87	30535631.96	32.25	0.0001
REP(TRT)	8	14728992.40	1841124.05	1.94	0.0684
ALLEY	8	22557393.94	2819674.24	2.98	0.0067
TRT*ALLEY	24	19105957.38	796081.56	0.84	0.6740

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	91606895.87	30535631.96	16.59	0.0009

Appendix 115. Analysis of variance table for grain yield of the 1987 rice crop at site B, Claveria, Philippines

Dependent Variable: GY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	5753188.527	133795.082	1.51	0.0661
Error	64	5668887.744	88576.371		
Corrected Total	107	11422076.272			

R-Square	C.V.	Root MSE	GY Mean
0.503690	27.77440	297.6178	1071.55463

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2572388.202	857462.734	9.68	0.0001
REP(TRT)	8	698223.861	87277.983	0.99	0.4558
ALLEY	8	961721.344	120215.168	1.36	0.2325
TRT*ALLEY	24	1520855.120	63368.963	0.72	0.8175

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2572388.202	857462.734	9.82	0.0047

Appendix 116. Analysis of variance table for plant stand at 7 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	148747.9537	3459.2547	1.21	0.2424
Error	64	183160.2963	2861.8796		
Corrected Total	107	331908.2500			

R-Square	C.V.	Root MSE	PS Mean
0.448160	18.42062	53.49654	290.416667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	36728.10185	12242.70062	4.28	0.0082
REP(TRT)	8	37067.70370	4633.46296	1.62	0.1370
ALLEY	8	22073.66667	2759.20833	0.96	0.4718
TRT*ALLEY	24	52878.48148	2203.27006	0.77	0.7582

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	36728.10185	12242.70062	2.64	0.1209

Appendix 117. Analysis of variance table for transformed seedling maggot eggs at 7 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.86069442	0.06652778	2.51	0.0004
Error	64	1.69506216	0.02648535		
Corrected Total	107	4.55575658			

R-Square	C.V.	Root MSE	SME1 Mean
0.627930	29.66182	0.162743	0.54866213

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.03754554	0.34584851	13.06	0.0001
REP(TRT)	8	0.48016539	0.06002067	2.27	0.0336
ALLEY	8	0.44144803	0.05518100	2.08	0.0504
TRT*ALLEY	24	0.90153546	0.03756398	1.42	0.1350

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.03754554	0.34584851	5.76	0.0213

Appendix 118. Analysis of variance table for transformed seedling maggot dead hearts at 7 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.20066708	0.05117830	1.37	0.1229
Error	64	2.38449860	0.03725779		
Corrected Total	107	4.58516569			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.479954	72.07576	0.193023	0.26780540

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.16431984	0.05477328	1.47	0.2310
REP(TRT)	8	0.60899366	0.07612421	2.04	0.0550
ALLEY	8	0.73062449	0.09132806	2.45	0.0221
TRT*ALLEY	24	0.69672910	0.02903038	0.78	0.7475

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.16431984	0.05477328	0.72	0.5678

Appendix 119. Analysis of variance table for transformed seedling maggot eggs per plant at 7 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.00105849	0.00002462	1.46	0.0832
Error	64	0.00107839	0.00001685		
Corrected Total	107	0.00213687			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.495344	87.48140	0.004105	0.00469225

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00016327	0.00005442	3.23	0.0281
REP(TRT)	8	0.00026168	0.00003271	1.94	0.0688
ALLEY	8	0.00018498	0.00002312	1.37	0.2257
TRT*ALLEY	24	0.00044856	0.00001869	1.11	0.3601

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00016327	0.00005442	1.66	0.2509

Appendix 120. Analysis of variance table for plant stand at 14 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	113280.7778	2634.4367	1.31	0.1637
Error	64	129050.0741	2016.4074		
Corrected Total	107	242330.8519			

R-Square	C.V.	Root MSE	PS Mean
0.467463	14.65248	44.90443	306.462963

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7748.92593	2582.97531	1.28	0.2885
REP(TRT)	8	36991.25926	4623.90741	2.29	0.0316
ALLEY	8	14638.18519	1829.77315	0.91	0.5161
TRT*ALLEY	24	53902.40741	2245.93364	1.11	0.3555

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7748.925926	2582.975309	0.56	0.6570

Appendix 121. Analysis of variance table for plant height at 14 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	255.3758333	5.9389729	3.85	0.0001
Error	64	98.6096296	1.5407755		
Corrected Total	107	353.9854630			

	R-Square	C.V.	Root MSE	AVEPH Mean
	0.721430	8.586320	1.241280	14.4564815

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	68.41953704	22.80651235	14.80	0.0001
REP(TRT)	8	48.58370370	6.07296296	3.94	0.0008
ALLEY	8	62.25629630	7.78203704	5.05	0.0001
TRT*ALLEY	24	76.11629630	3.17151235	2.06	0.0116

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	68.41953704	22.80651235	3.76	0.0597

Appendix 122. Analysis of variance table for transformed seedling maggot eggs at 14 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.76176163	0.06422701	7.09	0.0001
Error	64	0.57951678	0.00905495		
Corrected Total	107	3.34127841			

R-Square	C.V.	Root MSE	SME1 Mean
0.826558	8.075501	0.095157	1.17834791

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.81131862	0.27043954	29.87	0.0001
REP(TRT)	8	0.33589215	0.04198652	4.64	0.0002
ALLEY	8	1.21617606	0.15202201	16.79	0.0001
TRT*ALLEY	24	0.39837480	0.01659895	1.83	0.0285

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.81131862	0.27043954	6.44	0.0158

Appendix 123. Analysis of variance table for transformed seedling maggot dead hearts at 14 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.67011264	0.08535146	4.58	0.0001
Error	64	1.19391001	0.01865484		
Corrected Total	107	4.86402265			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.754543	14.83764	0.136583	0.92051550

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.28766330	0.42922110	23.01	0.0001
REP(TRT)	8	0.27575299	0.03446912	1.85	0.0843
ALLEY	8	1.35911208	0.16988901	9.11	0.0001
TRT*ALLEY	24	0.74758427	0.03114934	1.67	0.0537

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.28766330	0.42922110	12.45	0.0022

Appendix 124. Analysis of variance table for transformed seedling maggot eggs per plant at 14 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.00802256	0.00018657	5.33	0.0001
Error	64	0.00224171	0.00003503		
Corrected Total	107	0.01026427			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.781601	27.45372	0.005918	0.02155750

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00228404	0.00076135	21.74	0.0001
REP(TRT)	8	0.00067883	0.00008485	2.42	0.0236
ALLEY	8	0.00353949	0.00044244	12.63	0.0001
TRT*ALLEY	24	0.00152020	0.00006334	1.81	0.0314

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00228404	0.00076135	8.97	0.0061

Appendix 125. Analysis of variance table for transformed total weed dry weight at 20 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.18919598	0.07416735	1.59	0.0448
Error	64	2.98065163	0.04657268		
Corrected Total	107	6.16984761			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.516900	79.46314	0.215807	0.27158133

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.15614569	0.38538190	8.27	0.0001
REP(TRT)	8	0.12762738	0.01595342	0.34	0.9459
ALLEY	8	0.97874091	0.12234261	2.63	0.0149
TRT*ALLEY	24	0.92668200	0.03861175	0.83	0.6882

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.15614569	0.38538190	24.16	0.0002

Appendix 126. Analysis of variance table for transformed broadleaf weed dry weight at 20 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2.55926574	0.05951781	1.48	0.0774
Error	64	2.57970394	0.04030787		
Corrected Total	107	5.13896968			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.498011	83.67543	0.200768	0.23993686

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.85463658	0.28487886	7.07	0.0004
REP(TRT)	8	0.09668667	0.01208583	0.30	0.9634
ALLEY	8	0.89358299	0.11169787	2.77	0.0107
TRT*ALLEY	24	0.71435951	0.02976498	0.74	0.7932

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.85463658	0.28487886	23.57	0.0003

Appendix 127. Analysis of variance table for transformed grass weed dry weight at 20 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.93118973	0.02165558	1.23	0.2232
Error	64	1.12679218	0.01760613		
Corrected Total	107	2.05798191			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.452477	260.3989	0.132688	0.05095569

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.09752311	0.03250770	1.85	0.1477
REP(TRT)	8	0.10266742	0.01283343	0.73	0.6655
ALLEY	8	0.32990000	0.04123750	2.34	0.0283
TRT*ALLEY	24	0.40109920	0.01671247	0.95	0.5402

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.09752311	0.03250770	2.53	0.1304

Appendix 128. Analysis of variance table for transformed total weed abundance at 20 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	9.85382729	0.22915877	2.53	0.0004
Error	64	5.79624024	0.09056625		
Corrected Total	107	15.65006753			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.629635	26.48638	0.300942	1.13621535

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.54240384	0.51413461	5.68	0.0016
REP(TRT)	8	0.36910463	0.04613808	0.51	0.8449
ALLEY	8	7.20829294	0.90103662	9.95	0.0001
TRT*ALLEY	24	0.73402588	0.03058441	0.34	0.9978

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.54240384	0.51413461	11.14	0.0031

Appendix 129. Analysis of variance table for transformed broadleaf weed abundance at 20 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	10.16629516	0.23642547	2.63	0.0002
Error	64	5.75899651	0.08998432		
Corrected Total	107	15.92529167			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.638374	26.87301	0.299974	1.11626429

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.43004597	0.47668199	5.30	0.0025
REP(TRT)	8	0.40861397	0.05107675	0.57	0.8005
ALLEY	8	7.61981859	0.95247732	10.58	0.0001
TRT*ALLEY	24	0.70781663	0.02949236	0.33	0.9983

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.43004597	0.47668199	9.33	0.0054

Appendix 130. Analysis of variance table for transformed grass weed abundance at 20 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.11663632	0.07247991	1.50	0.0694
Error	64	3.09233990	0.04831781		
Corrected Total	107	6.20897623			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.501957	170.5105	0.219813	0.12891468

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.50144506	0.16714835	3.46	0.0214
REP(TRT)	8	0.25973200	0.03246650	0.67	0.7142
ALLEY	8	0.95249743	0.11906218	2.46	0.0215
TRT*ALLEY	24	1.40296182	0.05845674	1.21	0.2681

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.50144506	0.16714835	5.15	0.0284

Appendix 131. Analysis of variance table for plant stand at 21 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	209224.9630	4865.6968	1.67	0.0312
Error	64	186793.1111	2918.6424		
Corrected Total	107	396018.0741			

R-Square	C.V.	Root MSE	PS Mean
0.528322	18.78507	54.02446	287.592593

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	32770.7407	10923.5802	3.74	0.0153
REP(TRT)	8	44532.2222	5566.5278	1.91	0.0741
ALLEY	8	21700.0741	2712.5093	0.93	0.4987
TRT*ALLEY	24	110221.9259	4592.5802	1.57	0.0772

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	32770.74074	10923.58025	1.96	0.1983

Appendix 132. Analysis of variance table for plant height at 21 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1134.106296	26.374565	3.65	0.0001
Error	64	462.671111	7.229236		
Corrected Total	107	1596.777407			

R-Square	C.V.	Root MSE	AVEPH Mean
0.710247	13.03682	2.688724	20.6240741

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	532.2551852	177.4183951	24.54	0.0001
REP(TRT)	8	75.0755556	9.3844444	1.30	0.2606
ALLEY	8	267.1540741	33.3942593	4.62	0.0002
TRT*ALLEY	24	259.6214815	10.8175617	1.50	0.1024

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	532.2551852	177.4183951	18.91	0.0005

Appendix 133. Analysis of variance table for transformed seedling maggot eggs at 21 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.38197159	0.07865050	5.00	0.0001
Error	64	1.00727178	0.01573862		
Corrected Total	107	4.38924337			

R-Square	C.V.	Root MSE	SME1 Mean
0.770514	12.81057	0.125454	0.97929788

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.65493302	0.21831101	13.87	0.0001
REP(TRT)	8	0.71361332	0.08920167	5.67	0.0001
ALLEY	8	1.41848731	0.17731091	11.27	0.0001
TRT*ALLEY	24	0.59493793	0.02478908	1.58	0.0767

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.65493302	0.21831101	2.45	0.1385

Appendix 134. Analysis of variance table for transformed seedling maggot dead hearts at 21 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.45292626	0.08030061	3.70	0.0001
Error	64	1.38986668	0.02171667		
Corrected Total	107	4.84279294			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.713003	12.67421	0.147366	1.16272121

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.82422551	0.27474184	12.65	0.0001
REP(TRT)	8	0.47734218	0.05966777	2.75	0.0113
ALLEY	8	1.47221978	0.18402747	8.47	0.0001
TRT*ALLEY	24	0.67913880	0.02829745	1.30	0.1995

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.82422551	0.27474184	4.60	0.0374

Appendix 135. Analysis of variance table for transformed seedling maggot eggs per plant at 21 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.00422049	0.00009815	4.55	0.0001
Error	64	0.00138136	0.00002158		
Corrected Total	107	0.00560185			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.753410	31.94722	0.004646	0.01454219

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00048237	0.00016079	7.45	0.0002
REP(TRT)	8	0.00097136	0.00012142	5.63	0.0001
ALLEY	8	0.00211051	0.00026381	12.22	0.0001
TRT*ALLEY	24	0.00065626	0.00002734	1.27	0.2243

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00048237	0.00016079	1.32	0.3326

Appendix 136. Analysis of variance table for plant stand at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	69515.65741	1616.64320	1.64	0.0350
Error	64	62942.66667	983.47917		
Corrected Total	107	132458.32407			

R-Square	C.V.	Root MSE	PS Mean
0.524812	17.73355	31.36047	176.842593

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7266.99074	2422.33025	2.46	0.0704
REP(TRT)	8	14583.33333	1822.91667	1.85	0.0833
ALLEY	8	19831.24074	2478.90509	2.52	0.0189
TRT*ALLEY	24	27834.09259	1159.75386	1.18	0.2941

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	7266.990741	2422.330247	1.33	0.3313

Appendix 137. Analysis of variance table for tillers at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	100326.6204	2333.1772	5.34	0.0001
Error	64	27946.1481	436.6586		
Corrected Total	107	128272.7685			

R-Square	C.V.	Root MSE	TIL Mean
0.782135	29.65973	20.89638	70.4537037

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	26441.58333	8813.86111	20.18	0.0001
REP(TRT)	8	12145.18519	1518.14815	3.48	0.0022
ALLEY	8	48838.18519	6104.77315	13.98	0.0001
TRT*ALLEY	24	12901.66667	537.56944	1.23	0.2511

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	26441.58333	8813.86111	5.81	0.0209

Appendix 138. Analysis of variance table for plant height at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1633.790648	37.995131	4.35	0.0001
Error	64	558.423704	8.725370		
Corrected Total	107	2192.214352			

R-Square	C.V.	Root MSE	AVEPH Mean
0.745270	8.867287	2.953874	33.3120370

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	712.4447222	237.4815741	27.22	0.0001
REP(TRT)	8	150.2096296	18.7762037	2.15	0.0433
ALLEY	8	530.1168519	66.2646065	7.59	0.0001
TRT*ALLEY	24	241.0194444	10.0424769	1.15	0.3197

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	712.4447222	237.4815741	12.65	0.0021

Appendix 139. Analysis of variance table for white grub at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTWG1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	4.63136551	0.10770617	1.72	0.0242
Error	64	4.01102961	0.06267234		
Corrected Total	107	8.64239512			

R-Square	C.V.	Root MSE	TOTWG1 Mean
0.535889	43.72615	0.250344	0.57252791

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.75934353	0.58644784	9.36	0.0001
REP(TRT)	8	0.48527689	0.06065961	0.97	0.4690
ALLEY	8	0.96729209	0.12091151	1.93	0.0706
TRT*ALLEY	24	1.41945301	0.05914388	0.94	0.5469

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1.75934353	0.58644784	9.67	0.0049

Appendix 140. Analysis of variance table for transformed total weed dry weight at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	8.26671762	0.19224925	1.94	0.0080
Error	64	6.34766961	0.09918234		
Corrected Total	107	14.61438723			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.565656	58.20065	0.314932	0.54111468

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.35959617	1.11986539	11.29	0.0001
REP(TRT)	8	0.67715639	0.08464455	0.85	0.5600
ALLEY	8	2.73624687	0.34203086	3.45	0.0023
TRT*ALLEY	24	1.49371820	0.06223826	0.63	0.8972

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.35959617	1.11986539	13.23	0.0018

Appendix 141. Analysis of variance table for transformed broadleaf weed dry weight at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	8.29165536	0.19282919	2.03	0.0049
Error	64	6.06631960	0.09478624		
Corrected Total	107	14.35797497			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.577495	60.42446	0.307874	0.50951838

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.91402210	1.30467403	13.76	0.0001
REP(TRT)	8	0.58872982	0.07359123	0.78	0.6248
ALLEY	8	1.99541727	0.24942716	2.63	0.0147
TRT*ALLEY	24	1.79348617	0.07472859	0.79	0.7368

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.91402210	1.30467403	17.73	0.0007

Appendix 142. Analysis of variance table for transformed grass weed dry weight at 40 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.55917324	0.03625984	1.10	0.3592
Error	64	2.10899719	0.03295308		
Corrected Total	107	3.66817043			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.425055	255.5239	0.181530	0.07104220

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00674481	0.00224827	0.07	0.9766
REP(TRT)	8	0.24517070	0.03064634	0.93	0.4982
ALLEY	8	0.73770967	0.09221371	2.80	0.0101
TRT*ALLEY	24	0.56954806	0.02373117	0.72	0.8126

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.00674481	0.00224827	0.07	0.9726

Appendix 143. Analysis of variance table for plant stand and tillers at 50 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1340854.843	31182.671	6.42	0.0001
Error	64	310860.074	4857.189		
Corrected Total	107	1651714.917			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.811796	14.15177	69.69353	492.472222

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	648928.9907	216309.6636	44.53	0.0001
REP(TRT)	8	173148.5926	21643.5741	4.46	0.0002
ALLEY	8	353863.0000	44232.8750	9.11	0.0001
TRT*ALLEY	24	164914.2593	6871.4275	1.41	0.1367

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	648928.9907	216309.6636	9.99	0.0044

Appendix 144. Analysis of variance table for plant height at 50 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3637.528519	84.593686	6.05	0.0001
Error	64	894.848148	13.982002		
Corrected Total	107	4532.376667			

R-Square	C.V.	Root MSE	AVEPH Mean
0.802565	8.570805	3.739252	43.6277778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1374.195926	458.065309	32.76	0.0001
REP(TRT)	8	535.558519	66.944815	4.79	0.0001
ALLEY	8	1254.976667	156.872083	11.22	0.0001
TRT*ALLEY	24	472.797407	19.699892	1.41	0.1395

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1374.195926	458.065309	6.84	0.0134

Appendix 145. Analysis of variance table for transformed stemborer dead hearts at 50 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	7.25943643	0.16882410	2.51	0.0004
Error	64	4.30370366	0.06724537		
Corrected Total	107	11.56314009			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.627808	26.27161	0.259317	0.98706231

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.85505069	0.95168356	14.15	0.0001
REP(TRT)	8	0.86440778	0.10805097	1.61	0.1405
ALLEY	8	2.85307686	0.35663461	5.30	0.0001
TRT*ALLEY	24	0.68690109	0.02862088	0.43	0.9887

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2.85505069	0.95168356	8.81	0.0065

Appendix 146. Analysis of variance table for plant stand and tillers at 65 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	624216.6944	14516.6673	3.86	0.0001
Error	64	240493.1852	3757.7060		
Corrected Total	107	864709.8796			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.721880	13.33766	61.30013	459.601852

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	176663.0648	58887.6883	15.67	0.0001
REP(TRT)	8	237863.4815	29732.9352	7.91	0.0001
ALLEY	8	82420.7963	10302.5995	2.74	0.0115
TRT*ALLEY	24	127269.3519	5302.8897	1.41	0.1384

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	176663.0648	58887.6883	1.98	0.1955

Appendix 147. Analysis of variance table for plant height at 65 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	10400.47741	241.87157	8.06	0.0001
Error	64	1921.57778	30.02465		
Corrected Total	107	12322.05519			

R-Square	C.V.	Root MSE	AVEPH Mean
0.844054	9.434419	5.479476	58.0796296

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3787.632963	1262.544321	42.05	0.0001
REP(TRT)	8	3971.708889	496.463611	16.54	0.0001
ALLEY	8	1782.736852	222.842106	7.42	0.0001
TRT*ALLEY	24	858.398704	35.766613	1.19	0.2837

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3787.632963	1262.544321	2.54	0.1295

Appendix 148. Analysis of variance table for transformed stemborer dead hearts at 65 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.00932180	0.02347260	1.35	0.1362
Error	64	1.11297182	0.01739018		
Corrected Total	107	2.12229361			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.475581	11.12981	0.131872	1.18485300

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.18155127	0.06051709	3.48	0.0209
REP(TRT)	8	0.25120306	0.03140038	1.81	0.0923
ALLEY	8	0.11024083	0.01378010	0.79	0.6112
TRT*ALLEY	24	0.46632665	0.01943028	1.12	0.3520

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.18155127	0.06051709	1.93	0.2037

Appendix 149. Analysis of variance table for transformed panicles at 103 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PAN1031

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	14.83628605	0.34502991	7.59	0.0001
Error	64	2.91040711	0.04547511		
Corrected Total	107	17.74669316			

R-Square	C.V.	Root MSE	PAN1031 Mean
0.836003	11.68207	0.213249	1.82543838

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8.68056303	2.89352101	63.63	0.0001
REP(TRT)	8	1.17514314	0.14689289	3.23	0.0038
ALLEY	8	3.64391504	0.45548938	10.02	0.0001
TRT*ALLEY	24	1.33666485	0.05569437	1.22	0.2561

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	8.68056303	2.89352101	19.70	0.0005

Appendix 150. Analysis of variance table for transformed panicles at 110 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PAN1101

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.32933215	0.03091470	3.66	0.0001
Error	64	0.54016321	0.00844005		
Corrected Total	107	1.86949536			

R-Square	C.V.	Root MSE	PAN1101 Mean
0.711065	4.022451	0.091870	2.28392465

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.73515262	0.24505087	29.03	0.0001
REP(TRT)	8	0.12178473	0.01522309	1.80	0.0927
ALLEY	8	0.17737369	0.02217171	2.63	0.0149
TRT*ALLEY	24	0.29502112	0.01229255	1.46	0.1181

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.73515262	0.24505087	16.10	0.0009

Appendix 151. Analysis of variance table for transformed panicles at 118 days after emergence of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: PAN1181

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	0.62829333	0.01461147	3.35	0.0001
Error	64	0.27893431	0.00435835		
Corrected Total	107	0.90722764			

R-Square	C.V.	Root MSE	PAN1181 Mean
0.692542	2.757691	0.066018	2.39395138

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.36919925	0.12306642	28.24	0.0001
REP(TRT)	8	0.05926703	0.00740838	1.70	0.1156
ALLEY	8	0.11966825	0.01495853	3.43	0.0024
TRT*ALLEY	24	0.08015880	0.00333995	0.77	0.7622

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.36919925	0.12306642	16.61	0.0008

Appendix 152. Analysis of variance table for total straw yield at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTDWB

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	42743058.74	994024.62	2.21	0.0020
Error	64	28797504.44	449961.01		
Corrected Total	107	71540563.19			

R-Square	C.V.	Root MSE	TOTDWB Mean
0.597466	18.28581	670.7913	3668.37037

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	23968777.41	7989592.47	17.76	0.0001
REP(TRT)	8	3966894.22	495861.78	1.10	0.3738
ALLEY	8	1433975.35	179246.92	0.40	0.9175
TRT*ALLEY	24	13373411.76	557225.49	1.24	0.2454

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	23968777.41	7989592.47	16.11	0.0009

Appendix 153. Analysis of variance table for total straw yield of the top rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: DWBTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	36771476.10	855150.61	0.80	0.7823
Error	64	68576498.67	1071507.79		
Corrected Total	107	105347974.77			

R-Square	C.V.	Root MSE	DWBTR Mean
0.349048	48.90901	1035.137	2116.45370

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3828976.77	1276325.59	1.19	0.3202
REP(TRT)	8	8549990.00	1068748.75	1.00	0.4468
ALLEY	8	6774016.19	846752.02	0.79	0.6130
TRT*ALLEY	24	17618493.15	734103.88	0.69	0.8474

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3828976.769	1276325.590	1.19	0.3719

Appendix 154. Analysis of variance table for total straw yield of the middle rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: DWBMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	262898381.5	6113915.8	1.96	0.0071
Error	64	199445166.5	3116330.7		
Corrected Total	107	462343548.0			

R-Square	C.V.	Root MSE	DWBMR Mean
0.568621	33.97664	1765.313	5195.66667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	157645556.3	52548518.8	16.86	0.0001
REP(TRT)	8	11995660.1	1499457.5	0.48	0.8651
ALLEY	8	49124738.0	6140592.2	1.97	0.0646
TRT*ALLEY	24	44132427.0	1838851.1	0.59	0.9239

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	157645556.3	52548518.8	35.05	0.0001

Appendix 155. Analysis of variance table for total straw yield of the bottom rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: DWBBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	68640392.22	1596288.19	0.98	0.5251
Error	64	104515093.63	1633048.34		
Corrected Total	107	173155485.85			

R-Square	C.V.	Root MSE	DWBBR Mean
0.396409	37.48670	1277.908	3408.96296

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	18448817.26	6149605.75	3.77	0.0149
REP(TRT)	8	10932227.70	1366528.46	0.84	0.5738
ALLEY	8	20682118.02	2585264.75	1.58	0.1476
TRT*ALLEY	24	18577229.24	774051.22	0.47	0.9776

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	18448817.26	6149605.75	4.50	0.0395

Appendix 156. Analysis of variance table for total grain yield of the bottom rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTGY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	4048634.968	94154.302	4.34	0.0001
Error	64	1387879.140	21685.612		
Corrected Total	107	5436514.107			

R-Square	C.V.	Root MSE	TOTGY Mean
0.744712	22.81329	147.2604	645.502593

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1558720.599	519573.533	23.96	0.0001
REP(TRT)	8	528496.086	66062.011	3.05	0.0058
ALLEY	8	955505.648	119438.206	5.51	0.0001
TRT*ALLEY	24	1005912.634	41913.026	1.93	0.0192

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1558720.599	519573.533	7.86	0.0090

Appendix 157. Analysis of variance table for grain yield of the top rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GYTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1240209.990	28842.093	0.94	0.5873
Error	64	1974008.864	30843.889		
Corrected Total	107	3214218.854			

R-Square	C.V.	Root MSE	GYTR Mean
0.385851	61.79849	175.6243	284.188611

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	133833.3383	44611.1128	1.45	0.2376
REP(TRT)	8	281225.8189	35153.2274	1.14	0.3496
ALLEY	8	367052.8093	45881.6012	1.49	0.1794
TRT*ALLEY	24	458098.0235	19087.4176	0.62	0.9038

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	133833.3383	44611.1128	1.27	0.3486

Appendix 158. Analysis of variance table for grain yield of the center rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GYMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	17092238.91	397493.93	2.70	0.0002
Error	64	9432693.12	147385.83		
Corrected Total	107	26524932.04			

R-Square	C.V.	Root MSE	GYMR Mean
0.644384	44.67380	383.9086	859.359630

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5230581.930	1743527.310	11.83	0.0001
REP(TRT)	8	1993107.710	249138.464	1.69	0.1179
ALLEY	8	4507847.698	563480.962	3.82	0.0010
TRT*ALLEY	24	5360701.574	223362.566	1.52	0.0955

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	5230581.930	1743527.310	7.00	0.0126

Appendix 159. Analysis of variance table for grain yield of the bottom rows at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GYBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	5468913.986	127184.046	1.42	0.0991
Error	64	5723784.406	89434.131		
Corrected Total	107	11192698.392			

R-Square	C.V.	Root MSE	GYBR Mean
0.488614	55.91368	299.0554	534.851944

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1837750.967	612583.656	6.85	0.0004
REP(TRT)	8	917044.996	114630.624	1.28	0.2689
ALLEY	8	1224246.622	153030.828	1.71	0.1129
TRT*ALLEY	24	1489871.401	62077.975	0.69	0.8388

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1837750.967	612583.656	5.34	0.0259

Appendix 160. Analysis of variance table for transformed total weed dry weight at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.30439930	0.07684650	1.20	0.2539
Error	64	4.11007946	0.06421999		
Corrected Total	107	7.41447877			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.445668	17.92930	0.253417	1.41342188

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.13692735	0.04564245	0.71	0.5492
REP(TRT)	8	0.78406364	0.09800795	1.53	0.1659
ALLEY	8	0.91590626	0.11448828	1.78	0.0969
TRT*ALLEY	24	1.46750205	0.06114592	0.95	0.5366

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.13692735	0.04564245	0.47	0.7142

Appendix 161. Analysis of variance table for transformed broadleaf weed dry weight at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	9.29274935	0.21611045	1.99	0.0060
Error	64	6.93984078	0.10843501		
Corrected Total	107	16.23259014			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.572475	28.31306	0.329295	1.16304868

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.09598851	1.03199617	9.52	0.0001
REP(TRT)	8	2.33205678	0.29150710	2.69	0.0130
ALLEY	8	1.34733439	0.16841680	1.55	0.1569
TRT*ALLEY	24	2.51736967	0.10489040	0.97	0.5183

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.09598851	1.03199617	3.54	0.0678

Appendix 162. Analysis of variance table for transformed grass weed dry weight at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	10.60112694	0.24653784	1.09	0.3751
Error	64	14.50916030	0.22670563		
Corrected Total	107	25.11028724			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.422183	57.27908	0.476136	0.83125661

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.88217035	1.29405678	5.71	0.0016
REP(TRT)	8	2.43021249	0.30377656	1.34	0.2404
ALLEY	8	1.62640959	0.20330120	0.90	0.5246
TRT*ALLEY	24	2.66233451	0.11093060	0.49	0.9729

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	3.88217035	1.29405678	4.26	0.0449

Appendix 163. Analysis of variance table for transformed total weed abundance at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	1.80321196	0.04193516	1.23	0.2218
Error	64	2.17914868	0.03404920		
Corrected Total	107	3.98236064			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.452800	16.75252	0.184524	1.10147178

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.21784603	0.07261534	2.13	0.1048
REP(TRT)	8	0.33105652	0.04138206	1.22	0.3046
ALLEY	8	0.70892630	0.08861579	2.60	0.0157
TRT*ALLEY	24	0.54538311	0.02272430	0.67	0.8638

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.21784603	0.07261534	1.75	0.2333

Appendix 164. Analysis of variance table for transformed broadleaf weed abundance at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	3.74662441	0.08713080	1.30	0.1665
Error	64	4.28164696	0.06690073		
Corrected Total	107	8.02827137			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.466679	28.74573	0.258652	0.89979193

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.67926926	0.22642309	3.38	0.0234
REP(TRT)	8	1.36935188	0.17116899	2.56	0.0174
ALLEY	8	0.95788001	0.11973500	1.79	0.0955
TRT*ALLEY	24	0.74012325	0.03083847	0.46	0.9812

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.67926926	0.22642309	1.32	0.3330

Appendix 165. Analysis of variance table for transformed grass weed abundance at harvest of the 1988 rice crop at site B, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	5.23642923	0.12177742	1.11	0.3503
Error	64	7.03585992	0.10993531		
Corrected Total	107	12.27228915			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.426687	53.11340	0.331565	0.62425854

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.83749495	0.27916498	2.54	0.0643
REP(TRT)	8	1.66254776	0.20781847	1.89	0.0769
ALLEY	8	1.21087968	0.15135996	1.38	0.2237
TRT*ALLEY	24	1.52550685	0.06356279	0.58	0.9314

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	0.83749495	0.27916498	1.34	0.3272

Appendix 166. Analysis of variance table for total stover yield at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: TOTBIO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	2833447093	65894118	10.76	0.0001
Error	64	391976757	6124637		
Corrected Total	107	3225423851			

R-Square	C.V.	Root MSE	TOTBIO Mean
0.878473	27.95472	2474.800	8852.88889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1841564832	613854944	100.23	0.0001
REP(TRT)	8	143277771	17909721	2.92	0.0076
ALLEY	8	695226203	86903275	14.19	0.0001
TRT*ALLEY	24	153378288	6390762	1.04	0.4299

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	1841564832	613854944	34.27	0.0001

Appendix 167. Analysis of variance table for stover yield of top rows at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: BIOTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	30665145.33	713142.91	5.69	0.0001
Error	64	8016117.33	125251.83		
Corrected Total	107	38681262.67			

R-Square	C.V.	Root MSE	BIOTR Mean
0.792765	37.28414	353.9094	949.222222

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	21191076.00	7063692.00	56.40	0.0001
REP(TRT)	8	1684874.67	210609.33	1.68	0.1202
ALLEY	8	5359362.67	669920.33	5.35	0.0001
TRT*ALLEY	24	2429832.00	101243.00	0.81	0.7132

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	21191076.00	7063692.00	33.54	0.0001

Appendix 168. Analysis of variance table for stover yield of middle rows at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: BIOMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	118910468.0	2765359.7	10.39	0.0001
Error	64	17040928.0	266264.5		
Corrected Total	107	135951396.0			

R-Square	C.V.	Root MSE	BIOMR Mean
0.874654	31.04120	516.0082	1662.33333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	68421572.00	22807190.67	85.66	0.0001
REP(TRT)	8	7228352.00	903544.00	3.39	0.0026
ALLEY	8	37035576.00	4629447.00	17.39	0.0001
TRT*ALLEY	24	6224968.00	259373.67	0.97	0.5101

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	68421572.00	22807190.67	25.24	0.0002

Appendix 169. Analysis of variance table for stover yield of bottom rows at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: BIOBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	91970425.33	2138847.10	6.02	0.0001
Error	64	22753973.33	355530.83		
Corrected Total	107	114724398.67			

R-Square	C.V.	Root MSE	BIOBR Mean
0.801664	38.30117	596.2641	1556.77778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	55707300.00	18569100.00	52.23	0.0001
REP(TRT)	8	10233162.67	1279145.33	3.60	0.0017
ALLEY	8	19892154.67	2486519.33	6.99	0.0001
TRT*ALLEY	24	6137808.00	255742.00	0.72	0.8134

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	55707300.00	18569100.00	14.52	0.0013

Appendix 170. Analysis of variance table for total grain yield at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: GYTOTAL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	10446848.59	242949.97	11.60	0.0001
Error	64	1340191.68	20940.49		
Corrected Total	107	11787040.27			

R-Square	C.V.	Root MSE	GYTOTAL Mean
0.886300	37.47873	144.7083	386.107778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	4602350.428	1534116.809	73.26	0.0001
REP(TRT)	8	825901.559	103237.695	4.93	0.0001
ALLEY	8	3965254.900	495656.862	23.67	0.0001
TRT*ALLEY	24	1053341.699	43889.237	2.10	0.0099

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	4602350.428	1534116.809	14.86	0.0012

Appendix 171. Analysis of variance table for grain yield of top rows at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: GYTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	4719686.360	109760.148	3.41	0.0001
Error	64	2059319.771	32176.871		
Corrected Total	107	6779006.131			

R-Square	C.V.	Root MSE	GYTR Mean
0.696221	78.31243	179.3791	229.055741

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2206935.477	735645.159	22.86	0.0001
REP(TRT)	8	366775.130	45846.891	1.42	0.2035
ALLEY	8	1494923.538	186865.442	5.81	0.0001
TRT*ALLEY	24	651052.215	27127.176	0.84	0.6711

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	2206935.477	735645.159	16.05	0.0010

Appendix 172. Analysis of variance table for grain yield of middle rows at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: GYMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	28621600.42	665618.61	12.40	0.0001
Error	64	3436281.73	53691.90		
Corrected Total	107	32057882.15			

R-Square	C.V.	Root MSE	GYMR Mean
0.892810	39.37380	231.7151	588.500741

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	11060610.99	3686870.33	68.67	0.0001
REP(TRT)	8	1853430.59	231678.82	4.31	0.0003
ALLEY	8	12176296.39	1522037.05	28.35	0.0001
TRT*ALLEY	24	3531262.45	147135.94	2.74	0.0007

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	11060610.99	3686870.33	15.91	0.0010

Appendix 173. Analysis of variance table for grain yield of bottom rows at harvest of the 1987 maize crop at site B, Claveria, Philippines

Dependent Variable: GYBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	25394587.20	590571.80	6.06	0.0001
Error	64	6238627.51	97478.55		
Corrected Total	107	31633214.71			

R-Square	C.V.	Root MSE	GYBR Mean
0.802782	55.98144	312.2156	557.712593

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	10251520.56	3417173.52	35.06	0.0001
REP(TRT)	8	3535815.99	441977.00	4.53	0.0002
ALLEY	8	8173719.27	1021714.91	10.48	0.0001
TRT*ALLEY	24	3433531.39	143063.81	1.47	0.1135

Tests of Hypotheses using the Anova MS for REP(TRT) as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TRT	3	10251520.56	3417173.52	7.73	0.0095

Appendix 174. Analysis of variance table for plant stand at 18 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	242.5172072	6.3820318	2.73	0.0006
Error	48	112.1954365	2.3374049		
Corrected Total	86	354.7126437			

R-Square	C.V.	Root MSE	PS Mean
0.683700	6.663857	1.528857	22.9425287

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	75.52545156	37.76272578	16.16	0.0001
TRT	3	14.64040517	4.88013506	2.09	0.1142
TRT*REP	6	97.73131075	16.28855179	6.97	0.0001
ALLEY	7	10.12910354	1.44701479	0.62	0.7375
TRT*ALLEY	20	44.49093615	2.22454681	0.95	0.5311

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	67.90415989	33.95207994	14.53	0.0001
TRT	3	16.21287300	5.40429100	2.31	0.0879
TRT*REP	6	88.81955552	14.80325925	6.33	0.0001
ALLEY	7	11.71188272	1.67312610	0.72	0.6589
TRT*ALLEY	20	44.49093615	2.22454681	0.95	0.5311

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	16.21287300	5.40429100	0.37	0.7811

Appendix 175. Analysis of variance table for plant height at 18 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	2151.881502	56.628461	3.70	0.0001
Error	48	734.428383	15.300591		
Corrected Total	86	2886.309885			

R-Square	C.V.	Root MSE	AVEPH Mean
0.745548	15.27899	3.911597	25.6011494

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	886.7785878	443.3892939	28.98	0.0001
TRT	3	550.8579990	183.6193330	12.00	0.0001
TRT*REP	6	142.8550839	23.8091807	1.56	0.1806
ALLEY	7	218.8905051	31.2700722	2.04	0.0686
TRT*ALLEY	20	352.4993263	17.6249663	1.15	0.3343

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	832.2914599	416.1457300	27.20	0.0001
TRT	3	450.0421114	150.0140371	9.80	0.0001
TRT*REP	6	129.3933289	21.5655548	1.41	0.2305
ALLEY	7	221.8968318	31.6995474	2.07	0.0650
TRT*ALLEY	20	352.4993263	17.6249663	1.15	0.3343

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	450.0421114	150.0140371	6.96	0.0222

Appendix 176. Analysis of variance table for transformed seedling maggot eggs at 18 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1.52370271	0.04009744	0.64	0.9203
Error	48	2.99976824	0.06249517		
Corrected Total	86	4.52347095			

R-Square	C.V.	Root MSE	SME1 Mean
0.336844	172.7337	0.249990	0.14472590

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.01250798	0.00625399	0.10	0.9050
TRT	3	0.61635155	0.20545052	3.29	0.0285
TRT*REP	6	0.19652509	0.03275418	0.52	0.7872
ALLEY	7	0.11440404	0.01634343	0.26	0.9658
TRT*ALLEY	20	0.58391405	0.02919570	0.47	0.9670

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.01041010	0.00520505	0.08	0.9202
TRT	3	0.55901814	0.18633938	2.98	0.0405
TRT*REP	6	0.21886261	0.03647710	0.58	0.7415
ALLEY	7	0.09666271	0.01380896	0.22	0.9786
TRT*ALLEY	20	0.58391405	0.02919570	0.47	0.9670

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.55901814	0.18633938	5.11	0.0433

Appendix 177. Analysis of variance table for transformed seedling maggot dead hearts at 18 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1.10635868	0.02911470	0.73	0.8440
Error	48	1.92190319	0.04003965		
Corrected Total	86	3.02826188			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.365344	168.5170	0.200099	0.11874121

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.01127855	0.00563928	0.14	0.8690
TRT	3	0.39059121	0.13019707	3.25	0.0297
TRT*REP	6	0.17121939	0.02853657	0.71	0.6411
ALLEY	7	0.08455692	0.01207956	0.30	0.9497
TRT*ALLEY	20	0.44871262	0.02243563	0.56	0.9206

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.00484825	0.00242412	0.06	0.9413
TRT	3	0.34882903	0.11627634	2.90	0.0442
TRT*REP	6	0.18166876	0.03027813	0.76	0.6077
ALLEY	7	0.06615179	0.00945026	0.24	0.9742
TRT*ALLEY	20	0.44871262	0.02243563	0.56	0.9206

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.34882903	0.11627634	3.84	0.0757

Appendix 178. Analysis of variance table for transformed seedling maggot eggs per plant at 18 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	0.01283930	0.00033788	0.67	0.8942
Error	48	0.02404318	0.00050090		
Corrected Total	86	0.03688248			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.348114	195.8440	0.022381	0.01142786

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.00032219	0.00016110	0.32	0.7265
TRT	3	0.00505225	0.00168408	3.36	0.0262
TRT*REP	6	0.00154115	0.00025686	0.51	0.7957
ALLEY	7	0.00145378	0.00020768	0.41	0.8885
TRT*ALLEY	20	0.00446993	0.00022350	0.45	0.9741

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.00023539	0.00011770	0.23	0.7915
TRT	3	0.00442950	0.00147650	2.95	0.0421
TRT*REP	6	0.00183610	0.00030602	0.61	0.7203
ALLEY	7	0.00125365	0.00017909	0.36	0.9222
TRT*ALLEY	20	0.00446993	0.00022350	0.45	0.9741

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.00442950	0.00147650	4.82	0.0486

Appendix 179. Analysis of variance table for transformed total weed dry weight at 40 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4.17645738	0.10990677	3.31	0.0001
Error	48	1.59269259	0.03318110		
Corrected Total	86	5.76914997			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.723929	12.12310	0.182157	1.50255902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.48263057	0.24131528	7.27	0.0017
TRT	3	0.54228715	0.18076238	5.45	0.0026
TRT*REP	6	1.75342612	0.29223769	8.81	0.0001
ALLEY	7	0.18793812	0.02684830	0.81	0.5840
TRT*ALLEY	20	1.21017542	0.06050877	1.82	0.0453

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.47912983	0.23956492	7.22	0.0018
TRT	3	0.80126445	0.26708815	8.05	0.0002
TRT*REP	6	1.78122421	0.29687070	8.95	0.0001
ALLEY	7	0.29010079	0.04144297	1.25	0.2955
TRT*ALLEY	20	1.21017542	0.06050877	1.82	0.0453

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.80126445	0.26708815	0.90	0.4942

Appendix 180. Analysis of variance table for transformed broadleaf weed dry weight at 40 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	7.33109130	0.19292346	2.71	0.0006
Error	48	3.41753408	0.07119863		
Corrected Total	86	10.74862538			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.682049	24.50423	0.266831	1.08891672

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.30538012	0.15269006	2.14	0.1282
TRT	3	1.41988781	0.47329594	6.65	0.0008
TRT*REP	6	3.82593008	0.63765501	8.96	0.0001
ALLEY	7	0.27518829	0.03931261	0.55	0.7904
TRT*ALLEY	20	1.50470499	0.07523525	1.06	0.4216

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.22524012	0.11262006	1.58	0.2161
TRT	3	1.66814749	0.55604916	7.81	0.0002
TRT*REP	6	3.88592707	0.64765451	9.10	0.0001
ALLEY	7	0.30445062	0.04349295	0.61	0.7441
TRT*ALLEY	20	1.50470499	0.07523525	1.06	0.4216

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.66814749	0.55604916	0.86	0.5116

Appendix 181. Analysis of variance table for transformed grass weed dry weight at 40 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	5.76082111	0.15160056	2.06	0.0093
Error	48	3.53706495	0.07368885		
Corrected Total	86	9.29788606			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.619584	21.91087	0.271457	1.23891415

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.85311916	0.42655958	5.79	0.0056
TRT	3	0.85022953	0.28340984	3.85	0.0151
TRT*REP	6	2.10008322	0.35001387	4.75	0.0007
ALLEY	7	0.31953848	0.04564835	0.62	0.7372
TRT*ALLEY	20	1.63785072	0.08189254	1.11	0.3699

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.90115115	0.45057557	6.11	0.0043
TRT	3	1.10060037	0.36686679	4.98	0.0044
TRT*REP	6	2.12529860	0.35421643	4.81	0.0007
ALLEY	7	0.49317405	0.07045344	0.96	0.4735
TRT*ALLEY	20	1.63785072	0.08189254	1.11	0.3699

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.10060037	0.36686679	1.04	0.4416

Appendix 182. Analysis of variance table for transformed tassels at 47 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TAS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	9.71361404	0.25562142	4.01	0.0001
Error	48	3.05693476	0.06368614		
Corrected Total	86	12.77054880			

R-Square	C.V.	Root MSE	TAS1 Mean
0.760626	75.02945	0.252361	0.33634944

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	4.13353126	2.06676563	32.45	0.0001
TRT	3	2.61181132	0.87060377	13.67	0.0001
TRT*REP	6	0.86491522	0.14415254	2.26	0.0528
ALLEY	7	1.08561004	0.15508715	2.44	0.0322
TRT*ALLEY	20	1.01774620	0.05088731	0.80	0.7019

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	3.95528943	1.97764472	31.05	0.0001
TRT	3	2.10277002	0.70092334	11.01	0.0001
TRT*REP	6	0.96580697	0.16096783	2.53	0.0331
ALLEY	7	1.08420436	0.15488634	2.43	0.0323
TRT*ALLEY	20	1.01774620	0.05088731	0.80	0.7019

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2.10277002	0.70092334	4.35	0.0596

Appendix 183. Analysis of variance for transformed tassels at 67 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TAS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	0.36086233	0.00949638	2.55	0.0012
Error	48	0.17857715	0.00372036		
Corrected Total	86	0.53943948			

R-Square	C.V.	Root MSE	TAS1 Mean
0.668958	4.477045	0.060995	1.36238822

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.20658915	0.10329457	27.76	0.0001
TRT	3	0.01586330	0.00528777	1.42	0.2481
TRT*REP	6	0.02686629	0.00447771	1.20	0.3208
ALLEY	7	0.05274362	0.00753480	2.03	0.0710
TRT*ALLEY	20	0.05879998	0.00294000	0.79	0.7116

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.20947581	0.10473790	28.15	0.0001
TRT	3	0.01397987	0.00465996	1.25	0.3012
TRT*REP	6	0.03038965	0.00506494	1.36	0.2493
ALLEY	7	0.05351011	0.00764430	2.05	0.0671
TRT*ALLEY	20	0.05879998	0.00294000	0.79	0.7116

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.01397987	0.00465996	0.92	0.4859

Appendix 184. Analysis of variance for transformed silks at 67 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: SLK1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	5.72495694	0.15065676	3.96	0.0001
Error	48	1.82602761	0.03804224		
Corrected Total	86	7.55098455			

R-Square	C.V.	Root MSE	SLK1 Mean
0.758174	17.82597	0.195044	1.09415736

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1.99995375	0.99997687	26.29	0.0001
TRT	3	2.27944184	0.75981395	19.97	0.0001
TRT*REP	6	0.21032102	0.03505350	0.92	0.4880
ALLEY	7	0.64974464	0.09282066	2.44	0.0319
TRT*ALLEY	20	0.58549569	0.02927478	0.77	0.7342

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	2.08325135	1.04162568	27.38	0.0001
TRT	3	2.10554927	0.70184976	18.45	0.0001
TRT*REP	6	0.16730438	0.02788406	0.73	0.6254
ALLEY	7	0.63653825	0.09093404	2.39	0.0351
TRT*ALLEY	20	0.58549569	0.02927478	0.77	0.7342

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2.10554927	0.70184976	25.17	0.0008

Appendix 185. Analysis of variance for plant height at 67 days after emergence of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	111476.9641	2933.6043	7.60	0.0001
Error	48	18522.1403	385.8779		
Corrected Total	86	129999.1044			

R-Square	C.V.	Root MSE	AVEPH Mean
0.857521	12.02739	19.64378	163.325287

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	9664.17248	4832.08624	12.52	0.0001
TRT	3	65723.99000	21907.99667	56.77	0.0001
TRT*REP	6	3054.92535	509.15422	1.32	0.2669
ALLEY	7	21254.28476	3036.32639	7.87	0.0001
TRT*ALLEY	20	11779.59147	588.97957	1.53	0.1159

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	9616.59568	4808.29784	12.46	0.0001
TRT	3	57565.25360	19188.41787	49.73	0.0001
TRT*REP	6	2431.78041	405.29674	1.05	0.4053
ALLEY	7	21250.34554	3035.76365	7.87	0.0001
TRT*ALLEY	20	11779.59147	588.97957	1.53	0.1159

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	57565.25360	19188.41787	47.34	0.0001

Appendix 186. Analysis of variance table for total stover dry weight at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TOTBIO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	912531576.6	24013988.9	6.82	0.0001
Error	48	168889995.2	3518541.6		
Corrected Total	86	1081421571.8			

R-Square	C.V.	Root MSE	TOTBIO Mean
0.843826	26.11423	1875.778	7182.97011

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	110359978.5	55179989.2	15.68	0.0001
TRT	3	465465961.9	155155320.6	44.10	0.0001
TRT*REP	6	83504619.0	13917436.5	3.96	0.0027
ALLEY	7	155605364.1	22229337.7	6.32	0.0001
TRT*ALLEY	20	97595653.0	4879782.7	1.39	0.1757

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	114504565.6	57252282.8	16.27	0.0001
TRT	3	372619691.8	124206563.9	35.30	0.0001
TRT*REP	6	65214251.0	10869041.8	3.09	0.0122
ALLEY	7	152204095.8	21743442.3	6.18	0.0001
TRT*ALLEY	20	97595653.0	4879782.7	1.39	0.1757

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	372619691.8	124206563.9	11.43	0.0068

Appendix 187. Analysis of variance table for stover dry weight of top rows at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TBTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1748240040	46006317	1.67	0.0457
Error	48	1318891857	27476914		
Corrected Total	86	3067131897			

R-Square	C.V.	Root MSE	TBTR Mean
0.569992	70.40267	5241.843	7445.51724

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	214358780.4	107179390.2	3.90	0.0269
TRT	3	557990296.9	185996765.6	6.77	0.0007
TRT*REP	6	406135733.6	67689288.9	2.46	0.0371
ALLEY	7	59228064.7	8461152.1	0.31	0.9469
TRT*ALLEY	20	510527164.5	25526358.2	0.93	0.5561

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	234208031.2	117104015.6	4.26	0.0198
TRT	3	432258321.9	144086107.3	5.24	0.0033
TRT*REP	6	402836282.0	67139380.3	2.44	0.0384
ALLEY	7	49654427.5	7093489.6	0.26	0.9669
TRT*ALLEY	20	510527164.5	25526358.2	0.93	0.5561

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	432258321.9	144086107.3	2.15	0.1957

Appendix 188. Analysis of variance table for stover dry weight of middle rows at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TBMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	727934965.2	19156183.3	6.82	0.0001
Error	48	134909894.3	2810622.8		
Corrected Total	86	862844859.4			

R-Square	C.V.	Root MSE	TBMR Mean
0.843645	24.85142	1676.491	6746.05747

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	40147008.4	20073504.2	7.14	0.0019
TRT	3	405548402.7	135182800.9	48.10	0.0001
TRT*REP	6	36326499.0	6054416.5	2.15	0.0641
ALLEY	7	150193094.6	21456156.4	7.63	0.0001
TRT*ALLEY	20	95719960.4	4785998.0	1.70	0.0668

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	44552863.0	22276431.5	7.93	0.0011
TRT	3	334830688.4	111610229.5	39.71	0.0001
TRT*REP	6	26114860.4	4352476.7	1.55	0.1829
ALLEY	7	153806557.6	21972365.4	7.82	0.0001
TRT*ALLEY	20	95719960.4	4785998.0	1.70	0.0668

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	334830688.4	111610229.5	25.64	0.0008

Appendix 189. Analysis of variance table for stover dry weight of bottom rows at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TBBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	857211913.1	22558208.2	4.43	0.0001
Error	48	244409061.6	5091855.4		
Corrected Total	86	1101620974.7			

R-Square	C.V.	Root MSE	TBBR Mean
0.778137	30.16564	2256.514	7480.41034

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	55892594.0	27946297.0	5.49	0.0071
TRT	3	411649400.2	137216466.7	26.95	0.0001
TRT*REP	6	45596746.4	7599457.7	1.49	0.2009
ALLEY	7	254959010.0	36422715.7	7.15	0.0001
TRT*ALLEY	20	89114162.5	4455708.1	0.88	0.6166

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	65569717.0	32784858.5	6.44	0.0033
TRT	3	336418964.0	112139654.7	22.02	0.0001
TRT*REP	6	27194301.2	4532383.5	0.89	0.5096
ALLEY	7	260070490.7	37152927.2	7.30	0.0001
TRT*ALLEY	20	89114162.5	4455708.1	0.88	0.6166

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	336418964.0	112139654.7	24.74	0.0009

Appendix 190. Analysis of variance table for total grain yield at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TOTGY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	71196155.87	1873583.05	10.03	0.0001
Error	48	8966776.19	186807.84		
Corrected Total	86	80162932.06			

R-Square	C.V.	Root MSE	TOTGY Mean
0.888143	27.72788	432.2127	1558.76586

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	2858208.58	1429104.29	7.65	0.0013
TRT	3	42387192.54	14129064.18	75.63	0.0001
TRT*REP	6	4442897.24	740482.87	3.96	0.0027
ALLEY	7	10837300.02	1548185.72	8.29	0.0001
TRT*ALLEY	20	10670557.49	533527.87	2.86	0.0015

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	3256282.34	1628141.17	8.72	0.0006
TRT	3	34244762.05	11414920.68	61.11	0.0001
TRT*REP	6	3430397.20	571732.87	3.06	0.0129
ALLEY	7	11635493.01	1662213.29	8.90	0.0001
TRT*ALLEY	20	10670557.49	533527.87	2.86	0.0015

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	34244762.05	11414920.68	19.97	0.0016

Appendix 191. Analysis of variance table for grain yield of top two rows at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: GYTR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	93035991.59	2448315.57	7.00	0.0001
Error	48	16780658.99	349597.06		
Corrected Total	86	109816650.58			

R-Square	C.V.	Root MSE	GYTR Mean
0.847194	35.75836	591.2673	1653.50805

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	5417820.17	2708910.08	7.75	0.0012
TRT	3	54745487.97	18248495.99	52.20	0.0001
TRT*REP	6	10982107.04	1830351.17	5.24	0.0003
ALLEY	7	6889075.10	984153.59	2.82	0.0154
TRT*ALLEY	20	15001501.31	750075.07	2.15	0.0157

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	6016463.96	3008231.98	8.60	0.0006
TRT	3	41917966.30	13972655.43	39.97	0.0001
TRT*REP	6	10768609.17	1794768.20	5.13	0.0004
ALLEY	7	7285297.76	1040756.82	2.98	0.0112
TRT*ALLEY	20	15001501.31	750075.07	2.15	0.0157

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	41917966.30	13972655.43	7.79	0.0172

Appendix 192. Analysis of variance table for grain yield of center two rows at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: GYMR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	56316865.53	1482022.78	8.15	0.0001
Error	48	8732989.37	181937.28		
Corrected Total	86	65049854.90			

R-Square	C.V.	Root MSE	GYMR Mean
0.865749	30.01619	426.5411	1421.03678

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	270485.85	135242.92	0.74	0.4809
TRT	3	34897072.99	11632357.66	63.94	0.0001
TRT*REP	6	2090057.24	348342.87	1.91	0.0976
ALLEY	7	8280824.53	1182974.93	6.50	0.0001
TRT*ALLEY	20	10778424.93	538921.25	2.96	0.0011

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	430315.54	215157.77	1.18	0.3153
TRT	3	28045343.53	9348447.84	51.38	0.0001
TRT*REP	6	1677682.84	279613.81	1.54	0.1866
ALLEY	7	9014502.59	1287786.08	7.08	0.0001
TRT*ALLEY	20	10778424.93	538921.25	2.96	0.0011

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	28045343.53	9348447.84	33.43	0.0004

Appendix 193. Analysis of variance table for grain yield of bottom two rows at harvest of 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: GYBR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	76798053.70	2021001.41	4.32	0.0001
Error	48	22446068.29	467626.42		
Corrected Total	86	99244121.99			

R-Square	C.V.	Root MSE	GYBR Mean
0.773830	41.64574	683.8322	1642.02184

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	2083700.78	1041850.39	2.23	0.1188
TRT	3	42341345.77	14113781.92	30.18	0.0001
TRT*REP	6	5167540.10	861256.68	1.84	0.1108
ALLEY	7	17391886.53	2484555.22	5.31	0.0002
TRT*ALLEY	20	9813580.52	490679.03	1.05	0.4289

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	2605521.56	1302760.78	2.79	0.0717
TRT	3	36076604.94	12025534.98	25.72	0.0001
TRT*REP	6	3801265.34	633544.22	1.35	0.2520
ALLEY	7	17815705.81	2545100.83	5.44	0.0001
TRT*ALLEY	20	9813580.52	490679.03	1.05	0.4289

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	36076604.94	12025534.98	18.98	0.0018

Appendix 194. Analysis of variance table for transformed total weed dry weight at harvest of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	2.33709289	0.06150244	4.08	0.0001
Error	48	0.72410018	0.01508542		
Corrected Total	86	3.06119307			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.763458	5.541386	0.122823	2.21646210

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.20665000	0.10332500	6.85	0.0024
TRT	3	1.52454736	0.50818245	33.69	0.0001
TRT*REP	6	0.24677007	0.04112835	2.73	0.0232
ALLEY	7	0.13871633	0.01981662	1.31	0.2645
TRT*ALLEY	20	0.22040913	0.01102046	0.73	0.7755

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.17145791	0.08572896	5.68	0.0061
TRT	3	1.22050920	0.40683640	26.97	0.0001
TRT*REP	6	0.23447321	0.03907887	2.59	0.0296
ALLEY	7	0.13802158	0.01971737	1.31	0.2675
TRT*ALLEY	20	0.22040913	0.01102046	0.73	0.7755

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.22050920	0.40683640	10.41	0.0086

Appendix 195. Analysis of variance table for transformed broadleaf weed dry weight at harvest of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	5.70452591	0.15011910	3.62	0.0001
Error	48	1.98827215	0.04142234		
Corrected Total	86	7.69279806			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.741541	10.83725	0.203525	1.87801169

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	C.85021361	0.42510680	10.26	0.0002
TRT	3	2.04083514	0.68027838	16.42	0.0001
TRT*REP	6	1.31627461	0.21937910	5.30	0.0003
ALLEY	7	0.77967399	0.11138200	2.69	0.0196
TRT*ALLEY	20	0.71752856	0.03587643	0.87	0.6267

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.93662589	0.46831295	11.31	0.0001
TRT	3	1.82117052	0.60705684	14.66	0.0001
TRT*REP	6	1.26442531	0.21073755	5.09	0.0004
ALLEY	7	0.68556165	0.09793738	2.36	0.0369
TRT*ALLEY	20	0.71752856	0.03587643	0.87	0.6267

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.82117052	0.60705684	2.88	0.1251

Appendix 196. Analysis of variance table for transformed grass weed dry weight at harvest of the 1987 maize crop at site C-D, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	10.08359708	0.26535782	2.64	0.0008
Error	48	4.81946105	0.10040544		
Corrected Total	86	14.90305814			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.676613	17.57999	0.316868	1.80243663

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	3.29199067	1.64599534	16.39	0.0001
TRT	3	4.59180905	1.53060302	15.24	0.0001
TRT*REP	6	0.84489119	0.14081520	1.40	0.2332
ALLEY	7	0.54799310	0.07828473	0.78	0.6074
TRT*ALLEY	20	0.80691307	0.04034565	0.40	0.9855

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	3.46998263	1.73499131	17.28	0.0001
TRT	3	3.58539304	1.19513101	11.90	0.0001
TRT*REP	6	0.78827815	0.13137969	1.31	0.2716
ALLEY	7	0.55781256	0.07968751	0.79	0.5963
TRT*ALLEY	20	0.80691307	0.04034565	0.40	0.9855

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	3.58539304	1.19513101	9.10	0.0119

Appendix 197. Analysis of variance table for plant stand at 7 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1575037.146	41448.346	2.40	0.0022
Error	48	828619.291	17262.902		
Corrected Total	86	2403656.437			

R-Square	C.V.	Root MSE	PS Mean
0.655267	17.47373	131.3884	751.919540

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	562054.9282	281027.4641	16.28	0.0001
TRT	3	601995.9443	200665.3148	11.62	0.0001
TRT*REP	6	210797.5346	35132.9224	2.04	0.0790
ALLEY	7	43444.6383	6206.3769	0.36	0.9211
TRT*ALLEY	20	156744.1008	7837.2050	0.45	0.9716

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	553834.6714	276917.3357	16.04	0.0001
TRT	3	618487.7946	206162.5982	11.94	0.0001
TRT*REP	6	211463.3647	35243.8941	2.04	0.0781
ALLEY	7	39269.2581	5609.8940	0.32	0.9389
TRT*ALLEY	20	156744.1008	7837.2050	0.45	0.9716

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	618487.7946	206162.5982	5.85	0.0325

Appendix 198. Analysis of variance table for transformed seedling maggot eggs at 7 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	34.48824240	0.90758533	53.28	0.0001
Error	48	0.81759590	0.01703325		
Corrected Total	86	35.30583829			

R-Square	C.V.	Root MSE	SME1 Mean
0.976842	8.676870	0.130511	1.50413086

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	28.72936644	14.36468322	843.33	0.0001
TRT	3	2.54644974	0.84881658	49.83	0.0001
TRT*REP	6	1.39633757	0.23272293	13.66	0.0001
ALLEY	7	1.37215445	0.19602206	11.51	0.0001
TRT*ALLEY	20	0.44393419	0.02219671	1.30	0.2231

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	27.20510147	13.60255073	798.59	0.0001
TRT	3	2.43436441	0.81145480	47.64	0.0001
TRT*REP	6	1.29706011	0.21617668	12.69	0.0001
ALLEY	7	1.37963740	0.19709106	11.57	0.0001
TRT*ALLEY	20	0.44393419	0.02219671	1.30	0.2231

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2.43436441	0.81145480	3.75	0.0789

Appendix 199. Analysis of variance table for transformed seedling maggot dead hearts at 7 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	31.41677599	0.82675726	26.17	0.0001
Error	48	1.51620699	0.03158765		
Corrected Total	86	32.93298298			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.953961	12.81159	0.177729	1.38725299

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	25.67055527	12.83527763	406.34	0.0001
TRT	3	2.41943563	0.80647854	25.53	0.0001
TRT*REP	6	1.00555344	0.16759224	5.31	0.0003
ALLEY	7	1.53292657	0.21898951	6.93	0.0001
TRT*ALLEY	20	0.78830508	0.03941525	1.25	0.2598

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	24.43964051	12.21982025	386.85	0.0001
TRT	3	2.21781968	0.73927323	23.40	0.0001
TRT*REP	6	0.85235259	0.14205877	4.50	0.0011
ALLEY	7	1.56514463	0.22359209	7.08	0.0001
TRT*ALLEY	20	0.78830508	0.03941525	1.25	0.2598

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2.21781968	0.73927323	5.20	0.0416

Appendix 200. Analysis of variance table for transformed seedling maggot eggs per plant at 7 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SME_PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	0.06570830	0.00172917	21.12	0.0001
Error	48	0.00393009	0.00008188		
Corrected Total	86	0.06963839			

R-Square	C.V.	Root MSE	SME_PS1 Mean
0.943564	27.05723	0.009049	0.03344241

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.03982576	0.01991288	243.20	0.0001
TRT	3	0.00962142	0.00320714	39.17	0.0001
TRT*REP	6	0.01094067	0.00182345	22.27	0.0001
ALLEY	7	0.00333198	0.00047600	5.81	0.0001
TRT*ALLEY	20	0.00198847	0.00009942	1.21	0.2843

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.03465434	0.01732717	211.62	0.0001
TRT	3	0.00934530	0.00311510	38.05	0.0001
TRT*REP	6	0.00944277	0.00157379	19.22	0.0001
ALLEY	7	0.00337965	0.00048281	5.90	0.0001
TRT*ALLEY	20	0.00198847	0.00009942	1.21	0.2843

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.00934530	0.00311510	1.98	0.2186

Appendix 201. Analysis of variance table for plant stand at 14 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1296807.919	34126.524	2.75	0.0005
Error	48	596692.794	12431.100		
Corrected Total	86	1893500.713			

R-Square	C.V.	Root MSE	PS Mean
0.684873	14.42258	111.4948	773.057471

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	768667.7969	384333.8984	30.92	0.0001
TRT	3	187249.4587	62416.4862	5.02	0.0042
TRT*REP	6	115802.8916	19300.4819	1.55	0.1817
ALLEY	7	32211.6204	4601.6601	0.37	0.9152
TRT*ALLEY	20	192876.1514	9643.8076	0.78	0.7275

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	745942.5714	372971.2857	30.00	0.0001
TRT	3	183361.2039	61120.4013	4.92	0.0047
TRT*REP	6	108150.7306	18025.1218	1.45	0.2156
ALLEY	7	27350.9829	3907.2833	0.31	0.9440
TRT*ALLEY	20	192876.1514	9643.8076	0.78	0.7275

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	183361.2039	61120.4013	3.39	0.0948

Appendix 202. Analysis of variance table for plant height at 14 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	350.5789491	9.2257618	1.92	0.0163
Error	48	230.3638095	4.7992460		
Corrected Total	86	580.9427586			

R-Square	C.V.	Root MSE	AVEPH Mean
0.603466	11.76497	2.190718	18.6206897

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	65.0916043	32.5458021	6.78	0.0025
TRT	3	10.5213896	3.5071299	0.73	0.5387
TRT*REP	6	177.6123243	29.6020541	6.17	0.0001
ALLEY	7	30.0033942	4.2861992	0.89	0.5194
TRT*ALLEY	20	67.3502367	3.3675118	0.70	0.8045

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	65.4640505	32.7320252	6.82	0.0025
TRT	3	9.8438637	3.2812879	0.68	0.5664
TRT*REP	6	169.9101448	28.3183575	5.90	0.0001
ALLEY	7	30.3023611	4.3289087	0.90	0.5128
TRT*ALLEY	20	67.3502367	3.3675118	0.70	0.8045

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	9.84386367	3.28128789	0.12	0.9475

Appendix 203. Analysis of variance table for transformed seedling maggot eggs at 14 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4.61380594	0.12141595	14.23	0.0001
Error	48	0.40956813	0.00853267		
Corrected Total	86	5.02337407			

R-Square	C.V.	Root MSE	SME1 Mean
0.918468	5.318522	0.092372	1.73680682

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	2.27869742	1.13934871	133.53	0.0001
TRT	3	1.04503834	0.34834611	40.82	0.0001
TRT*REP	6	0.72512793	0.12085466	14.16	0.0001
ALLEY	7	0.28255630	0.04036519	4.73	0.0004
TRT*ALLEY	20	0.28238595	0.01411930	1.65	0.0778

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	2.07747960	1.03873980	121.74	0.0001
TRT	3	1.00482790	0.33494263	39.25	0.0001
TRT*REP	6	0.72497130	0.12082855	14.16	0.0001
ALLEY	7	0.27809977	0.03972854	4.66	0.0005
TRT*ALLEY	20	0.28238595	0.01411930	1.65	0.0778

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.00482790	0.33494263	2.77	0.1331

Appendix 204. Analysis of variance table for transformed seedling maggot dead hearts at 14 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	7.80228407	0.20532326	19.07	0.0001
Error	48	0.51671294	0.01076485		
Corrected Total	86	8.31899701			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.937888	6.048536	0.103754	1.71535415

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	6.26416064	3.13208032	290.95	0.0001
TRT	3	0.10393053	0.03464351	3.22	0.0308
TRT*REP	6	0.83915540	0.13985923	12.99	0.0001
ALLEY	7	0.38698299	0.05528328	5.14	0.0002
TRT*ALLEY	20	0.20805451	0.01040273	0.97	0.5152

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	5.94822546	2.97411273	276.28	0.0001
TRT	3	0.11221321	0.03740440	3.47	0.0230
TRT*REP	6	0.78943310	0.13157218	12.22	0.0001
ALLEY	7	0.38957802	0.05565400	5.17	0.0002
TRT*ALLEY	20	0.20805451	0.01040273	0.97	0.5152

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.11221321	0.03740440	0.28	0.8353

Appendix 205. Analysis of variance table for plant stand at 21 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	2184431.096	57485.029	6.86	0.0001
Error	48	402434.651	8384.055		
Corrected Total	86	2586865.747			

R-Square	C.V.	Root MSE	PS Mean
0.844432	11.53439	91.56449	793.839080

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1691756.864	845878.432	100.89	0.0001
TRT	3	181115.820	60371.940	7.20	0.0004
TRT*REP	6	119509.223	19918.204	2.38	0.0433
ALLEY	7	28392.594	4056.085	0.48	0.8416
TRT*ALLEY	20	163656.595	8182.830	0.98	0.5048

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1712214.704	856107.352	102.11	0.0001
TRT	3	189385.689	63128.563	7.53	0.0003
TRT*REP	6	121320.320	20220.053	2.41	0.0406
ALLEY	7	20022.534	2860.362	0.34	0.9308
TRT*ALLEY	20	163656.595	8182.830	0.98	0.5048

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	189385.6895	63128.5632	3.12	0.1094

Appendix 206. Analysis of variance table for plant height at 21 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1458.259425	38.375248	8.82	0.0001
Error	48	208.816667	4.350347		
Corrected Total	86	1667.076092			

R-Square	C.V.	Root MSE	AVEPH Mean
0.874741	8.291909	2.085749	25.1540230

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	371.9873637	185.9936819	42.75	0.0001
TRT	3	934.0150289	311.3383430	71.57	0.0001
TRT*REP	6	38.4791160	6.4131860	1.47	0.2071
ALLEY	7	20.5577503	2.9368215	0.68	0.6921
TRT*ALLEY	20	93.2201664	4.6610083	1.07	0.4073

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	313.2890599	156.6445299	36.01	0.0001
TRT	3	849.2793451	283.0931150	65.07	0.0001
TRT*REP	6	36.9656768	6.1609461	1.42	0.2280
ALLEY	7	21.4546349	3.0649478	0.70	0.6681
TRT*ALLEY	20	93.2201664	4.6610083	1.07	0.4073

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	849.2793451	283.0931150	45.95	0.0002

Appendix 207. Analysis of variance table for transformed seedling maggot eggs at 21 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SME1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4.36563655	0.11488517	9.41	0.0001
Error	48	0.58597655	0.01220784		
Corrected Total	86	4.95161311			

R-Square	C.V.	Root MSE	SME1 Mean
0.881659	6.668150	0.110489	1.65696798

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.58819545	0.29409773	24.09	0.0001
TRT	3	2.23127794	0.74375931	60.92	0.0001
TRT*REP	6	0.97997583	0.16332930	13.38	0.0001
ALLEY	7	0.40407954	0.05772565	4.73	0.0004
TRT*ALLEY	20	0.16210779	0.00810539	0.66	0.8402

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.40083485	0.20041743	16.42	0.0001
TRT	3	2.12463483	0.70821161	58.01	0.0001
TRT*REP	6	0.86692233	0.14448706	11.84	0.0001
ALLEY	7	0.39643417	0.05663345	4.64	0.0005
TRT*ALLEY	20	0.16210779	0.00810539	0.66	0.8402

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2.12463483	0.70821161	4.90	0.0471

Appendix 208. Analysis of variance table for transformed seedling maggot dead hearts at 21 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SMDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4.02702792	0.10597442	7.24	0.0001
Error	48	0.70244036	0.01463417		
Corrected Total	86	4.72946828			

R-Square	C.V.	Root MSE	SMDH1 Mean
0.851476	7.750704	0.120972	1.56078463

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.13308462	0.06654231	4.55	0.0155
TRT	3	1.51014645	0.50338215	34.40	0.0001
TRT*REP	6	1.70608645	0.28434774	19.43	0.0001
ALLEY	7	0.49847551	0.07121079	4.87	0.0003
TRT*ALLEY	20	0.17923489	0.00896174	0.61	0.8838

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.04473355	0.02236678	1.53	0.2273
TRT	3	1.48923575	0.49641192	33.92	0.0001
TRT*REP	6	1.48402511	0.24733752	16.90	0.0001
ALLEY	7	0.49916036	0.07130862	4.87	0.0003
TRT*ALLEY	20	0.17923489	0.00896174	0.61	0.8838

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.48923575	0.49641192	2.01	0.2145

Appendix 209. Analysis of variance table for plant stand at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	2087573.525	54936.145	6.96	0.0001
Error	48	379058.291	7897.048		
Corrected Total	86	2466631.816			

R-Square	C.V.	Root MSE	PS Mean
0.846326	18.99019	88.86533	467.954023

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1452662.470	726331.235	91.98	0.0001
TRT	3	96351.928	32117.309	4.07	0.0118
TRT*REP	6	346287.264	57714.544	7.31	0.0001
ALLEY	7	57922.434	8274.633	1.05	0.4112
TRT*ALLEY	20	134349.430	6717.471	0.85	0.6442

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1439781.079	719890.540	91.16	0.0001
TRT	3	111525.657	37175.219	4.71	0.0058
TRT*REP	6	342979.431	57163.239	7.24	0.0001
ALLEY	7	58855.142	8407.877	1.06	0.4004
TRT*ALLEY	20	134349.430	6717.471	0.85	0.6442

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	111525.6566	37175.2189	0.65	0.6111

Appendix 210. Analysis of variance table for tillers at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: TIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1558955.583	41025.147	9.75	0.0001
Error	48	202026.762	4208.891		
Corrected Total	86	1760982.345			

R-Square	C.V.	Root MSE	TIL Mean
0.885276	32.78848	64.87597	197.862069

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	754361.8042	377180.9021	89.62	0.0001
TRT	3	416022.0925	138674.0308	32.95	0.0001
TRT*REP	6	264065.9541	44010.9924	10.46	0.0001
ALLEY	7	26672.8915	3810.4131	0.91	0.5103
TRT*ALLEY	20	97832.8406	4891.6420	1.16	0.3256

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	714021.9538	357010.9769	84.82	0.0001
TRT	3	395248.2272	131749.4091	31.30	0.0001
TRT*REP	6	262301.4129	43716.9021	10.39	0.0001
ALLEY	7	27106.5396	3872.3628	0.92	0.4995
TRT*ALLEY	20	97832.8406	4891.6420	1.16	0.3256

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	395248.2272	131749.4091	3.01	0.1161

Appendix 211. Analysis of variance table for plant height at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4221.871468	111.101881	7.72	0.0001
Error	48	690.508532	14.385594		
Corrected Total	86	4912.380000			

R-Square	C.V.	Root MSE	AVEPH Mean
0.859435	9.928886	3.792835	38.2000000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1240.510038	620.255019	43.12	0.0001
TRT	3	2490.642616	830.214205	57.71	0.0001
TRT*REP	6	83.688298	13.948050	0.97	0.4559
ALLEY	7	85.842329	12.263190	0.85	0.5503
TRT*ALLEY	20	321.188187	16.059409	1.12	0.3654

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1214.616307	607.308153	42.22	0.0001
TRT	3	2363.374661	787.791554	54.76	0.0001
TRT*REP	6	95.844210	15.974035	1.11	0.3703
ALLEY	7	89.574563	12.796366	0.89	0.5221
TRT*ALLEY	20	321.188187	16.059409	1.12	0.3654

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2363.374661	787.791554	49.32	0.0001

Appendix 212. Analysis of variance table for transformed white grub at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: WG6M1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	6.99002556	0.18394804	2.63	0.0008
Error	48	3.35824893	0.06996352		
Corrected Total	86	10.34827449			

R-Square	C.V.	Root MSE	WG6M1 Mean
0.675477	38.83558	0.264506	0.68109243

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1.28144317	0.64072158	9.16	0.0004
TRT	3	1.56193440	0.52064480	7.44	0.0003
TRT*REP	6	1.41933050	0.23655508	3.38	0.0073
ALLEY	7	0.74214652	0.10602093	1.52	0.1848
TRT*ALLEY	20	1.98517097	0.09925855	1.42	0.1601

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1.42291915	0.71145958	10.17	0.0002
TRT	3	1.09238096	0.36412699	5.20	0.0034
TRT*REP	6	1.60471890	0.26745315	3.82	0.0034
ALLEY	7	0.47741105	0.06820158	0.97	0.4603
TRT*ALLEY	20	1.98517097	0.09925855	1.42	0.1601

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.09238096	0.36412699	1.36	0.3411

Appendix 213. Analysis of variance table for transformed total weed dry weight at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	11.65983786	0.30683784	8.75	0.0001
Error	48	1.68315738	0.03506578		
Corrected Total	86	13.34299524			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.873855	13.59539	0.187259	1.37736806

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	5.12676509	2.56338254	73.10	0.0001
TRT	3	4.94006937	1.64668979	46.96	0.0001
TRT*REP	6	0.19183555	0.03197259	0.91	0.4946
ALLEY	7	0.75948313	0.10849759	3.09	0.0090
TRT*ALLEY	20	0.64168472	0.03208424	0.91	0.5718

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	4.78149842	2.39074921	68.18	0.0001
TRT	3	4.80770721	1.60256907	45.70	0.0001
TRT*REP	6	0.19557043	0.03259507	0.93	0.4825
ALLEY	7	0.78746819	0.11249546	3.21	0.0072
TRT*ALLEY	20	0.64168472	0.03208424	0.91	0.5718

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	4.80770721	1.60256907	49.17	0.0001

Appendix 214. Analysis of variance table for transformed broadleaf weed dry weight at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	10.42813067	0.27442449	5.71	0.0001
Error	48	2.30804543	0.04808428		
Corrected Total	86	12.73617611			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.818780	17.66530	0.219281	1.24131092

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	3.97802449	1.98901225	41.37	0.0001
TRT	3	3.87863148	1.29287716	26.89	0.0001
TRT*REP	6	0.89719017	0.14953169	3.11	0.0118
ALLEY	7	1.03005896	0.14715128	3.06	0.0096
TRT*ALLEY	20	0.64422558	0.03221128	0.67	0.8348

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	3.62245408	1.81122704	37.67	0.0001
TRT	3	3.83071275	1.27690425	26.56	0.0001
TRT*REP	6	0.88577577	0.14762930	3.07	0.0126
ALLEY	7	1.03576553	0.14796650	3.08	0.0093
TRT*ALLEY	20	0.64422558	0.03221128	0.67	0.8348

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	3.83071275	1.27690425	8.65	0.0134

Appendix 215. Analysis of variance table for transformed grass weed dry weight at 40 days after emergence of 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	15.93347211	0.41930190	5.35	0.0001
Error	48	3.76213161	0.07837774		
Corrected Total	86	19.69560372			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.808986	37.36253	0.279960	0.74930760

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	7.15667148	3.57833574	45.65	0.0001
TRT	3	5.36764260	1.78921420	22.83	0.0001
TRT*REP	6	1.27636886	0.21272814	2.71	0.0237
ALLEY	7	0.55435936	0.07919419	1.01	0.4359
TRT*ALLEY	20	1.57842982	0.07892149	1.01	0.4720

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	6.88516919	3.44258460	43.92	0.0001
TRT	3	4.78122951	1.59374317	20.33	0.0001
TRT*REP	6	1.05717662	0.17619610	2.25	0.0543
ALLEY	7	0.62751485	0.08964498	1.14	0.3524
TRT*ALLEY	20	1.57842982	0.07892149	1.01	0.4720

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	4.78122951	1.59374317	9.05	0.0121

Appendix 216. Analysis of variance table for plant stand and tillers at 50 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	2690591.229	70805.032	6.47	0.0001
Error	48	525007.874	10937.664		
Corrected Total	86	3215599.103			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.836731	11.93075	104.5833	876.586207

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1531550.371	765775.186	70.01	0.0001
TRT	3	321353.288	107117.763	9.79	0.0001
TRT*REP	6	488021.933	81336.989	7.44	0.0001
ALLEY	7	186641.583	26663.083	2.44	0.0320
TRT*ALLEY	20	163024.055	8151.203	0.75	0.7601

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1579305.156	789652.578	72.20	0.0001
TRT	3	361780.437	120593.479	11.03	0.0001
TRT*REP	6	522419.711	87069.952	7.96	0.0001
ALLEY	7	139340.834	19905.833	1.82	0.1050
TRT*ALLEY	20	163024.055	8151.203	0.75	0.7601

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	361780.4369	120593.4790	1.39	0.3350

Appendix 217. Analysis of variance table for plant height at 50 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4889.753559	128.677725	6.55	0.0001
Error	48	943.048740	19.646849		
Corrected Total	86	5832.802299			

R-Square	C.V.	Root MSE	AVEPH Mean
0.838320	10.59469	4.432477	41.8367816

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1698.453472	849.226736	43.22	0.0001
TRT	3	2158.321114	719.440371	36.62	0.0001
TRT*REP	6	377.974022	62.995670	3.21	0.0100
ALLEY	7	167.613984	23.944855	1.22	0.3111
TRT*ALLEY	20	487.390966	24.369548	1.24	0.2651

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1659.210037	829.605019	42.23	0.0001
TRT	3	2141.575910	713.858637	36.33	0.0001
TRT*REP	6	357.793061	59.632177	3.04	0.0135
ALLEY	7	170.065109	24.295016	1.24	0.3018
TRT*ALLEY	20	487.390966	24.369548	1.24	0.2651

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	2141.575910	713.858637	11.97	0.0061

Appendix 218. Analysis of variance table for transformed stemborer dead hearts at 50 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1.58689647	0.04176043	1.88	0.0192
Error	48	1.06436104	0.02217419		
Corrected Total	86	2.65125751			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.598545	10.22406	0.148910	1.45646583

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.75293390	0.37646695	16.98	0.0001
TRT	3	0.06727050	0.02242350	1.01	0.3960
TRT*REP	6	0.21895774	0.03649296	1.65	0.1552
ALLEY	7	0.13085344	0.01869335	0.84	0.5576
TRT*ALLEY	20	0.41688088	0.02084404	0.94	0.5440

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.65903437	0.32951718	14.86	0.0001
TRT	3	0.03598168	0.01199389	0.54	0.6566
TRT*REP	6	0.25237995	0.04206333	1.90	0.1006
ALLEY	7	0.13978705	0.01996958	0.90	0.5139
TRT*ALLEY	20	0.41688088	0.02084404	0.94	0.5440

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.03598168	0.01199389	0.29	0.8347

Appendix 219. Analysis of variance table for plant stand and tillers at 70 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PSNTIL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	2991105.844	78713.312	5.17	0.0001
Error	48	730764.869	15224.268		
Corrected Total	86	3721870.713			

R-Square	C.V.	Root MSE	PSNTIL Mean
0.803657	11.26760	123.3867	1095.05747

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1767827.067	883913.534	58.06	0.0001
TRT	3	543645.397	181215.132	11.90	0.0001
TRT*REP	6	289686.094	48281.016	3.17	0.0106
ALLEY	7	182544.382	26077.769	1.71	0.1284
TRT*ALLEY	20	207402.904	10370.145	0.68	0.8243

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1653738.906	826869.453	54.31	0.0001
TRT	3	556147.622	185382.541	12.18	0.0001
TRT*REP	6	289722.635	48287.106	3.17	0.0106
ALLEY	7	168152.806	24021.829	1.58	0.1649
TRT*ALLEY	20	207402.904	10370.145	0.68	0.8243

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	556147.6220	185382.5407	3.84	0.0757

Appendix 220. Analysis of variance table for plant height at 70 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: AVEPH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	12574.74628	330.91438	5.91	0.0001
Error	48	2688.92222	56.01921		
Corrected Total	86	15263.66851			

R-Square	C.V.	Root MSE	AVEPH Mean
0.823835	13.11052	7.484598	57.0885057

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	4550.168932	2275.084466	40.61	0.0001
TRT	3	6358.134909	2119.378303	37.83	0.0001
TRT*REP	6	389.010081	64.835014	1.16	0.3447
ALLEY	7	243.503502	34.786215	0.62	0.7359
TRT*ALLEY	20	1033.928859	51.696443	0.92	0.5630

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	4466.280365	2233.140182	39.86	0.0001
TRT	3	5885.620817	1961.873606	35.02	0.0001
TRT*REP	6	363.548842	60.591474	1.08	0.3868
ALLEY	7	239.966553	34.280936	0.61	0.7432
TRT*ALLEY	20	1033.928859	51.696443	0.92	0.5630

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	5885.620817	1961.873606	32.38	0.0004

Appendix 221. Analysis of variance table for transformed stemborer dead hearts at 70 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: SBDH1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	5.28936396	0.13919379	12.77	0.0001
Error	48	0.52302487	0.01089635		
Corrected Total	86	5.81238883			

R-Square	C.V.	Root MSE	SBDH1 Mean
0.910016	7.829232	0.104386	1.33327999

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	4.21697184	2.10848592	193.50	0.0001
TRT	3	0.47556560	0.15852187	14.55	0.0001
TRT*REP	6	0.25218093	0.04203015	3.86	0.0032
ALLEY	7	0.18292666	0.02613238	2.40	0.0345
TRT*ALLEY	20	0.16171893	0.00808595	0.74	0.7635

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	4.18313393	2.09156697	191.95	0.0001
TRT	3	0.48666648	0.16222216	14.89	0.0001
TRT*REP	6	0.25313877	0.04218979	3.87	0.0031
ALLEY	7	0.18376381	0.02625197	2.41	0.0338
TRT*ALLEY	20	0.16171893	0.00808595	0.74	0.7635

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.48666648	0.16222216	3.85	0.0755

Appendix 222. Analysis of variance table for transformed panicles at 105 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PA1051

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	3.89857289	0.10259402	3.28	0.0001
Error	48	1.50305483	0.03131364		
Corrected Total	86	5.40162771			

R-Square	C.V.	Root MSE	PA1051 Mean
0.721740	7.093470	0.176957	2.49464084

Source	DF	Type 1 SS	Mean Square	F Value	Pr > F
REP	2	1.08584936	0.54292468	17.34	0.0001
TRT	3	1.93643813	0.64547938	20.61	0.0001
TRT*REP	6	0.33627464	0.05604577	1.79	0.1212
ALLEY	7	0.18162246	0.02594607	0.83	0.5688
TRT*ALLEY	20	0.35838830	0.01791941	0.57	0.9128

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1.05641865	0.52820933	16.87	0.0001
TRT	3	1.84949795	0.61649932	19.69	0.0001
TRT*REP	6	0.32856165	0.05476027	1.75	0.1301
ALLEY	7	0.18173406	0.02596201	0.83	0.5684
TRT*ALLEY	20	0.35838830	0.01791941	0.57	0.9128

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.84949795	0.61649932	11.26	0.0071

Appendix 223. Analysis of variance table for transformed panicles at 114 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PA1141

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	1.12368511	0.02957066	2.44	0.0018
Error	48	0.58090935	0.01210228		
Corrected Total	86	1.70459446			

R-Square	C.V.	Root MSE	PA1141 Mean
0.659210	4.071439	0.110010	2.70200189

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.13099911	0.06549955	5.41	0.0076
TRT	3	0.56512496	0.18837499	15.57	0.0001
TRT*REP	6	0.22721290	0.03786882	3.13	0.0114
ALLEY	7	0.09339443	0.01334206	1.10	0.3769
TRT*ALLEY	20	0.10695372	0.00534769	0.44	0.9754

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.13537964	0.06768982	5.59	0.0066
TRT	3	0.53283122	0.17761041	14.68	0.0001
TRT*REP	6	0.22545823	0.03757637	3.10	0.0119
ALLEY	7	0.09298980	0.01328426	1.10	0.3799
TRT*ALLEY	20	0.10695372	0.00534769	0.44	0.9754

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.53283122	0.17761041	4.73	0.0506

Appendix 224. Analysis of variance table for transformed panicles at 121 days after emergence of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: PA1211

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	0.44590701	0.01173440	3.20	0.0001
Error	48	0.17588240	0.00366422		
Corrected Total	86	0.62178941			

R-Square	C.V.	Root MSE	PA1211 Mean
0.717135	2.155792	0.060533	2.80791295

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.05222541	0.02611271	7.13	0.0019
TRT	3	0.21028104	0.07009368	19.13	0.0001
TRT*REP	6	0.07628841	0.01271473	3.47	0.0063
ALLEY	7	0.05508260	0.00786894	2.15	0.0561
TRT*ALLEY	20	0.05202955	0.00260148	0.71	0.7963

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.05080005	0.02540002	6.93	0.0023
TRT	3	0.19200904	0.06400301	17.47	0.0001
TRT*REP	6	0.07188881	0.01198147	3.27	0.0089
ALLEY	7	0.05559687	0.00794241	2.17	0.0540
TRT*ALLEY	20	0.05202955	0.00260148	0.71	0.7963

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.19200904	0.06400301	5.34	0.0394

Appendix 225. Analysis of variance table for total straw dry weight at harvest of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: DWTB

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	279041067.1	7343186.0	4.19	0.0001
Error	48	84023721.4	1750494.2		
Corrected Total	86	363064788.5			

R-Square	C.V.	Root MSE	DWTB Mean
0.768571	33.61588	1323.062	3935.82529

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	188706513.3	94353256.7	53.90	0.0001
TRT	3	30472000.5	10157333.5	5.80	0.0018
TRT*REP	6	24647252.7	4107875.4	2.35	0.0456
ALLEY	7	25845078.5	3692154.1	2.11	0.0604
TRT*ALLEY	20	9370222.2	468511.1	0.27	0.9989

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	179860548.7	89930274.4	51.37	0.0001
TRT	3	28546292.8	9515430.9	5.44	0.0027
TRT*REP	6	24443488.7	4073914.8	2.33	0.0472
ALLEY	7	25639997.4	3662856.8	2.09	0.0624
TRT*ALLEY	20	9370222.2	468511.1	0.27	0.9989

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	28546292.75	9515430.92	2.34	0.1733

Appendix 226. Analysis of variance table for total grain yield at harvest of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: DWGY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	6825004.038	179605.369	1.07	0.4077
Error	48	8051802.832	167745.892		
Corrected Total	86	14876806.871			

R-Square	C.V.	Root MSE	DWGY Mean
0.458768	43.19509	409.5679	948.181609

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1586342.056	793171.028	4.73	0.0134
TRT	3	275561.945	91853.982	0.55	0.6522
TRT*REP	6	1698820.863	283136.811	1.69	0.1444
ALLEY	7	2092105.495	298872.214	1.78	0.1129
TRT*ALLEY	20	1172173.680	58608.684	0.35	0.9937

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1262411.146	631205.573	3.76	0.0303
TRT	3	156329.561	52109.854	0.31	0.8176
TRT*REP	6	1622549.634	270424.939	1.61	0.1643
ALLEY	7	2144371.373	306338.768	1.83	0.1038
TRT*ALLEY	20	1172173.680	58608.684	0.35	0.9937

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	156329.5615	52109.8538	0.19	0.8977

Appendix 227. Analysis of variance table for total weed dry weight at harvest of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: TOTAL1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	4.29348761	0.11298652	7.11	0.0001
Error	48	0.76242576	0.01588387		
Corrected Total	86	5.05591338			

R-Square	C.V.	Root MSE	TOTAL1 Mean
0.849201	5.481139	0.126031	2.29936206

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	1.57591703	0.78795852	49.61	0.0001
TRT	3	0.70354886	0.23451629	14.76	0.0001
TRT*REP	6	1.46137705	0.24356284	15.33	0.0001
ALLEY	7	0.14558825	0.02079832	1.31	0.2664
TRT*ALLEY	20	0.40705642	0.02035282	1.28	0.2370

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	1.58380176	0.79190088	49.86	0.0001
TRT	3	0.54053204	0.18017735	11.34	0.0001
TRT*REP	6	1.43449049	0.23908175	15.05	0.0001
ALLEY	7	0.12868037	0.01838291	1.16	0.3446
TRT*ALLEY	20	0.40705642	0.02035282	1.28	0.2370

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.54053204	0.18017735	0.75	0.5592

Appendix 228. Analysis of variance table for broadleaf weed dry weight at harvest of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: BROAD1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	3.35200582	0.08821068	4.19	0.0001
Error	48	1.01162902	0.02107560		
Corrected Total	86	4.36363484			

R-Square	C.V.	Root MSE	BROAD1 Mean
0.768168	7.154000	0.145174	2.02927581

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	0.05261469	0.02630734	1.25	0.2962
TRT	3	1.36898745	0.45632915	21.65	0.0001
TRT*REP	6	1.05612309	0.17602051	8.35	0.0001
ALLEY	7	0.29565067	0.04223581	2.00	0.0740
TRT*ALLEY	20	0.57862993	0.02893150	1.37	0.1830

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	0.05578203	0.02789101	1.32	0.2758
TRT	3	1.19881125	0.39960375	18.96	0.0001
TRT*REP	6	0.88484261	0.14747377	7.00	0.0001
ALLEY	7	0.30740407	0.04391487	2.08	0.0635
TRT*ALLEY	20	0.57862993	0.02893150	1.37	0.1830

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	1.19881125	0.39960375	2.71	0.1381

Appendix 229. Analysis of variance table for grass weed dry weight at harvest of the 1988 rice crop at site C-D, Claveria, Philippines

Dependent Variable: GRASS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	38	30.68819605	0.80758411	8.26	0.0001
Error	48	4.69145610	0.09773867		
Corrected Total	86	35.37965214			

R-Square	C.V.	Root MSE	GRASS1 Mean
0.867397	18.27038	0.312632	1.71114024

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	2	20.04959811	10.02479906	102.57	0.0001
TRT	3	5.78369470	1.92789823	19.73	0.0001
TRT*REP	6	1.97637113	0.32939519	3.37	0.0075
ALLEY	7	1.43783255	0.20540465	2.10	0.0613
TRT*ALLEY	20	1.44069955	0.07203498	0.74	0.7687

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	2	19.90169807	9.95084904	101.81	0.0001
TRT	3	4.33698608	1.44566203	14.79	0.0001
TRT*REP	6	1.89388437	0.31564740	3.23	0.0096
ALLEY	7	1.28469318	0.18352760	1.88	0.0941
TRT*ALLEY	20	1.44069955	0.07203498	0.74	0.7687

Tests of Hypotheses using the Type III MS for TRT*REP as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	4.33698608	1.44566203	4.58	0.0539