YIELD RESPONSES OF OKRA TO SELECTED ORGANIC FERTILIZERS UNDER CATBALOGAN SOIL CONDITIONS

A Thesis

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In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Teaching Vocational Education

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by

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APPROVAL SHEET

In partial fulfillment of the requirements for the degree of MASTER OF ARTS IN TEACHING VOCATIONAL EDUCATION, this thesis entitled YIELD RESPONSES OF OKRA TO SELECTED ORGANIC FERTILIZERS UNDER CATBALOGAN SOIL CONDITIONS has been prepared and submitted by THELMA CABADSAN-QUITALIG who is recommended for oral examination.

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Thel

D E D I C A T I O N

To my native land for her economic upliftment; to the farmers who are the backbone of the nation; and to my dear and loving husband,

LUISITO M. QUITALIG,

and to our precious jewels:

EWIN

and

LOTLOT,

for their love, understanding, support and inspiration, I dedicate this humble work.

Thel

ABSTRACT

This study compared the yield responses of okra to selected organic fertilizers (carabao manure and chicken dung) under catbalogan soil conditions. The plants in treatment 2 (with chicken dung) manifest the best responses in terms of average number of pods and mean increase per hill, average length and diameter of pods, and the total yield in kilograms. Those in treatment 1 (with carabao manure) rank second and the last is treatment 3 (no fertilizer). for the conclusion, okra responds well to chicken dung in terms of the number of pods, the length and diameter, and the weight of the pods. Although the difference in yield is insignificant under .05 and .01 levels, the little advantage derived from the use of chicken dung may lead to a greater profit in large-scale farming. For the recommendation, under the soil conditions of Catbalogan, Samar chicken dung is strongly recommend in the production of okra. In the absence of chicken dung, carabao manure is secondarily recommended in the production of okra. A study on the market profitability of okra in relation to other vegetables is hereby recommended under the market condition of Catbalogan, Samar.

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CHAPTER I

THE PROBLEM

Introduction

Okra (Hibiscus Esculentus), commonly called "gumbo" is a highly nutritious vegetable. It contains protein, iron, calcium, vitamin A, thiamine, riboflavin, niacin, vitamin C, and calories.[1] This vegetable is considered as an annual crop with very wide adaptability to both soil and climatic conditions.[2]

Many gardeners resort to production of this crop because within a period of three months, the fruits can be harvested already.[3]

Aside from being a nutritious vegetable, okra has also its excellent uses, according to the Philippine Council for Agriculture and Resource Research and Development (PCARRD). The seeds of this vegetable can be used in different ways. The matured seeds can be cooked just like that of the beans. The young tender pods can be used as substitute for legumes. The pulverized seeds of

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[1]James E. Fabicon, et. al., Green Revolution: Easy Methods of Vegetable Growing, Vol. I (Manila: National Book Store, Inc., 1974), p. 50.

[2]Epifanio Madali and E. S. Cruz, Elementary Agriculture (Manila: Philippine Book Co., 1976), p. 3.

[3]Fabicon, loc. cit.

okra is used as coffee in El Salvador and Malaysia.[4] The young tender pods can be boiled and seasoned with pepper, butter and vinegar. Others prefer okra with eggs and cornmeal or in creole style. For variation, it may be served with tomatoes or in tomato sauce.[5]

Okra plantation is advantageous to gardeners who have only a limited space for their gardens. There are varieties like the Dwarf Green Longpod which do not occupy so much space. The growth of this plant is upward so that even a space as wide as a winnowing basket can be planted to three hills of okra. It does not require so much attention from the gardeners and this is also a kind of vegetable which is not susceptible to garden pests.[6]

In the culture of okra, one packet of seeds will supply the needs of most families. A tender plant, okra must not be planted outdoors until all danger of stormy weather has passed.[7] The process of planting okra is just easy. It can be planted at a depth of

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[4]United Super Stories, No. 850, "Planting Okra is Attracting" (Mla.: Affiliated Pub. Inc., 1984), p. 17.

[5]Daniel J. Foley, Vegetable Gardening In Color (New York: The Macmillan Company, 1944), p. 249.

[6]United Super Stories, loc. cit.

[7]Foley, op. cit., p. 115.

five to eight centimeters. Other farmers plant it by just broadcasting the seeds on the field but this process does not guarantee good growth and yield of the plants.[8]

Like other crops, okra needs nutrients for its proper growth and development. These nutrients can be taken from fertilizers; the organic fertilizer and the inorganic fertilizer. Native or natural fertilizers are stable manure, poultry manure or chicken dung and guano. These manures should not be used while fresh as they become heated and retard the growth of plants. However, fresh manure may be used in preparing liquid manure fertilizer.[9]

Perhaps the best source of organic fertilizer for the vegetable garden is the excreta of animals, like carabao manure and chicken dung. This carabao manure can be taken from barnyards or stables. This is rich in nutrients like any other organic fertilizers for it is from grasses and leaves eaten by carabaos.[10] These grasses and leaves are highly nutritious like cogon, ipil-ipil leaves, camote and kangkong leaves, banana leaves and other weeds that grew naturally in farmyards. Some of these grasses are scientifically grown for

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[8]United Super Stories, loc. cit.

[9]Foley, op. cit., p. 26.

[10]The SAMAKA GUIDE To Homesite Farming (Mla.: Samaka Service Center, Inc., 1962), p. 32.

cattle feeds.

Chicken dung on the other hand, is also rich in nutrients. It comes from feeds which are rich in food elements like that of corn. Nowadays, because of scientific and technological researches and inventions, chicken feeds are made scientifically. But its application is so determined that overuse of this cause soil acidity.[11]

Carabao manure and chicken dung can be a substitute for commercial fertilizers for they contain the three most important nutrients needed by the plant. These are nitrogen, phosphorus and potassium, which help much in a successful vegetable production. All too often, these organic fertilizers are scarce, and in recent years have become rather expensive. In rural areas, however, its cost is not so much felt due to its abundance.

As of now, the supply of okra cannot meet the demands even here in our local markets. With this market condition there is an increasing need for producing more of this crop. Seeing that the kind of organic fertilizers which are abundant in the locality are chicken dung and stable manure, particularly carabao manure, these fertilizers were made as the object of

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[11] Foley, op. cit., p. 27.

study in relation to the yield responses of okra under Catbalogan soil conditions.

Theoretical Framework

The theoretical base for the conduct of this study is the principle of crop production that "plants grow vigorously and give better yield with the application of fertilizers" as enunciated by Howard E. Baumann. Reports indicate that a good number of experiments have shown a very considerable effect of fertilizers on different field crops, particularly vegetables. Records also show that fertilizer practices used must be specifically fitted to the particular soil and crop.[12]

In crop production, it will be noted that several environmental factors affect the yield of the crops planted. One of these is the soil environment. Soil, besides providing anchorage and support for the plants, is also the source of the minerals and water used by the plant. It also plays a major role in determining the crops to be grown. Variations in soil condition and in mineral content affect so much the growth of the plant. These factors of the soil environment that help plant growth are nitrogen, phosphorus and potassium (N, P and K res-

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[12] Howard E. Baumann, Nutrients In Processed Foods (U.S.A.: Pub. Science Group, Inc., 1974), p. 42.

pectively) which must be adjusted regularly by adding either commercial chemical fertilizer or animal manure.[13]

Mineral elements needed by the plant in lesser quantities (micro-nutrients) may also be required. Soil compaction and drainage exert considerable effect upon plant growth by influencing soil aeration. Crops and varieties that will perform well under the prevailing soil environment should be carefully selected. Some varieties will respond to fertilizer by giving higher yields; other varieties give reduced yields or do not respond at all.[14]

It is evident that for a successful vegetable growing, several cultural aspects must be taken into consideration. Aside from the soil environment, is the type or kind of plant to be planted. Experience tells that there are plants that respond well in terms of growth and yield in any type of soil; be it sandy, loam, clay, sandy-loam or clay-loam. However, vegetables are best in clay-loam soil, which is neither sticky nor loose.[15]

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[13] Danilo Eligio and Edgar Ricamonte, Agricultural Arts for Sec. Schools (Quezon City: Mercantile, Inc., 1980), pp. 69-70.

[14] Roman Anday, Teaching Guides in Elem. Agriculture (Bagiuo City: National Nutrition Council, 1977), pp. 19-20.

[15] Eligio, op. cit., p. 71.

Due to varied conditions in different localities, crops do not exhibit the same pattern of growth. It is of prime importance that the variety of crops be adapted to the condition of the locality where it will be planted. It is possible that a variety which thrives well in one region may not necessarily yield the same result if grown in another region. However, a variety may also produce a good yield in two separate regions.[16]

According to Eligio and Ricamonte, the use of fertilizer to supplement nutrients in the soil improves the quality and yield of crops. No crop will survive without certain elements such as nitrogen, phosphorus, potassium and other needed elements as mentioned in the previous part of this study. At present, there are 16 elements which are essential for the growth of plants. If the amount or even one of these elements is lacking, the crops will not grow and fruit properly. The application of fertilizer supplements the deficiency in the amount of elements which may be lacking.[17]

Of the three elements, nitrogen, phosphorus and potassium, nitrogen exerts the greatest influence on the ability of plants to develop luxuriantly dark green

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[16] Ibid., p. 72.

[17] Ibid., p. 76.

colored leaves and properly developed stems needed by growing plants.[18]

Early maturing of crops is hastened through the application of phosphorus aside from aiding the transfer of nutrients from the stalk, leaves and other growing parts of the seed, making the grain plump and full. It also increases the yield of the grains, stimulates root development in young crops, strengthens the stem and increase resistance against diseases.[19]

Potassium on the other hand, helps the plants build resistance against certain diseases and improves the vegetative parts of the plants. Lack of potassium causes the early ripening of fruits even if they are still immature due to the weakening of the stems.[20]

The use of organic fertilizers like carabao manure and chicken dung will surely help gardeners and farmers improve the yield of their farm crops as both contain the three most important elements needed by the plants (see appendix I, page 76). The output of this study which focuses on its profitability is further illustrated in the conceptual framework that follows.

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[18] Ibid.

[19] Anday, op. cit., pp. 29-30.

[20] Ibid.

Conceptual Framework

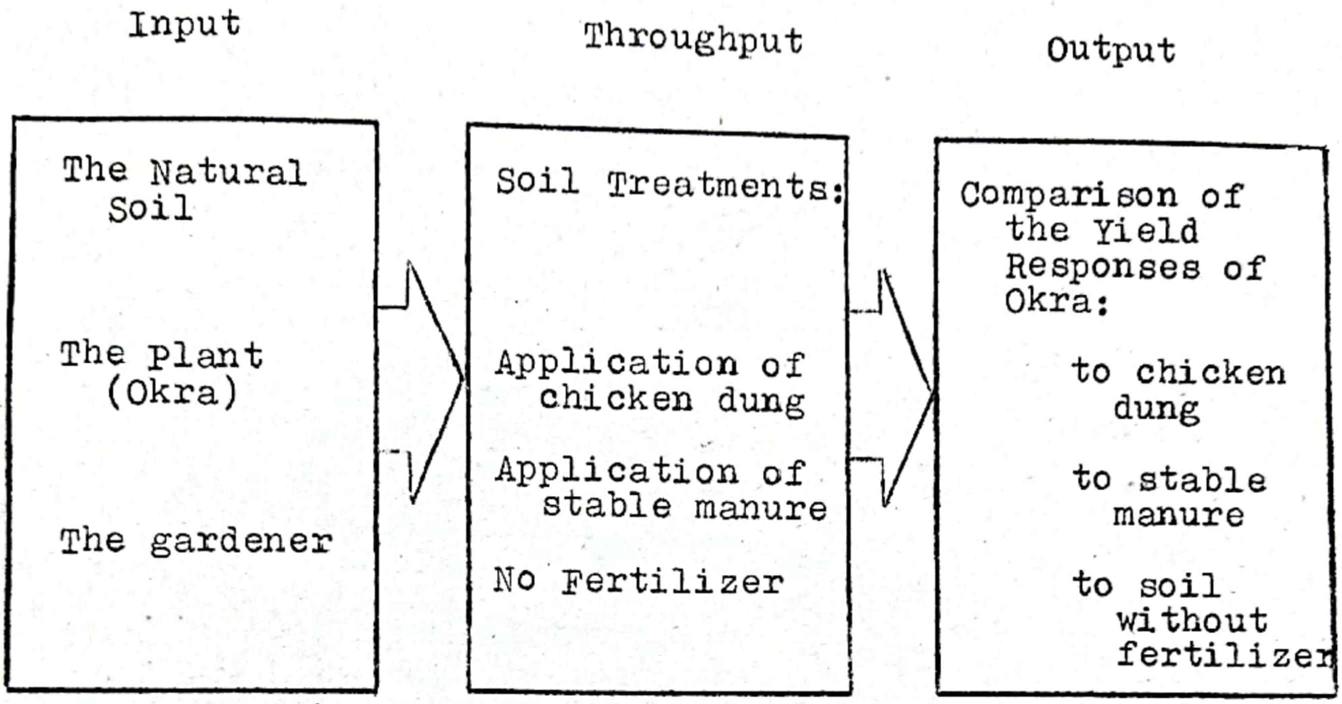

Figure 1. Based on Baumann's Theory that plants give better yield with the application of fertilizer, the gardener of any crop is expected to do some soil treatments to improve the yield responses of the plant.

In the conduct of this study, the input consists of the natural soil, the plant (okra), and the gardener. The natural soil here, besides providing physical support and anchorage for the plant, is the source of the minerals and water used by the plant. Variations in mineral content of the soil affect plant growth. Okra, on the other hand, is the subject or responding organism to the different soil environmental factors. The gardener acts as an agent of change in the cultural practices of okra production. These three factors are responsible in making the throughput work.

The throughput which includes the different soil treatments such as application of chicken dung, application of stable manure, and soil without fertilizer are the factors that determine the effectiveness of the input. With the application of organic fertilizers to the soil, the plant can produce higher yields.[21] Therefore, the supply of these organic fertilizers to crops is necessary. The objective is to increase yields through direct or indirect control of the environment of the vegetable crops. The effect is direct if the fertilizer favorably influences the vegetable plants themselves. It is indirect when the fertilizer controls the biological environment (bacteria, fungi, weeds, insects, and animals) of the crop.[22]

The output stresses on the comparison of the yield responses of okra with the application of the different soil treatments mentioned above. Their influences will vary in intensity, duration and quality.[23] Variations in the intensity of the soil environmental factors are illustrated by the amount of fertilizer applied to the field, the percentage of active chemical for an insecticide applied to the crop, the number of

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[21] Anday, op. cit., p. 21.

[22] Ibid., p. 22.

[23] Ibid.

rainfall or water applied by irrigation.[24] Duration, on the other hand, refers to the measure of time during which the plant is exposed to an environmental factor; the time during which the environmental factor can exert an influence upon the growth and development of the plant. Variations in duration are illustrated by the length of time that a fertilizer will remain in the soil without being leached out or fixed in a form unusable to the plant.[25] Soil texture can be considered as soil quality and the source and form of nitrogen fertilizer.[26]

With the different soil treatments made on this study, varied yield responses of okra are expected.

Statement of the Problem

This study is an attempt to determine and compare the yield responses of okra to selected organic fertilizers (carabao manure and chicken dung) under Catbalogan soil conditions. Specifically, it sought answer to the following questions:

1. What is the average number of pods per hill per treatment during the initial fruiting?

2. What is the average weekly increase in the

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[24]Ibid.

[25]Ibid.

[26]Ibid.

number of pods from initial fruiting up to three-month period per treatment?

3. What is the average length and diameter of the young tender pods per treatment?

4. What is the total yield in kilograms of the young tender pods per treatment?

Hypothesis

This study compared the yield responses of okra to selected organic fertilizers (carabao manure and chicken dung) under Catbalogan soil conditions. Based on the statement of the problem, the following null hypothesis was tested:

1. The yield of okra with the use of carabao manure and the yield of okra with the use of chicken dung are the same.

Importance of the Study

The findings of this study would be beneficial to the students, teachers, gardeners, farmers, to the school and to the community in general.

Through this study, the researcher, as an educator, can set herself as an example to students in the food production campaign of the government and in the conduct of experimental study like this which initiates industry, resourcefulness and self-reliance.

To agricultural arts teachers, gardeners and farmers, this study will be a tool for information campaign on the use of organic fertilizers particularly carabao manure and chicken dung, which give more yield to okra.

To the school, this study will contribute to the attainment of one of its goals; that is, to turn out products that will meet the needs of the community.

Furthermore, this study will encourage the families to plant okra in their backyards for home consumption and even to produce more to meet the great demand in the markets, thus, uplifting their socio-economic status in particular and the economic status of the community in general.

Scope and Delimitation

The study compared the yield responses of okra to selected organic fertilizers (carabao manure and chicken dung) under Catbalogan soil conditions.

This experimental study was conducted in the Samar State Polytechnic College compound just behind the old electricity building. The period covered by this study was from May 26, 1984 to October 20 of the same year. The area used was 7 x 15 meters or 105 square meters. The amount of organic fertilizers (carabao manure and chicken dung) used per square meter is one kilogram. In controlling insect pests, the foliar spray insecticide (Sevin) was used at the rate of one tablespoonful per gallon of water. The prevailing climatic condition of the place at this period falls on Type G which is marked by an even distribution of rainfall with no marked seasonality. The climate was favorable and lacks any seasonal contrast which is appropriate for growing okra.

The okra variety used in this study was the "Sabour Selection".

Definition of Terms

In order to provide a common frame of reference for the researcher and the readers, the following terms are defined:

Alleyway. The term refers to the passageway provided for between blocks and between sub-plots.

Carabao manure. This is the excrement of carabao used as fertilizer in this study.

Chicken dung. This applies to the chicken excrement used as fertilizer in this study.

Experimental design. This term refers to the layout of the field experiment using a certain statistical model.[27]

Fertilizer. This is the material added to the soil to provide essential nutritive elements and to improve the physical condition of the soil.[28]

Hill. This refers to the plant or cluster of plants a little laid up from the plot surface.[29]

Initial fruiting. This is the period from the time the crop starts to bear fruits up to one week.

Manure. This applies to the refuse of animals in stables and barnyards, with or without litter. They are usually excreta of cattle.[30]

Organic fertilizer. They are soil enriching materials found in nature out of plants and animal bodies or synthesized in the laboratory.[31]

PCARRD. This is the acronym of Philippine Council for Agriculture and Resource Research and Develop-

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[27] Webster, Webster's Third New International Dictionary of English Language (Springfield, Mass., U.S.A., G & C Merriam Co., 1972), p. 240.

[28] Ibid., p. 340.

[29] Jules Janick, Horticultural Science (San Francisco California: W.H. Freeman & Co., 1972), p. 184.

[30] Webster, op. cit., p. 823.

[31] Cagayan Valley Institute of Technology, MATEA Center, Leafy Vegetables (Cabagan, Isabela: 1976), p. 8.

ment.[32]

Randomized complete block design. This refers to an experimental design wherein the total area is divided into blocks and all treatments are arranged within each block in a random order.[33]

Replication. This applies to the number of times a complete set of variables is repeated in an experiment.[34]

Response. This term refers to an activity of the crop resulting from stimulation; a reaction.[35]

Sample size. This is the number of sampling unit to be measured in each population. In replicated trials, it specifies the number of plants per plot to be measured for the different data to be gathered.[36]

Sampling design. This is a design that describes the manner in which sampling units are selected from the population.[37]

Sampling unit. This applies to the unit in which actual measurement of a character is made.[38]

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[32] MATEA Monitor, *loc. cit.*

[33] Ibid.

[34] Webster, *op. cit.*, p. 727.

[35] MATEA Monitor, *op. cit.*, p. 33.

[36] Ibid.

[37] Ibid.

[38] Ibid.

Simple random sampling. This is a kind of sampling design where each unit in the population has an equal chance of being selected to compose the sampling unit.[39]

Treatment. This term refers to a particular set of experimental conditions which will be imposed on an experimental unit within the confines of the chosen design.[40]

Variance. This applies to the fact or state of being in disagreement; differences or deviation; not in harmony or agreement.[41]

Yield. This is the aggregate of product resulting from growth or cultivation.[42]

Young tender pods. This refers to the green pods of okra which are of good sizes but before they are tough and stringy.[43]

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[39] Ibid.

[40] Ibid.

[41] Ibid., p. 10.

[42] Ibid.

[43] Madali and Cruz, op. cit., p. 45.

CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

In view of the researcher's desire to obtain information relevant to this study, she reviewed manuals, books, unpublished theses, magazines, brochures, and other reading materials both foreign and local.

LITERATURE

Foreign

Foreign reading materials provide a broader field of information to this particular study, so that a review of these literatures were made by the researcher.

Description of the crop. A great favorite in the South, especially for soups and also when cooked alone, okra, a tropical vegetable, is sometimes called "gumbo". The unusually decorative, large creamy white flowers resembling single hollyhocks are quickly followed by edible pods, which, to be useful, must be cut while they are still young and tender. Pods allowed to mature fully are of little value. Warm summer weather with hot nights and humid atmosphere are ideal for growing okra. The plants need ample space to develop since some varieties grow four to six feet tall, dwarf kinds are also available.[44]

Varieties. Clemson Spineless is considered one of the best of the long green-podded kinds because it is almost spineless. As its name suggests, Dwarf Green Long-pod is compact, growing 60 to 90 centimeters in height. Perkins Mammoth Long-pod is an early variety noted for its productiveness. White Velvet, a pale greenish white kind with round smooth pods, is grown for its fine flavor.[45]

Culture. One packet of seeds will supply the needs of most families. A tender plant, okra must not be planted outdoors until all danger of stormy weather has passed. Plant the seeds in rows at intervals of 15 centimeters. When seedlings are large enough to be handled easily, they should be thinned to stand 30 to 45 centimeters apart in rows at least 120 centimeters apart, except the dwarf kinds which will not require as much space between rows. Rich fertile soils suit okra best. Cultivate freely to keep weeds in check and watch for quick ripening when bloom shows.[46]

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[44]Foley, op. cit., p. 114.

[45]Ibid., p. 115.

[46]Ibid.

It will continue to bear fruits if the young tender pods will be harvested frequently. They should be picked when about five centimeters long, before they are matured. To keep plants productive do not allow any of the pods to mature.[47]

Insects and diseases. On the whole, okra is quite free from the usual garden pests. If ever it is attacked, chewing insects can be overcome by spraying with a good insecticide.[48]

Local

Though okra has originated from Africa and in Central Asia,[49] its popularity had also been extended here in the Philippines.

Description of the crop. Okra is an annual herbaceous plant. Slightly hairy, it belongs to the same family as cotton, the Malvaceae. In Africa, it is called "quimbambo", and "bhindee" in India, and "gumbo" in many countries.[50]

The tall varieties may reach a height of 1.8 to

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[47]Ibid.

[48]Ibid.

[49]Adoracion A. Virtucio, Okra (A pamphlet, Bureau of Plant Industry, 1973), p. 1.

[50]Ibid.

2.4 meters. The leaves are rounded, 25 to 30 centimeters accross, with 3 to 5 ovate to oblong and coarsely-toothed lobes. The plants large yellow flowers have reddish centers. They are borne singly in the axils of the leaves. Okra is primarily cultivated for its soft immature edible pods which are 5 to 20 centimeters long. The pods, creamy-white to dark-green, contain a mucilaginous substance that thickens soups and stews. Pods may be preserved in brine, canned or frozen for future use. The stem and mature pods contain a fiber which may be used in the manufacture of paper.[51]

Varieties of okra. Like other crops, okra has undergone varietal changes. Some varietal improvements have been done by way of introduction and selection. The varieties adapted under Philippine conditions are; Clemson Spineless, Sabour Selection, Emerald or the Dwarf Green Long-pod, Louisiana Green Velvet and Native Brown.[52]

Clemson Spineless is an American variety, 1.5 meters tall. It produces long thick pods with moderate ridging. The leaves are deeply lobed and spineless.

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[51] Ibid.

[52] Ibid., p. 2.

Native Brown has purple stems, petioles and upper mid-ribs. The pods are thick and well-ridged. Sabour Selection from India has deeply lobed leaves and the plants show much tillering. The pods produced are slim, green, smooth and long. The edges of the leaves, petioles and stems are purplish. Emerald or Dwarf Green Long-pod has pods that are very dark-green, slender, smooth and spineless. The plants as the name signifies are short and vigorous with dark-green leaves. Louisiana Green Velvet has green, slender and smooth pods. The plants are tall with large dark-green leaves.[53]

Kinds of soil and climate. Okra grows in any kind of soil. However, it thrives best in well-drained, sandy and clay loam soils. It is also best adapted in low elevation.[54] The suitable climate for growing okra is that with even distribution of rainfall for maintaining growth of the crop. Long warm season is also adapted with supplemental irrigation for good growth and development of high quality pods.[55]

Methods of planting. Okra is usually planted

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[53] Ibid., pp. 2-3.

[54] Fabicon, op. cit., p. 50.

[55] Ibid., p. 51.

twice a year, from April to June and October to January. It is planted by different methods. One of these is the drill method, in which the seeds are drilled in the furrows eighty centimeters apart for animal power and one meter apart for machine power. In this method, the rows are thinned to one plant to a hill at intervals of thirty to forty centimeters.[56]

The other is called hill method whereby the distance between hills is about fifty centimeters and eighty centimeters between rows (see Table 1) at the rate of eighty kilos per hectare.[57]

Fertilization. Fertilization is applied before, during and after planting time. For an average sandy loam soil, organic matter is recommended. Before planting, 40 to 50 kilograms of nitrogen per hectare should be applied. During planting, it can be applied around each plant as a top dress in the form of a ring ten to fifteen tons per hectare. When pods begin to set, a side-dressing of 15 to 20 kilograms of nitrogen per hectare can contribute for continued plant growth and can improve the yield.[58] Liquid

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[56]Ibid.

[57]Virtucio, op. cit., pp. 2-3.

[58]CVIT, op. cit., p. 4.

compost or liquid manure is applied in the same manner.[59]

Care of the plants. To have a good harvest, frequent weeding and cultivation must be done. Hoeing or cultivation should be shallow. Okra plants must also be properly irrigated during the growth period.[60]

Planting okra by following the suggested spacing and using enough fertilizer such as carabao or chicken manure, won't cause us much of a weeding problem.[61]

Pests and diseases and their control. The most serious pests of okra are aphids, leafhoppers, corn-ear worms, and cutworms. These pests can be controlled by spraying the plants with either Diazinon 20 - E at the rate of three tablespoonfuls per five gallons of water, or Sevin at the rate of one tablespoonful per gallon of water.[62]

Mosaic is the most common disease of okra. It

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[59] Ibid.

[60] Fabicon, *loc. cit.*

[61] Virtucio, *loc. cit.*

[62] Fabicon, *loc. cit.*

is caused by certain virus diseases of plants characterized by mottling of the foliage. This can be controlled by eliminating the infected plants.[63]

Podspot is another disease of okra which is caused by fungus. It is characterized by the appearance of dark, water-soaked lesions on the young pods. These slowly enlarge and then finally turn brown, making pods unsuitable for marketing. The recommended control measures for this disease are through sanitation and use of resistant varieties.[64]

As a whole, to get away with these diseases, the field to be planted with okra should be treated with nematicides at the rate recommended by the manufacturer.[65]

Growing of okra. Table 1 shows the growing of okra until it reaches the stage of maturity. For vegetable purposes, however, the pods are harvested when they are still young and tender, shortly before they start to mature.[66]

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[63]Ibid.

[64]Virtucio, op. cit., p. 4.

[65]Ibid.

[66]My Little Green Book, op. cit., p. 26.

Table 1

Growing of Okra

Name of Vegetable	Seeding Method	Planting Row (cm)	Distance Hole (cm)	Maturity Period (days)
Okra	Direct	80-120	30-40	60-70

Nutritive value of okra. Okra is a nutritious vegetable. Appendix L on page 83 shows the percentage of nutritive value found among the common Philippine vegetables per 100 grams of edible portion (E.P.).[67] As seen from the table, okra compared with other vegetables like "labong", papaya, eggplant, upo or even soybean and cabbage contains more if not all the nutrients found in vegetables, though, some are just in a very small quantity. So far, with the presence of all the nutrients in okra, the crop is to be considered as one of the nutritious Philippine vegetables.

The Description of the Organic Fertilizers Used in this Study

a. Poultry Manure. It is the richest of the

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[67] Food Composition Table Recommended for Use in the Phil. (Mla.: FNIR & NSDB, 5th printing, June 1976), pp. 15-37.

animal manures because it is very concentrated and rich in nitrogen. It is advisable to mix it with less concentrated manure when applied to the soil in increasing crop yields. It is highly beneficial for crops that require large amount of nitrogen.[68]

b. Carabao Manure. It is more watery than horse manure but contains less fiber. Because of the low amount of fiber in the manure it is not good source of humus. Carabao manure is wet cold manure. It ferments slowly, and its low fertilizing value is due to the large amount of water it contains. It does not firefang or turn white when exposed to the air. In fertilizing value, it is a little lower than the horse manure, as it contains more water and less dry weight.[69]

The average nitrogen contents of dried manure analyzed at the U.P. Los Baños, Laguna are cattle, 2.4%; carabao, 1.09%; swine, 2.11%; and broilers, 3.17%.[70]

STUDIES

In the tropics the decomposition of organic

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[68] Eulalio P. Baltazar, Organic and Inorganic Fertilizer, p. 2.

[69] Ibid., p. 9.

[70] L. B. Flores, "Some Truths About Animal Manure", Crops and Soils, Vol. III, No. 8, (October 1977), p. 4.

fertilizers or matter proceeds rapidly as soon as such a soil is brought under cultivation. There is no lull in microbial activity as in the temperate zones. The high moisture and warm temperatures contribute to a high rate of activity of the micro-organisms concerned with the mineralization of organic matter. Actually the quality of manure that is normally applied per hectare is so small in relation to the volume of soil. Small applications made more frequently are better than heavy applications made at heavier intervals. A forkful is put in a hole, and a little soil placed over this before the seeds are planted. The effect of the manure is beneficial to the soil in the immediate area of the hill.[71]

If the soil is clay, the texture can be improved by adding enough organic fertilizers such as compost, chicken or animal manure. Use one big kerosene can (5 gallons) of organic fertilizer for every square meter of surface soil.[72]

The fertilizer is preferably applied in the hills or in the rows as this practice yields better results than merely broadcasting.[73]

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[71] J. R. Hildreth, et. al., "Effects of Climatic Factors on Growing Plants, Climate and Man", U.S.D.A., Yearbook of Agriculture (Washington D.C.: 1941), pp.292-295

[72] Pedro Padlan, SNTC, Bayambang, Pangasinan.

[73] Madali, op. cit., p. 128.

Studies of Paningbatan (1957)[74] at Sariaya, Quezon revealed that organic fertilizers not only hiked yield of vegetable crops but also improved its quality.

The recently concluded conference on organic fertilizer sponsored by the Food and Agriculture Organization (FAO) in Bangkok recommended the use of dried manure for hygienic reason.[75] It also stressed that the application of fresh manure directly to croplands is often discourage because of the presence of weeds, seeds, worms, pests, and harmful organisms that may be contained in the excrement.

In Japan the manure of 10 hens a year was reported sufficient to fertilize a hectare of rice field.[76]

Fruit vegetables can be grown in a wide range of climate but prefer a warm temperature with moderate rainfall during the growth period or vegetative development. They grow practically in all kinds of soil but better yield are obtained in loam to sandy loam, clay loam, alluvial soils with good drainage.[77]

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[74] Anonymous, "It Pays to Fertilize Pechay", Crops and Soils, Vol. 1, No. 2 (March 1975), p. 7.

[75] L. B. Flores, "Some Truths About Animal Manure", Crops and Soils, Vol. III, No. 8, UPLB-CA, (College, Laguna: October 1977), p. 4.

[76] Ibid., p. 78.

[77] Anday, *op. cit.*, p. 84.

In general aspects, according to Eligio and Ricamonte, the kind of crop to be planted varies from one location to another. Other crops may exhibit the same distribution.[78]

In an experiment conducted in Palale Elementary School, Palale, Sta. Margarita, Samar from April 1, 1980 to May 20, 1980 using selected organic fertilizers to determine the yield of pechay, had shown a considerable effect of chicken dung over the other fertilizers like carabao manure, horse manure, and ipil-ipil leaves.[79]

In the same experiment, the result showed that pechay applied with chicken dung produced the heaviest plants with an average of 239.25 grams per plant. While plants treated with carabao manure had only 157 grams per plant.[80]

Lim,[81] further recommends planting the crop with the use of chicken dung for a vigorous, bigger and heavier yield as revealed from his study at Palale Elementary

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[78]Eligio and Ricamonte, op. cit., p. 38.

[79]Manuel L. Lim, "Response of Pechay to Selected Organic Fertilizers" (unpublished master's thesis, Leyte State College, Tacloban City, 1981), p. 34.

[80]Ibid.

[81]Ibid., p. 36.

School, Sta. Margarita, Samar. Aside from yielding more, it also hastens the fruiting period of the crops.

According to Virtucio, pods of okra 4 to 6 days old are highest in table quality. It is at this stage that the greatest increase in pod weight, length and diameter occurs. Harvesting every 3 to 4 days results in a prolonged and continuous fruiting period with a harvest of three times as many pods as when the pods are allowed to mature.[82] Under tropical conditions, harvesting daily or every other day is advisable in commercial production.[83] But, recent studies showed that no available good experiment evidence on fertilization of okra in the Philippine has been made.[84]

Based on the statements of different researchers here and abroad about the yield responses of the crops with the use of organic fertilizers under varying soil and climatic conditions and with the succeeding line from the BPI, the researcher conducted an experiment using okra as the subject of study with the application of organic fertilizers particularly carabao manure and chicken dung under the soil conditions of Catbalogan,

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[82] Virtucio, op. cit., p. 4.

[83] Hoskins, op. cit., p. 35.

[84] Bureau of Plant Industry, Cultural Directions for Phil. Agricultural Crops (Vegetable), "Cultural Requirement for Okra" (Mla.: 1980), pp. 30-31.

Samar.

This study would further attest the extent of the relationship between the findings of previous experiments conducted here and abroad.

Relationship with the Present Study

The studies just reviewed are closely related to this study in the sense that most of them focus on the effects of fertilizers on plants, or responses of plants to fertilizers. They differ, however, on the kind of crop selected as subject of the study.

CHAPTER III

METHODS AND PROCEDURES

In the researcher's desire to help in the far-reaching effort for greater food sufficiency, she gathered basic information on improved methods and procedures of vegetable growing, particularly okra and the kind of fertilizers to be used, pests control, and other allied aspects.

The Method Used

The study used the randomized complete block design (RCBD) in three treatments replicated four times. The three treatments are:

T_1 - with carabao manure, 1.0 kilogram per square meter.

T_2 - with chicken dung, 1.0 kilogram per square meter.

T_3 - control (no fertilizer)

Procedures

Experimental layout. The experimental area measuring 7 x 15 meters was divided into 12 plots measuring 1 x 3 meters. One half meter space between plots were provided to serve as alleyways. The randomized complete block design was used in assigning treatments to the different plots. Each plot had two rows of hills, distanced at 80 centimeters between the rows and 40 centimeters between plants within the rows (see Appendix F on page 72).

Land preparation. The experimental lot was prepared thoroughly by cutting all the tall weeds and grasses. The area alloted for plots were dug and allowed to fallow for days to permit decomposition of the weeds. The soil was pulverized or redug with the use of pick mattock, spading fork and bolo.

Planting. The seeds were planted at a depth of three centimeters from the surface of the soil. Each plot had 14 hills planted to four seeds per hill at a distance pattern of 40 x 80 centimeters. The planting of seeds was done in the afternoon.

Application of fertilizer. The fertilizers were applied before, during and after planting. In the first application, fertilizers were applied uniformly over the entire area to serve as starter. During planting, the fertilizers were applied around each plant in the form of a ring three centimeters from the seeds planted. After planting, fertilizers were applied again following the same manner of fertilizer application during planting.

Care of plants. To insure normal growth and yield of the crops, the following were taken into consideration: (1) The experimental area was fenced to protect the plants from astray animals and careless or even wicked persons, (2) fifteen days after planting, the hills were thinned to one plant per hill, (3) the soil was cultivated thoroughly, especially the part around the plants and the weeding was done at the same time. Extra care of the plants was taken during cultivation so that its roots would not be injured, (4) the watering of the plants was done immediately after planting and every morning and afternoon or as often as necessary to ensure the normal growth of the plants, (5) a canal was constructed around the experimental area so as not to flood the plants during rainy days, (6) the foliar spray insecticide (Sevin) was used to control insect pests at regular intervals, and (7) ipil-ipil trees that shade the experimental area were cut down to allow whole day exposure of the plants to sunlight.

Harvesting. The harvesting period was done daily from the initial fruiting up to three-month period. It started from July 26, 1984 up to October 20 of the same year. The crops that were picked at the same time in all treatments of the four replications were the ones classified as young tender pods. They were separated according to treatment for every replication.

GATHERING OF DATA

Simple random sampling was employed in this study in order to get the samples or representatives from the total population to compose the sampling unit. The researcher assigned number to each hill or plant in every plot throughout the four replications (the numbering starts from 1 to 14 consecutively). Pieces of cards were numbered corresponding to the number of population per plot; placed in a box and shuffled thoroughly before the 10 cards were drawn to represent the size of the sample. This procedure was followed in every plot of the four replications.

Classifying of Data

The data were obtained through counting and measuring and classified as to the number of fruits per hill per treatment, weekly increase in the number of fruits per hill per treatment, the length and diameter of the fruits in centimeter, and the yield in kilograms.

Tallying of Data

a. The data on the number of fruits per hill per treatment were taken daily within one week period to find out the average number of fruits during the initial fruiting. The initial fruiting took place from July 20, 1984 to July 26 of the same year.

b. The weekly increase in the number of fruits from initial fruiting up to three-month period per treatment was also taken to determine the average weekly increase of the young tender pods.

c. The middle-most portion of the fruits were measure to find out the average diameter of the young tender pods per treatment.

d. The fruits were measured from base to tip to get the average length of the young tender pods per treatment.

e. The yield of the crop per plot was weighed to find out the total yield in kilograms per treatment.

Tabulating the Data

After tallying, the necessary data were tabulated as follows:

1. The average number of fruits per hill per treatment during the initial fruiting.

2. Analysis of variance for the average number of fruits per hill per treatment during the initial fruiting.

3. The average weekly increase in the number of fruits from initial fruiting up to three-month period per treatment.

4. Analysis of variance for the average weekly increase in the number of fruits from initial fruiting up to three-month period per treatment.

5. The average length of the young tender pods per treatment.

6. Analysis of variance for the average length of the young tender pods per treatment.

7. The average diameter of the young tender pods per treatment.

8. Analysis of variance for the average diameter of the young tender pods per treatment.

9. The total yield in kilograms of the young tender pods per treatment.

10. Analysis of variance for the average yield in kilograms of the young tender pods per treatment.

STATISTICAL TREATMENT OF DATA

Statistical Treatment Used

Analysis of variance (ANOVA) was used to analyze the effect of the independent variables on the dependent variables. The independent variables were: carabao manure and chicken dung. The dependent variables involved in this particular study were the following:

a. The average number of fruits per hill per treatment during the initial fruiting.

b. The average weekly increase in the number of fruits from initial fruiting to three-month period per treatment.

c. The average length of the young tender pods per treatment.

d. The average diameter of the young tender pods per treatment.

e. The total yield in kilograms of the young tender pods per treatment.

Such statistical tool was at the same time used to evaluate the critical F-value if it falls within the region of acceptance or rejection of the null hypothesis. Below are the steps in the computation of the analysis of variance.[85]

A. Find the Correction Factor

1. Correction Factor (C.F.)= $\frac{(\text{Grand Total})^2}{\text{No. of Blocks}}$

B. Calculate the Sum of Squares (S.S.) of the data:

1. Replication S.S. = $\frac{\text{Sums of Squares}}{\text{No. of Treatments}}$ - C.F.

2. Treatment S.S. = $\frac{\text{Sums of Squares}}{\text{No. of Replications}}$ - C.F.

[85]Bureau of Soils' Standard Operating Procedure on Soil Fertility, pp. 60-71.

3. Total S.S. = Sums of Squares - C.F.

4. Error S.S. = Total S.S. - (R.S.S. - T.S.S.)

C. These sum of squares are entered in analysis of variance table shown below.

Table for Analysis of Variance

Sources of Variations	d.f.	S.S.	M.S.	F-value	F-table .05	F-table .01
Replications	(r-1)					
Treatments	(t-1)					
Error	(r-1)(t-1)					
Total						

D. Find the Mean Square (M.S.). To obtain the M.S., divide each sum of squares by the corresponding number of degrees of freedom.

1. Replication M.S. = $\frac{\text{R.S.S.}}{\text{d.f.}}$

2. Treatment M.S. = $\frac{\text{T.S.S.}}{\text{d.f.}}$

3. Error M.S. = $\frac{\text{E.S.S.}}{\text{d.f.}}$

E. Find the F-value for replication

E.F. Value (R) = $\frac{\text{Replication M.S.}}{\text{Error M.S.}}$

F. Find the F-value for treatment

E.F. Value (T) = $\frac{\text{Treatment M.S.}}{\text{Error M.S.}}$

If the F-test has given highly significant results, the critical difference (C.D.) or the least significant difference (L.S.D.) between two treatment means should be computed to make individual comparisons among treatments by means of the t-test.[86] Since the findings of this study had not exhibited significant differences between the variances as shown by the analysis of variance (F-test) at .05 and .01 levels of significance, t-test is not anymore necessary in this study.

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[86] Bureau of Soils, loc. cit.

CHAPTER IV

PRESENTATION, ANALYSES AND INTERPRETATIONS OF DATA

This chapter covers the presentation of the data, as well as their analyses and interpretations.

The Average Number of Fruits Per Hill Per Treatment During the Initial Fruiting

Table 2 shows the average number of pods per hill per treatment during the initial fruiting. As seen from the data, treatment 2 exhibited the highest average number of pods per hill in all replications with a combined mean of 1.5 pieces. Treatment 1 follows next with a combined mean of 1.1 pieces. It is in Replication 1 of this same treatment that the plants almost competed with treatment 2 as to the average number of pods per hill. It yielded an average of 2.0 pieces as against the 2.1 pieces in treatment 2 of the same replication, thus ranking second highest in all treatments and replications. It is also in this treatment (treatment 1) where the lowest average number of pods per hill is exhibited, with only 0.5 pieces. Treatment 3 did not vary significantly in their average number of pods per hill in all replications, although, replications 3 and 4 are a little higher than replications 1 and 2. It will be noted that the combined mean in all the four replications of this treatment, is the lowest with only 0.425 pieces.

Table 2

Average Number of Pods Per Hill Per Treatment During the Initial Fruiting

Treatments	Replications 1	2	3	4	Treatment Total	Mean
1	2.0	0.8	1.1	0.5	4.4	1.1
2	2.1	1.2	1.7	1.0	6.0	1.5
3	0.2	0.3	0.6	0.6	1.7	0.425
Replication Total	4.3	2.3	3.4	2.1	12.1	3.025

Analysis of Variance for the Average Number of Pods Per Hill Per Treatment During the Initial Fruiting

The combined mean of the number of pods per hill in all the three treatments did not have significant differences as shown by the analysis of variance table on page 44. The experimental F-value for treatment which is 1.2212 is very much lower than 5.14 which is the Tabular F-value at the .05 level of significance. At the .01 level of significance, this F-value for treatment becomes more insignificant. Based on this findings, the two kinds of organic fertilizers used in this experiment had no significant effect in the number of pods per hill during the initial fruiting of okra.

Table 3

Analysis of Variance for the Average Number of Pods Per Hill Per Treatment During the Initial Fruiting

Source of variations	d.f. (n-1)	Sums of Squares	Mean Square/ Variance	Experimental F-value	F-table .05	F-table .01
Replications	3	1.049167	0.3497	0.36165	4.76	9.78
Treatments	2	2.3617	1.18085	1.22120	5.14	10.92
Error	6	5.8017	0.96695			
Total	11	4.489167				

The Average Weekly Increase in the Number of Pods from Initial Fruiting Up to Three Month Period Per Treatment

The average weekly increase in the number of pods from initial fruiting up to three-month period is shown in Table 4.

Treatment 2 produced the highest weekly increase in the number of pods per treatment as shown by the combined mean of 10.59 pieces as against treatments 1 and 3 with only 8.96 and 6.52 pieces, respectively. It is only in replication 3 where treatment 2 yielded a lower mean of 11.08 pieces compared with treatment 1 with 11.33 pieces. The lowest average weekly increase is obtained by treatment 3 in all replications, especially in replication 2 with only 4.75 pieces.

On the whole, the average weekly increase in the number of pods ranges as follows: (1) 5.83 to 11.83 pieces for treatment 1; (2) 7.42 to 12.17 pieces for treatment 2; and (3) 4.75 to 9.17 pieces for treatment 3.

Table 4

The Average Weekly Increase in the Number of Pods from Initial Fruiting Up to Three Month Period Per Treatment

Treatments	Replications				Treatment	
	1	2	3	4	Total	Mean
1	11.83	6.83	11.33	5.83	35.82	8.96
2	12.17	7.42	11.08	11.67	42.34	10.59
3	9.17	4.75	7.08	5.08	26.08	6.52
Replication Total	33.17	19.00	29.49	22.58	104.24	26.07

The foregoing data reveal that okra generally responds better to chicken dung than to carabao manure in terms of the average weekly increase in the number of pods.

Analysis of Variance for the Average Weekly Increase in the Number of Pods from Initial Fruiting Up to Three-Month Period Per Treatment

The analysis of variance shown in Table 5, shows the average weekly increase in the number of pods from initial fruiting up to three-month period per treatment. The experimental F-value which is 2.6435, demonstrated an insignificant difference of the variances, both at the .05 and .01 levels of significance as indicated by its corresponding value of 5.14 and 10.92, respectively. This proves that organic fertilizers used in this particular study did not have significant differences in the average weekly increase in the number of pods per treatment of the okra crop.

Table 5

Analysis of Variance for the Average Weekly Increase in the Number of Pods from Initial Fruiting Up to Three Month Period Per Treatment

Source of Variations	d.f. (n-1)	Sums of Squares	Mean Square/Variance	Experimental F-value	F - table .05	F - table .01
Replications	3	41.4237	13.8079	0.2107	4.76	9.78
Treatments	2	346.4734	173.2367	2.6435	5.14	10.92
Error	6	393.2119	65.5353			
Total	11	88.1623				

Average Length and Diameter of the Young Tender Pods Per Treatment

Table 6-A presents the data on the average length of pods per treatment. Treatment 1 exhibited a combined mean of 14.77 centimeters. While treatment 2 obtained 16.17 centimeters as their combined mean. Treatment 3

Table 6

Average Length and Diameter of the Young Tender Pods Per Treatment

A. Average Length

Treatments	Replications 1	2	3	4	Treatment Total	Mean
1	14.86	14.16	14.97	15.09	59.08	14.17
2	16.45	17.76	15.18	15.28	64.67	16.17
3	14.93	14.12	13.05	13.03	55.13	13.78

B. Average Diameter

Treatments	Replications 1	2	3	4	Treatment Total	Mean
1	2.189	2.042	2.038	2.055	8.324	2.081
2	2.167	2.295	2.087	2.196	8.745	2.186
3	1.860	2.049	1.902	1.865	7.676	1.919
Replication Total	6.216	6.386	6.027	6.116	24.745	6.186

had only a combined mean of 13.78 centimeters. Based on these data, it is treatment 2 which has the highest combined mean in length, followed by treatment 1 and the last is treatment 3.

The average length of the young tender pods per treatment on replication basis ranges from 14.16 to

15.09 centimeters for treatment 1, 15.18 to 17.76 centimeters for treatment 2, and 13.03 to 14.93 centimeters for treatment 3.

Table 6-b shows the average diameter of pods per treatment.

Treatment 2 obtained a combined mean of 2.186 centimeters, making this as the highest among the three treatments. In this same treatment, the highest of all the four replications in their average diameter of pods is in replication 2 with 2.295 centimeters. Second to this is 2.196 centimeters of replication 4 followed by replication 1 with 2.167 centimeters. The lowest of the four replications is in replication 3 with only 2.087 centimeters as its average diameter of pods.

Treatment 1 ranks second in their average diameter of pods of all the three treatments with 2.081 centimeters. Just like treatment 2, it did not demonstrate a significant difference in their average diameter of pods in all the four replications. It is in replication 1 that this plant had obtained 2.189 centimeters in its average diameter of pods per treatment. Next to this is 2.055 centimeters in replication 4 followed by replication 2 with 2.042 centimeters. The lowest average diameter of pods obtained by this treatment is 2.038 centimeters.

Comparing the three treatments, it is treatment 3 which ranked last in their average diameter of pods with only 1.919 centimeters. Under this treatment, replications 1, 2, 3 and 4 did not vary significantly in their average diameter of pods which are 1.860, 2.049, 1.902, and 1.865 centimeters, respectively.

Analysis of Variance for the Average Length and Diameter of the Young Tender Pods Per Treatment

Table 7 (page 50), shows the analysis of variance for the average length and diameter of the young tender pods of okra. The obtained differences of the variances of the treatments for the average length is -23.9674. This figure is very much lower than the Tabular F-value and therefore insignificant at both the .05 and .01 levels of significance under the F-test which are 5.14 and 10.92 respectively. This obtained figure (treatment F-value) contributes in proving the null hypothesis of this experimental study that "the yield of okra with the use of carabao manure and the yield of okra with the use of chicken dung are the same".

The experimental F-value for the treatment in

Table 7

Analysis of Variance for the Average Length and Diameter of the Young Tender Pods Per Treatment

A. Average Length

Source of Variations	d.f. (n-1)	Sums of Squares	Mean Square/ Variance	Experimental F-value	F - table .05	F - table .01
Replications	3	31.8352	10.6117	-44.3262	4.76	9.78
Treatments	2	11.4755	5.7378	-23.9674	5.14	10.92
Error	6	-1.4364	-0.2394			
Total	11	18.9233				

B. Average Diameter

Source of Variations	d.f. (n-1)	Sums of Squares	Mean Square/ Variance	Experimental F-value	F - table .05	F - table .01
Replications	3	0.0237	0.0079	0.1447	4.76	9.78
Treatments	2	0.1450	0.0725	1.3278	5.14	10.92
Error	6	0.3277	0.0546			
Total	11	0.2064				

Table 7-b which is 1.3278 is very much lower than the tabular F-value both at .05 and .01 levels of significance which are 5.14 and 10.92, respectively. Based on these data, it can be said that the two kinds of organic fertilizers used in this study had an insignificant effect on the diameter of the young tender pods of okra.

The Total Yield in Kilograms of the Young Tender Pods Per Treatment

Table 8 shows the total yield in kilograms of the young tender pods of okra per treatment. This was computed based on the data gathered from initial fruiting up to the last period of the experiment.

Treatment 2 obtained 13.150 kilograms as their combined mean. This figure is far ahead the 9.359 kilograms as combined mean of treatment 1. Treatment 3, on the other hand, obtained only a combined mean of 8.740 kilograms, which is so far the lowest among the three combined means.

Treatment 2 had obtained a considerable yield in kilograms in all the four replications. It was in repli-

Table 8

Total Yield in Kilograms of the Young Tender Pods Per Treatment

Treatments	Replications				Treatment	
	1	2	3	4	Total	Mean
1	14.005	7.105	7.993	8.333	37.436	9.359
2	15.231	13.588	13.442	10.340	52.601	13.150
3	10.624	8.149	7.770	8.415	34.958	8.740
Replication Total	39.860	28.840	29.205	27.088	124.995	31.249

cation 1 that this plant yielded the highest with 15.231 kilograms. This is also followed by 13.588 kilograms in replication 2. In replication 3, of this same treatment obtained 13.442 kilograms and 10.340 kilograms in replication 4, which is the lowest under this treatment.

Treatment 3 had demonstrated a yield which competed with replications 2, 3 and 4 in treatment 1. In replication 1 o this treatment (treatment 3) with 10.624 kilograms is a little higher than replication 4 of treatment 2 with only 10.340 kilograms. It is also in this replication that this treatment had shown the highest yield in kilograms followed by replication 4 with 8.415 kilograms. Next to this is 8.149 kilograms in replication 2 and the lowest is in replication 3 with only 7.770 kilograms.

Analysis of Variance for the Total Yield in Kilograms of the Young Tender Pods per Treatment

The experimental F-value of the mean square for the treatments is 1.3097. This is very much lower compared to the tabular F-value both at the .05 and .01 levels of significance as shown in Table 9. This implies that organic fertilizers (chicken dung and carabao manure) used in this experiment did not show a significant difference on the yield in kilograms of the young tender pods of okra.

Table 9

Analysis of Variance for the Total Yield in Kilograms of the Young Tender Pods Per Treatment

Source of Variations	d.f. (n-1)	Sums of Squares	Mean Square/ Variance	Experimental F-value	F - table .05	F - table .01
Replications	3	33.7732	11.2577	0.6464	4.76	9.78
Treatments	2	45.6161	22.8081	1.3097	5.14	10.92
Error	6	104.4925	17.4154			
Total	11	92.6496				

Estimated Average Cost of Production of Okra Per Treatment

Table 10 shows the estimated average cost of production of okra per treatment. These data were computed based on the total cost of this experimental study which are itemized below:

Bamboo fence . . . . ₱48.00

Nails (1 kilo). 12.00

Seeds (1/8 kilo) 2.30

Insecticide (Sevin). . . 12.00

Carabao manure (12 kl.). 10.00

Chicken dung (12 kl.). . 15.00

Labor: a) land preparation . . . ₱40,00

b) planting 3.75

c) application of fertilizer 3.75

d) cultivation and weeding 60.00

e) harvesting 15.00

Total ₱221.80

Treatment 2 had the highest average cost of production among the three treatments with 20.15 pesos. The second highest was obtained by treatment 1 with 18.90 pesos and the last which is 16.40 pesos was the average cost of production of treatment 3. This table illustrates further that the average cost of production in all treatments do not vary significantly.

Table 10

Estimated Average Cost of Production Per Treatment

Treat- ments	Replications				Treatment	
	1	2	3	4	Total	Mean
1	18.90	18.90	18.90	18.90	75.60	18.90
2	20.15	20.15	20.15	20.15	80.60	20.15
3	16.40	16.40	16.40	16.40	65.60	16.40
R_t	55.45	55.45	55.45	55.45	221.80	55.45

Forecasted Yield in Number of the Young Tender Pods Per Treatment on a Hectare Basis

The experiment had been conducted on an area of 105 square meters using only 12 square meters for every treatment. In treatment 1 the total yield of the young tender pods reached 1,814 pieces, treatment 2, 2,335 pieces making it as the highest and treatment 3, 1,799 pieces. For farmers who are involved in an extensive farming, a forecasted yield in number of the young tender pods is shown in table 11.

Treatment 2 shows a considerable yield in number of the young tender pods over the other treatments with a total yield of 1,945,832 pieces per hectare. Treatment 1 yields 1,511,666 pieces as second highest, while the lowest yield obtained is 1,499,166 pieces in treatment 3.

In obtaining these data on a hectare basis, it was obtained on the yield of the experimental area. As mentioned earlier, the lot used in the actual experiment was only very small compared to a hectare. The 12 square meters which is the total area used per treatment is only 1/833.333 of a hectare and the 3 square meters alloted per treatment per replication is only 1/3333.333 of a hectare. Multiplying the number of pods obtained from a 3 square meters by 3333.333 had given the number of pieces shown in every treatment per

Table 11

Forecasted Yield in Number of the Young Tender Pods Per Treatment on a Hectare Basis

Treat-ment	Replications				Treatment	
	1	2	3	4	Total	Mean
1	582,500	279,167	309,999	340,000	1,511,666	377,916.5
2	512,500	554,166	503,333	375,833	1,945,832	486,458
3	444,167	346,666	342,500	365,833	1,499,166	374,791.5
R_t	1539,167	1179,999	1155,832	1081,666	4,956,664	1239,166

replication on the table above. Added together (that is, per replication per treatment), results to the total yield in number of the young tender pods on a hectare basis. However, this data was arrived not considering any weather disturbances that would affect the plants or pests to attack them within a three-month period.

Table 12

Estimated Net Income Per Treatment On a Hectare Basis

Treat-ment	Yield per Hectare	Price per dozen	Cost of Pro-duction	Total Income	Net Income
1	1,511,666	₱1.50	₱62,999.97	₱188,958.25	₱125,958.28
2	1,945,832	1.50	67,166.64	243,228.99	176,062.35
3	1,499,166	1.50	54,666.65	187,395.75	132,729.10
Total	4,956,664		184,833.26	619,586.99	434,749.73

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted to determine the yield responses of okra to selected organic fertilizers, particularly chicken dung and carabao manure under Catbalogan soil conditions. Further, this was conducted because up to now records and researches show that there had been no study similar to this conducted in this particular place under its climatic and soil conditions.

Likewise, this study was an attempt to establish a medium that would create change in the agricultural field, especially that of cultural practices in the production of okra. In creating change, this study had not resorted to its sophisticated art, rather, it attempted to encourage Filipino farmers and gardeners to adopt simple methods and cheaper costs of production.

Specifically, this study sought answers to the following questions:

1. What is the average number of pods per hill per treatment during the initial fruiting?

2. What is the average weekly increase in the number of pods from initial fruiting up to three-month

period?

3. What is the average length and diameter of the young tender pods per treatment?

4. What is the total yield in kilograms of the young tender pods per treatment?

This is an experimental study conducted in the Samar State Polytechnic College compound just behind the electricity building for secondary. The period covered for the experiment was from May 26, 1984 to October 20, 1984. The area used was 7 x 15 meters or 105 square meters with a clay loam soil. The experimental area was divided into rows with three sub-blocks per row replicated four times. The alloted area for each sub-block per replication is 1 x 3 meters or 3 square meters. It constituted one treatment composed of 14 hills, 10 of which were included to compose the 120 samples (40 samples were drawn per treatment in the four replications). Below are the three treatments involved in this study. They are as follows;

1. T_1 - with carabao manure
2. T_2 - with chicken dung
3. T_3 - control (no fertilizer)

The experimental design used in this study was the Randomized Complete Block (RCB). The treatments were randomly assigned to each replication making each treatment occur only one in each block.

The subjects of this study were grouped into two major groups: the independent variables and the dependent variables. The independent variables include the two organic fertilizers used; the chicken dung and the carabao manure. While the yield of okra in terms of number of pods, in weight, length and diameter, belong to the dependent variables.

To determine the effect of the independent variables on the dependent ones, the statistical tool employed was the Analysis of Variance (ANOVA).

Findings. The following were the findings of the study: (1) Treatment 2 had the highest average number of pods during the initial fruiting with 1.5 pieces. Second to this is 1.1 pieces of treatment 1 and the lowest was obtained by treatment 3 with only 0.425 pieces; (2) In the average weekly increase in the number of pods from initial fruiting up to three-month period, treatment 2 obtained the highest mean increase which is 10.59 pieces. This was followed by treatment 1 with 8.96 pieces. The lowest average weekly increase is 6.52 pieces produced by treatment 3; (3) Treatment 2 obtained the highest average length and diameter of the young tender pods which are 16.17 and 2.186 centimeters, respectively. These are followed by 14.77 and 2.081 centimeters of treatment 1. So far, the lowest yield obtained by the plants in terms of length and diameter was in treatment 3 which are 13.78 and 1,919 centimeters, respectively; (4) Based on the total yield in kilograms of the young tender pods, it was in treatment 2 that these plants exhibited the highest combined mean with 13.15 kilograms. Second highest was obtained by treatment 1 with 9.359 kilograms, and the lowest is 8.74 kilograms which was yielded by treatment 3.

In terms of yield in number of the young tender pods on a hectare basis, a considerable yield is expected from okra plants applied with chicken dung as shown on the forecasted table in Chapter IV, page 56.

Conclusion

Based on the findings just presented, the following conclusion is made:

1. Under the soil conditions of Catbalogan, Samar, okra responds better to chicken dung than to carabao manure in terms of the number of pods per hill, the weekly increase of pods, the length and diameter,

and the weight of the pods. Although the difference in yield is insignificant under small-scale production, as in the case of this study, the little advantage derived from the use of chicken dung may lead to a greater profit in large-scale farming.

Recommendations

On the basis of the conclusion made on the study, the researcher recommends the following:

1. Under the soil conditions of Catbalogan, Samar, chicken dung is strongly recommended in the production of okra.

2. In the absence of chicken dung, carabao manure is secondarily recommended in the production of okra.

3. In order for the crop or vegetable to become more popular, a study on its market profitability is recommended to other researchers in the agricultural field.

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Conditions". A Master's Thesis, Leyte Institute of Technology, Tacloban City: 1982.

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D. MAP

Soil Map (SAMAR), Dept. Of Agricultural and Natural Resources, Bureau of Soil Conservation.

A P P E N D I C E S

APPENDIX A

Republic of the Philippines
Samar State Polytechnic College
Catbalogan, Samar

August 3, 1984

The Chairman of the Thesis Committee
Samar State Polytechnic College
Catbalogan, Samar

S i r :

It is my intention to start writing my thesis proposal. In view of this, I have the honor to submit for your approval the following topics for my study:

1. Yield Responses of Okra to Selected Organic Fertilizers Under Catbalogan Soil Conditions.

2. The One-Hour Practical Arts Period: Its Impact Upon the Vocational Achievement of Students in Secondary Schools in Catbalogan, Samar.

3. Income-Generating Projects in Practical Arts: Their Influences Upon the Economic Status of the Students of Secondary Schools in Wright, Samar.

I hope for your early favorable action on this matter.

Very truly yours,

(SGD.) THELMA C. QUITALIG
Graduate Student

Approved Problem No. 1

(SGD.) DOMINADOR Q. CABANGANAN, Ed.D.
Chairman, Thesis Committee
8/31/83

APPENDIX B

Republic of the Philippines
Samar State Polytechnic College
Catbalogan, Samar

GRADUATE SCHOOL

APPLICATION FOR ASSIGNMENT OF ADVISER

Name: QUITALIG, THELMA CABADSAN
Family Name First Name Middle Name

Candidate for Degree in Master of Arts in Teaching Vocational Education (MATVE)

Area of Specialization AGRICULTURE

Title of Proposed Thesis YIELD RESPONSES OF OKRA TO SELECTED ORGANIC FERTILIZERS UNDER CATBALOGAN SOIL CONDITIONS

Name of Requested Adviser ALEJANDRO E. CANANUA

Approval of Adviser SGD. ALEJANDRO E. CANANUA
Signature

Disapproval ____________________
Signature

Approved:

SGD. DOMINADOR Q. CABANGANAN, Ed.D.
Chairman, Thesis Committee

Date: January 23, 1984

APPENDIX C

Republic of the Philippines
Samar State Polytechnic College
Catbalogan, Samar

April 13, 1984

The Actg. Dean Graduate Studies
Samar State Polytechnic College
Catbalogan, Samar

S i r :

I have the honor to request that I be scheduled for a pre-oral defense of my thesis proposal entitled "YIELD RESPONSES OF OKRA TO SELECTED ORGANIC FERTILIZERS UNDER CATBALOGAN SOIL CONDITIONS" on the fourth Friday of this month, April 27, 1984.

I hope for your immediate and favorable action on this matter.

Very truly yours,

(SGD.) THELMA C. QUITALIG
Graduate Student

N O T E D :

(SGD.) ALEJANDRO E. CANANUA
Adviser

Approved: As per schedule, at 2:00 P.M.

A P P R O V E D :

(SGD.) DOMINADOR Q. CABANGANAN, Ed.D.
Actg. Dean, Graduate Studies

APPENDIX D

Republic of the Philippines
Samar State Polytechnic College
Catbalogan, Samar

May 2, 1984

The Acting President
Samar State Polytechnic College
Catbalogan, Samar

S i r :

I have the honor to request permission from your good office to use the vacant lot behind the old electricity building for secondary for my experimental study entitled "YIELD RESPONSES OF OKRA TO SELECTED ORGANIC FERTILIZERS UNDER CATBALOGAN SOIL CONDITIONS".

I anticipate with gratitude your kind and favorable consideration on this request.

Very truly yours,

(SGD.) THELMA C. QUITALIG
Graduate Student

Recommending Approval:

(SGD.) DOMINADOR Q. CABANGANAN, Ed. D.
Actg. Dean Graduate Studies

A P P R O V E D :

(SGD.) BASILIO S. FRINCILLO
Acting President
5/2/84

APPENDIX E

Republic of the Philippines
Samar State Polytechnic College
Catbalogan, Samar

March 20, 1985

The Actg. Dean Graduate Studies
Samar State Polytechnic College
Catbalogan, Samar

S i r :

I have the honor to request that I be scheduled for a final oral examination of my master's thesis entitled "YIELD RESPONSES OF OKRA TO SELECTED ORGANIC FERTILIZERS UNDER CATBALOGAN SOIL CONDITIONS" on February 1, 1985.

I hope for your immediate and favorable action on this matter.

Very truly yours,

(SGD.) THELMA C. QUITALIG
Graduate Student

N O T E D :

(SGD.) ALEJANDRO E. CANANUA
Adviser

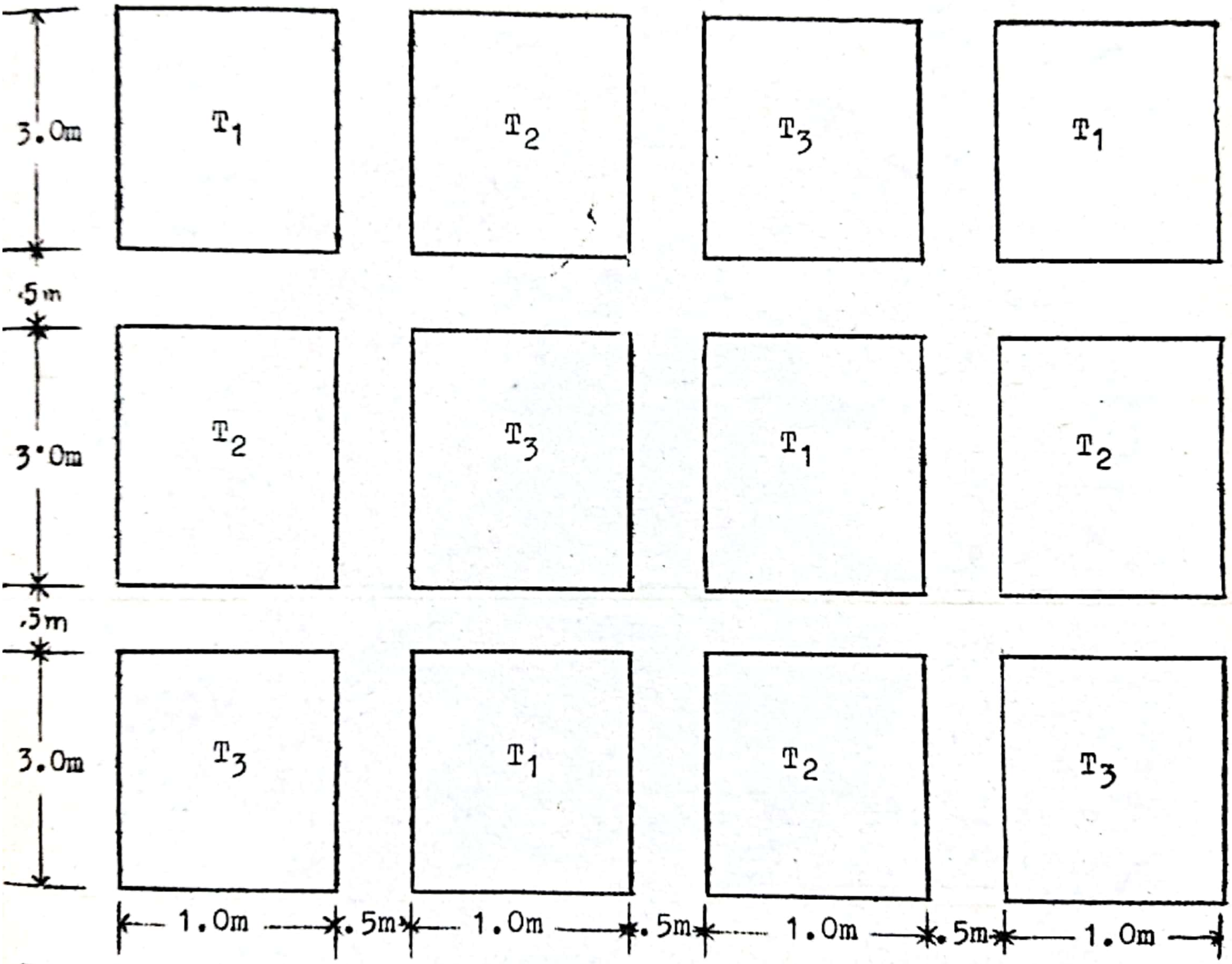
Approved: As per schedule, at 9:00 A.M.

A P P R O V E D :

(SGD.) DOMINADOR Q. CABANGANAN, Ed
Actg. Dean, Graduate Studies

APPENDIX F

EXPERIMENTAL DESIGN
(Randomized Complete Block Design)



Legend:

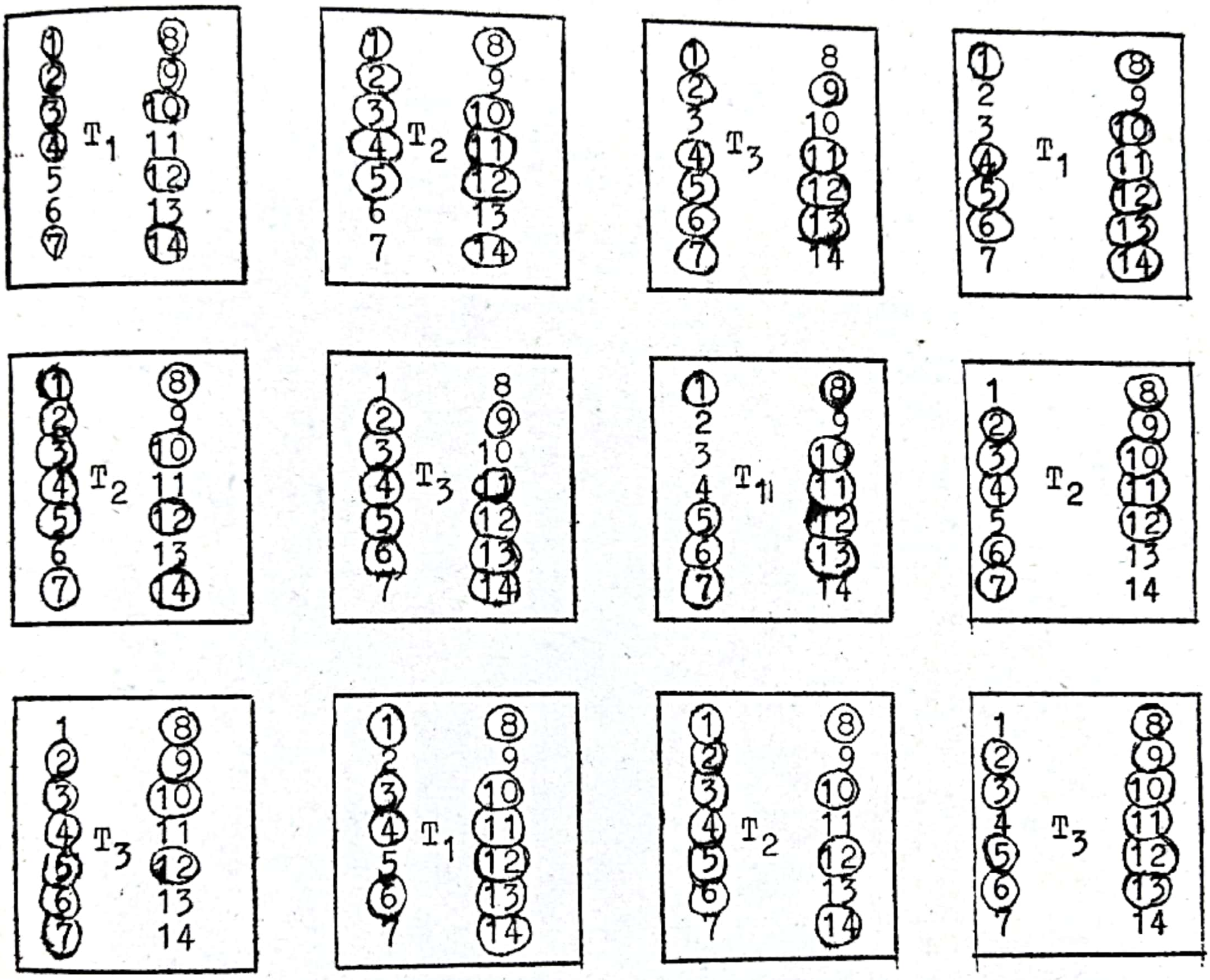
T_1 - carabao manure

T_2 - chicken dung

T_3 - control (no fertilizer)

APPENDIX G

THE SAMPLES



Note:

The encircled numbers are the hills or plants that composed the samples per treatment. The position of the samples within the treatment is decided by chance, that is, by simple random sampling (draw by lots) and not by a deliberate selection.

APPENDIX H

RANDOMIZED COMPLETE BLOCK (RCB)

Description

The treatments are randomly assigned to each replication subject to the restriction that each treatment may occur only one in each block.

Advantages

1. It is possible to group experimental units into blocks so that more precision is obtained than with the completely random design.

2. There is no restriction on the number of treatments or blocks.

3. If, as a result of mishap, the data from a complete block or for certain treatments are unusable, these data may be omitted without complicating the analysis.

4. The design is quite flexible. Since the variability between replications can be removed from the experimental error, it is unnecessary for the replications to be contiguous.

Disadvantages

The design is applicable to a moderate number of variables. When the number of variables exceed 15, a loss of efficiency is likely to occur because the replications become wide in dimension with result that they may incompass soil of a more heterogeneous nature.

Source of variation and key out of the degrees of freedom are as follows:

Replications	(r-1)
Treatments	(t-1)
Error	(r-1)(t-1)
Total	rt-1

Source: Bureau of Soils Standard Operating Procedures on Soil Fertility, pp. 60-61.

APPENDIX I

CHEMICAL COMPOSITION OF ORGANIC FERTILIZERS

Kind of Manure	Nitrogen (N)	Phosphoric Acid (P_2O_5)	Potash (K_2O)
Guano	8.5	5.0	1.5
Cattle (dried)	2.0	1.5	2.0
Horse (dried)	2.0	1.5	1.5
Goat (dried)	1.5	1.5	3.0
Poultry (dried)	5.0	3.0	1.5
Sheep (dried)	2.0	1.5	3.0
Swine (dried)	1.5	1.5	1.5
Tobacco stem	3.0	5.0	8.0
Tobacco seed core	2.7	1.8	1.4
Banana stalk	-	2.4	21.6
Barit grass (old)	0.41	1.6	0.94
Soybean manufacture waste	6.53	0.25	2.58
Sawdust	-	1.69	6.99
Rice Hull	-	0.32	5.97
Rice Straw	-	0.34	1.22

Source: *Teaching Guides in Elementary Agriculture*, pp. 72-73.

APPENDIX J

CATBALOGAN CLAY LOAM

Description

1. Formation and origin. Primary soil developed from shades and sandstones.

2. Profile

   A. Surface soil. Grayish brown to dark gray when moist, light grayish brown to gray when dry; coarse granular to blocky clay loam to silty clay loam with an easy root penetration. Boundary to lower layer is gradual. Depth is 10 to 30 centimeters.

   B_1 Upper subsoil. Light yellowish brown. Coarse granular to blocky clay loam with an easy root penetration. Grayish brown spots with some crumbs and fragments of highly weathered shale. Boundary to lower layer is diffused. Depth is from 25 to 50 centimeters from the surface.

   B_2 Lower subsoil. Yellowish gray to light gray, blocky clay loam with crumbs and blocks of highly weathered shale. The crumbs and blocks give either reddish brown to coloration or reddish black tints when cut.

Boundary to substratum is diffused. Depth ranges from 45 to 90 centimeters from the surface.

C. Substratum. Yellowish gray to pinkys brown clay loam with reddish brown freckles of highly weathered and partly massive, stratified shale and sandstone.

3. Relief. Rolling of hilly and mountainous.
4. Drainage. Excellent to excessive surface drainage, fair to poor internal drainage.
5. Vegetation. Talahib, cogon, aguingay, secondary and primary forests, and agricultural crops.

Source: Soil Series Notes and Soil Mapping Procedure, Bureau of Soils, p. 263.

APPENDIX K

SEVEN CLIMATE TYPES IN MAJORITY OF THE PROVINCES IN THE PHILIPPINES[87]

Provinces	Type of Climate
Abra	A & B
Agusan del Norte	E & G
Albay	F & G
Antique.	A
Bataan	A
Batanes	D
Batangas	A & B
Bohol	D & G
Bukidnon	C, F & G
Bulacan	A & B
Cagayan	D
Camarines Norte & Sur.	C
Capiz	A
Catanduanes.	C
Cavite	A & B
Cebu	A
Davao	E, F & G
Ilocos Norte & Sur	A & C

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[87]Eligio and Ricamonte, op. cit., pp. 21-24.

APPENDIX K (continued)

Province	Type of Climate
Iloilo	A
Isabela	D
Laguna	B
Lanao del Norte & Sur.	C, F & G
La Union	A & B
Leyte	D,E,F & G
Maguindanao	F & G
Marinduque	D
Masbate	D
Misamis Occidental & Oriental	C
Mountain province	B & G
Negros Occidental	B & E
Negros Oriental	E & G
North Cotabato	F & G
Nueva Ecija	A & B
Occidental Mindoro	A, B & D
Oriental Mindoro	E
Palawan	B & D
Pampanga	A
Pangasinan	A & B
Quezon	E
Rizal	B

APPENDIX K (continued)

Province	Type of Climate
Romblon	E
Samar	E & G
Siquijor	C & E
Sorsogon	C & D
Sulu	G
Sultan Kudarat	F & G
Tarlac	A
Tawi-tawi	G
Surigao del Norte & Sur	E
Zambales	A & B
Zamboanga del Norte	A, C & D
Zamboanga del Sur	E, F & G

Legend:

Type A - characterized by a long dry season (Oct-Mar) and a very pronounced wet season during the rest of the year.

Type B - has a shorter and less severe drought period than Type A; lasting from 1 - 4 months.

Type C - has a short dry season lasting from 1 - 3 months (Oct-Mar).

Type D - short dry season like Type C with a duration of 1-3 months (Apr-Sep).

APPENDIX K (continued)

Legend:

Type E - marked by a heavy rainfall (third week of March).

Type F - heavy rainfall during third week of September.

Type G - even distribution of rainfall with no marked seasonality.

APPENDIX L

COMPOSITION OF PHILIPPINE VEGETABLES, 100 GRAMS, EDIBLE PORTION (E.P.)

Food Composition	Food and Description				
	Abitsuwelas (Phaseolus vulgaria Linn.	Alagaw (Premma odorata Blanco)	Alugbati (Basella rubra Linn.)	Ampalaya Momordica charantial	Apulid (Eleocharis dulcis Frin.)
E.P. (%)	96	25	62	82	60
Moisture (%)	90.5	75.2	92.4	93.4	79.2
Food energy (cal)	34	83	22	22	88
protein (gm)	2.0	5.5	2.0	0.9	1.6
Fat (gm)	0.1	1.1	0.3	0.4	0.9
Carbohydrates (gm)	6.8	16.9	4.1	4.6	21.4
Fiber (gm)	1.0	4.5	0.8	0.9	0.8
Ash (gm)	0.6	1.3	1.2	0.7	0.9
CA (mg)	72	109	117	32	13
P (mg)	38	58	32	32	59
FE (mg)	0.8	5.3	3.1	0.9	0.6
NA (mg)	2	5	21	2	16
K (mg)	182	574	505	211	409
Vit. A value (I.U.)	525	6575	6390	335	...
Thiamine (mg)	.07	.07	.05	.06	.03
Riboflavin (mg)	.10	.11	.15	.03	.01
Niacin (mg)	0.7	1.3	0.5	0.3	1.0
Ascorbic Acid (mg)	15	15	88	55	7

APPENDIX L (continued)

Food and Composition	Bago, dahon (Gnetum, gnenon Linn.)	Baino, bunga (Nelumbium nelumbo Linn.)	Bataw (Dolichos lablab (Linn.)	Bawang (Allium sativum; Linn.)	Kabuti sariwa
E.P. (%)	...	49	80	85	94
Moisture (%)	70.6	80.4	87.8	66.2	87.7
Food energy (Cal)	104	67	47	122	39
protein (gm)	7.4	4.1	3.0	7.0	3.8
Fat (gm)	2.0	1.1	0.5	0.3	0.6
Carbohydrate (gm)	19.4	13.5	7.9	24.9	6.9
Fiber (gm)	0.6	11.3	1.7	1.1	1.2
Ash (gm)	0.6	0.9	0.8	1.6	1.0
CA (mg)	44	62	50	26	3
P (mg)	15	122	47	109	94
FE (mg)	0.1	0.9	1.0	1.2	1.7
NA (mg)	...	...	2	13	...
K (mg)	...	...	285	346	...
Vit. A value (I.U.)	1680	...	460	...	...
Thiamine (mg)	.10	.22	.08	.23	.11
Riboflavin (mg)	...	.06	.09	.08	.17
Niacin (mg)	1.2	2.1	1.1	0.4	8.3
Ascorbic Acid (mg)	121	14	13	7	5

APPENDIX L (continued)

Food and Compo- tion	Food and Description					
	Kakaw buto Theobroma cacao Linn.	Kadyos bunga (Cajanua cajan)	Kalabasa, bunga (Cucurbita maxima	Kales, dahon at tangkay	Kamatis (Lycopersicum esculentum Miller	Kamote Ipomoea batatas
E.P. (%)	100	56	70	71	95	53
Moisture (%)	0.7	62.2	89.6	90.5	95.1	84.8
Food energy (Cal)	530	143	34	27	19	53
Protein (gm)	11.6	8.4	1.9	3.1	1.0	2.8
Fat (gm)	34.1	0.7	0.4	0.5	0.2	0.5
Carbohydrate (gm)	50.2	26.5	7.3	4.3	4.1	10.3
Fiber (gm)	22.5	3.4	0.7	1.4	0.8	2.2
Ash (gm)	3.4	2.2	0.8	1.6	0.6	1.6
CA (mg)	285	78	19	159	18	107
P (mg)	461	198	35	41	18	65
FE (mg)	2.9	1.8	0.5	3.9	0.8	6.0
NA (mg)	...	5	.5	...	4	5
K (mg)	...	622	363	...	236	562
Vit. A value (I.U.)	...	285	1065	4370	735	5665
Thiamine (mg)	.03	.44	.08	.09	.06	.12
Riboflavin (mg)	.13	.16	.07	.19	.04	.20
Niacin (mg)	1.3	1.5	1.5	0.8	0.6	0.9
Ascorbic Acid (mg)	...	29	18	55	29	32

APPENDIX L (continued)

Food Composition	Food and Description: Kamoteng Kahoy (Manihot esculenta Crantz	Kangkong Ipomoea Aquatica	Kaong (Arenga Pinnata Wurmb)	Karot (Daucus carota Linn)	Kasuy talbos (Anacardium occidentale Linn.)	Katanda, talbos (Cassica tora Linn.)
E.P. (%)	76	60	100	82	...	...
Moisture (%)	64.0	89.7	97.4	85.1	69.9	76.9
Food energy (Cal)	141	30	19	55	...	74
Protein (gm)	0.7	3.9	0.1	1.3	5.2	4.4
Fat (gm)	0.1	0.6	0.2	0.4	0.6	1.0
Carbohydrate (gm)	34.3	4.4	4.9	12.4	...	15.3
Fiber (gm)	1.0	1.0	0.5	0.9	1.2	2.6
Ash (gm)	0.9	1.4	0.1	0.8	...	2.4
CA (mg)	24	71	21	60	...	110
P (mg)	37	67	3	28	...	61
FE (mg)	1.5	3.2	0.5	1.7	...	6.4
NA (mg)	3	49	...	32	...	...
K (mg)	418	458	...	283	...	...
Vit. A value (I.U.)	...	4825	...	18520	1025	15400
Thiamine (mg)	.04	.09	...	.04	.01	.19
Riboflavin (mg)	.01	.24	.01	.04	.01	.29
Niacin (mg)	0.6	1.3	0.1	0.6	1.4	1.6
Ascorbic Acid (mg)	41	49	...	9	89	185

APPENDIX L (continued)

Food Composition	Food and Description: Kintsay (Apium graveolena Linn.)	Koliplawer (Brasica oleracia Linn.)	Kolis talbos (Pisonia alba Span.)	Kulitis (Amaranthus gracilis Desf.)	Kundol (Benincasa hispida Thumb Cogn.)	Gabi, dahon (Colocasia esculentum)
E.P. (%)	52	59	...	47	...	55
Moisture (%)	93.6	90.3	85.2	84.7	95.6	79.6
Food energy (Cal)	18	31	46	47	15	69
Protein (gm)	1.2	2.4	4.7	4.6	0.4	4.4
Fat (gm)	...	0.4	0.9	1.1	0.2	1.8
Carbohydrate (gm)	4.2	6.1	7.6	7.4	3.5	12.2
Fiber (gm)	0.7	0.6	2.1	1.4	0.7	3.4
Ash (gm)	1.0	0.8	1.6	2.5	0.9	2.0
CA (mg)	57	34	312	341	18	268
P (mg)	26	50	58	76	17	78
FE (mg)	2.8	1.0	1.8	18.0	0.2	4.3
NA (mg)	14	8	...	51	6	11
K (mg)	448	314	...	443	111	1237
Vit. A value (I.U.)	80	95	1915	12860	...	20385
Thiamine (mg)	.10	.13	.03	.03	.02	.12
Riboflavin (mg)	.33	.16	.16	.05	.03	.05
Niacin (mg)	2.0	1.2	1.3	0.2	0.3	0.5
Ascorbic Acid (mg)	22	90	33	120	22	142

APPENDIX L (continued)

Food Composition	Food and Description: Garbansos (Cicer arietinum Linn.)	Ispinaka (Tetragonia expansa Murr.)	Labong (Bambusa spinosa Roxb.)	Labanos (Raphanus sativus Linn.)	Langka hilaw (Artocarpus heterophyla)	Letsugas (Cactuca sativa Linn.)
E.P. (%)	100	47	100	68	60	81
Moisture (%)	10.8	92.2	92.2	93.5	85.2	93.9
Food energy (cal.)	366	20	27	21	51	19
Protein (gm)	20.0	3.5	2.0	0.6	2.0	1.3
Fat (gm)	6.4	0.5	0.7	0.1	0.6	0.3
Carbohydrate (gm)	59.7	2.2	4.5	5.3	11.5	3.7
Fiber (gm)	2.6	0.8	0.7	0.6	2.6	0.5
Ash (gm)	3.1	1.8	0.6	0.5	0.7	0.8
CA (mg)	106	208	19	32	53	97
P (mg)	340	54	26	21	20	36
FE (mg)	3.8	2.6	0.2	0.6	0.4	4.3
NA (mg)	10	...	...	...	...	17
K (mg)	1007	...	...	218	323	328
Vit. A value (I.U.)	15	7840	...	...	30	3340
Thiamine (mg)	.13	.03	.03	.02	.12	.06
Riboflavin (mg)	.16	.16	.05	.03	.05	.13
Niacin (mg)	1.2	1.3	0.2	0.3	0.5	0.4
Ascorbic Acid (mg)	Tr.	46	3	25	12	21

APPENDIX L (continued)

Food Composition	Food and Description: Lubi-lubi (Solanum sativa Linn.)	Lupo-lupo (Achyranthes aspera Linn.)	Luya (Zingiber officinale Rosc.)	Malunggay (Moringa olefera Lam)	Mani (Arachis hypogaea Linn.)	Mungo (phaseolus aureus Roxb.)
E.P. (%)	61	72	74	61	51	100
Moisture (%)	85.0	85.0	90.3	77.4	49.6	6.1
Food energy (cal)	14	46	37	75	274	356
Protein (gm)	4.5	6.4	1.1	5.9	14.1	24.4
Fat (gm)	0.3	1.0	0.8	1.8	19.4	1.0
Carbohydrate (gm)	8.6	6.2	7.0	12.8	15.5	64.6
Fiber (gm)	1.1	0.8	1.0	1.8	1.1	4.3
Ash (gm)	0.8	1.6	1.4	0.8	2.1	3.9
CA (mg)	222	158	32	353	50	125
P (mg)	94	59	28	95	194	340
FE (mg)	2.3	Tr.	3.0	3.5	1.9	5.7
NA (mg)	...	...	6	4	3	6
K (mg)	...	...	264	473	421	1141
Vit. A value (I.U.)	3110	10925	...	12450	35	130
Thiamine (mg)	.10	.13	.04	.20	.94	.66
Riboflavin (mg)	.24	.48	.04	.73	.20	.22
Niacin (mg)	1.3	1.0	0.6	3.7	8.0	2.4
Ascorbic Acid (mg)	20	30	4	232	11	10

APPENDIX L (continued)

Food Composition	Food and Description					
	Mustasa (Brassica integrifolia	Okra (Hibiscus esculentus Linn.)	Olassiman Portulaca oleracia Linn.)	Paayap (Vigna sinensis Linn.)	Pako (Athyrium esculentum Retz.)	Pakupis (Trichosanthes ang. Linn.)
E.P. (%)	86	90	47	84	59	86
Moisture (%)	92.3	89.1	90.7	86.7	89.9	95.2
Food energy (Cal)	22	34	25	50	37	16
Protein (gm)	2.2	1.8	2.3	3.7	3.8	0.6
Fat (gm)	0.3	0.1	0.4	0.3	2.1	Tr.
Carbohydrate (gm)	4.1	8.2	4.6	8.5	2.9	4.0
Fiber (gm)	0.7	0.7	0.9	2.8	1.3	0.5
Ash (gm)	1.2	0.8	2.0	0.8	1.3	0.2
CA (mg)	192	120	135	114	23	22
P (mg)	39	49	36	65	67	15
FE (mg)	5.3	0.8	4.9	1.1	4.4	0.3
NA (mg)	28	4	262	1	15	...
K (mg)	309	246	390	216	554	...
Vit. A value (I.U.)	3350	240	6660	1035	3775	235
Thiamine (mg)	.08	.08	.06	.17	...	.02
Riboflavin (mg)	.14	.09	.16	.18	.09	.03
Niacin (mg)	0.6	0.8	1.0	1.1	1.7	0.3
Ascorbic Acid (mg)	77	17	51	36	2	12

APPENDIX L (continued)

Food Composition	Food and Description: Pakwan buto (Citrullus vulgaris Sch.)	Papaya, bunga (Carica papaya Linn.)	Patani (Phaseolus lunatos Linn.)	Patatas (Solanum tuberosum	Patola (Luffa cylindrica Linn: M. Roem:	Pepino (Cucumis sativus Linn.)
E.P. (%)	35	64	44	85	71	81
Moisture (%)	9.9	93.2	66.3	80.7	93.9	94.4
Food energy (Cal.)	514	24	129	72	21	12
Protein (gm)	40.2	1.0	8.3	2.4	0.6	0.6
Fat (gm)	43.2	0.1	0.7	0.1	0.2	0.2
Carbohydrate (gm)	4.8	5.2	23.1	16.0	4.9	2.4
Fiber (gm)	3.8	0.8	1.0	0.4	0.5	0.5
Ash (gm)	3.6	0.5	1.6	0.8	0.4	0.4
CA (mg)	3.8	0.5	1.6	0.8	0.4	0.4
P (mg)	444	26	111	49	24	12
FE (mg)	5.6	0.3	2.6	1.1	0.6	0.4
NA (mg)	492	...	2	4	3	5
K (mg)	400	...	747	449	97	122
Vit. A value (I.U.)	20	...	65	...	45	Tr.
Thiamine (mg)	.02	.03	.15	.13	.04	.02
Riboflavin (mg)	.06	.02	.10	.06	.02	.02
Niacin (mg)	1.2	0.2	1.2	2.2	0.3	0.1
Ascorbic Acid (mg)	Tr.	22	27	31	7	10

APPENDIX L (continued)

Food Composition	Food and Description					
	Petsay (Brassica chinensis Linn.)	Repolyo (Brassica oleracea var. capitata	Rimas (Artocarpus altiillis)	Saging puso (Musa sapientum Linn.)	Sago (Metroxylon sagu Rottb.	Sayote (Sechim edule Sw.)
E.P. (%)	82	82	71	54	100	86
Moisture (%)	93.1	92.1	83.6	88.9	11.0	94.4
Food energy (cal)	21	25	56	36	316	19
Protein (gm)	1.8	1.7	2.4	1.6	0.5	0.4
Fat (gm)	0.3	0.2	0.5	0.4	Tr.	0.1
Carbohydrate (gm)	3.9	5.3	12.9	8.0	88.2	4.9
Fiber (gm)	0.7	0.9	1.4	1.1	Tr.	0.6
Ash (gm)	0.9	0.7	0.7	1.1	0.3	0.2
CA (mg)	147	64	40	56	32	20
P (mg)	33	26	36	42	10	9
FE (mg)	4.4	0.7	1.3	1.1	0.8	0.3
NA (mg)	20	8	13	...	...	2
K (mg)	323	209	497	...	...	103
Vit. A value (I.U.)	3600	75	55	440	...	50
Thiamine (mg)	.07	.05	.09	.02	Tr.	.02
Riboflavin (mg)	.13	.05	.05	.02	Tr.	.02
Niacin (mg)	1.0	0.3	1.5	0.5	0.1	0.4
Ascorbic Acid (mg)	74	62	45	13	...	16

APPENDIX L (continued)

Food Composition	Food and Description: Sibuyas (Allium cepa Linn.)	Sigarilyas (Psophocarpus tetra	Sili, berde (Capsicum annum Linn.)	Siling Labuyo (Capsicum frutescens Linn.	Siniguelas (Spondias purpurea Linn.)
E.P. (%)	92	96	83	89	97
Moisture (%)	86.6	90.7	93.3	72.2	88.6
Food energy (cal)	48	29	23	62	35
Protein (gm)	1.8	2.7	0.7	4.8	4.3
Fat (gm)	0.2	0.3	0.2	2.2	0.8
Carbohydrate (gm)	10.8	5.6	5.4	9.0	5.1
Fiber (gm)	0.7	1.3	1.5	1.4	1.6
Ash (gm)	0.6	0.7	0.4	11.8	1.2
CA (mg)	34	64	12	65	12
P (mg)	63	35	18	89	73
FE (mg)	0.7	0.1	0.4	2.3	2.8
NA (mg)	11	3	8	23	...
K (mg)	102	205	170	1286	...
Vit. A value (I.U.)	...	545	260	7010	...
Thiamine (mg)	.02	.24	.05	.31	.08
Riboflavin (mg)	.02	.09	.03	.25	.12
Niacin (mg)	0.4	1.2	0.5	1.8	1.5
Ascorbic Acid (mg)	5	15	84	69	26

APPENDIX L (continued)

Food Composition	Food and Description: Sinkamas (Pachyrrhizas erosus	Sitaw (Vigma sinensis var sesquiscalis	Sitsaro (Pisum sativum Linn.	Talinum (Talinum triangulare Willd.)	Talong (Solanum melongena Linn.)
E.P. (%)	87	91	93	67	91
Moisture (%)	89.5	88.1	81.9	92.5	92.5
Food energy (cal)	39	38	57	22	24
Protein (gm)	1.1	2.8	3.3	1.7	1.0
Fat (gm)	0.2	0.2	0.3	0.4	0.2
Carbohydrate (gm)	8.9	8.2	13.0	4.2	5.7
Fiber (gm)	0.5	1.5	1.2	0.7	0.8
Ash (gm)	0.3	0.7	1.5	1.2	0.6
CA (mg)	14	42	76	79	30
P (mg)	15	46	45	22	27
FE (mg)	0.4	0.9	1.4	5.5	0.6
NA (mg)	2	5	2	10	4
K (mg)	113	230	112	393	223
Vit. A value (I.U.)	Tr.	570	305	5255	130
Thiamine (mg)	.05	.12	.14	.11	.10
Riboflavin (mg)	.02	.13	.09	.17	.05
Niacin (mg)	.02	1.2	0.9	0.5	0.6
Ascorbic Acid (mg)	14	22	77	58	5

APPENDIX L (continued)

Food Composition	Food and Description: Tapilan (Phaseolus culcaratus Roxb.)	Toge (Phaseolus aurens Roxb.	Unsuy (Coriandrum sativum Linn.)	Upo (Lagenaria siceraria Standl.)	Utaw (Glycine max Linn.)
E.P. (%)	100	87	80	84	100
Moisture (%)	10.1	85.6	86.8	95.4	7.5
Food energy (Cal)	352	43	40	15	405
Protein (gm)	18.4	5.6	2.7	0.5	39.1
Fat (gm)	3.1	0.1	0.6	0.1	17.0
Carbohydrate (gm)	64.5	8.0	8.0	3.5	31.7
Fiber (gm)	7.3	0.6	1.1	0.4	4.8
Ash (gm)	3.9	0.7	1.9	0.5	5.1
CA (mg)	397	19	222	16	296
P (mg)	285	82	25	14	541
FE (mg)	4.0	0.8	3.2	0.4	12.2
NA (mg)	...	7	42	3	9
K (mg)	...	288	540	137	1540
Vit. A value (I.U.)	55	15	6800	10	...
Thiamine (Mg)	.54	.15	.12	.04	.44
Riboflavin (mg)	.17	.16	.32	.02	.18
Niacin (mg)	2.2	1.1	1.6	0.4	2.0
Ascorbic Acid (mg)	...	52	161	11	Tr.

APPENDIX M

ABBREVIATIONS, SIGNS AND SYMBOLS[88]

gm.	. . . .	gram
mg.	. . . .	milligram
I.U.	. . . .	International Unit
Tr.	. . . .	traces or negligible amount
( )	. . . .	imputed values
...	. . . .	means not analyzed
pc.	. . . .	piece
cm.	. . . .	centimeter
diam.	. . . .	diameter
cal.	. . . .	calories
E.P.	. . . .	Edible Portion

[88] Ibid., p. 5.

APPENDIX N - 1

Computation of the Analysis of Variance for the Average Number of Pods Per Hill Per Treatment During the Initial Fruiting

(1) Correction Factor (C.F.) = $\frac{(\text{Grand Total})^2}{\text{No. of Blocks}}$

$$C.F. = \frac{(12.1)^2}{12}$$

$$= \frac{146.41}{12}$$

$$= 12.200833$$

(2) Replication Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Treatments}}$ - C.F.

$$R.S.S. = \frac{(4.3)^2 + (2.3)^2 + (3.4)^2 + (2.1)^2}{3} - 12.200833$$

$$= \frac{18.49 + 5.29 + 11.56 + 4.41}{3} - 12.200833$$

$$= \frac{39.75}{3} - 12.200833$$

$$= 13.25 - 12.200833$$

$$= 1.049167$$

(3) Treatment Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Replications}}$ - C.F.

$$T.S.S. = \frac{(1.7)^2 + (6.0)^2 + (4.4)^2}{4} - 12.200833$$

$$= \frac{2.89 + 36 + 19.36}{4} - 12.200833$$

$$= \frac{58.25}{4} - 12.200833$$

$$= 14.5625 - 12.200833$$

$$= 2.3617$$

(4) Total Sums of Squares = Sums of Squares - C.F.

$$T.S.S. = (0.2)^2 + (2.1)^2 + (2.0)^2 + (0.3)^2 + (1.2)^2 + (0.8)^2 + (0.6)^2 + (1.7)^2 + (1.1)^2 + (C.6)^2 + (1.0)^2 + (0.5)^2 - 12.200833$$

$$= 0.04 + 4.41 + 4.0 + 0.09 + 1.44 + 0.64 + 0.36 + 2.89 + 1.21 + 0.36 + 1.0 + 0.25 - 12.200833$$

$$= 16.69 - 12.200833$$

$$= 4.489167$$

(5) Error Sums of Squares = Total S.S. - (R.S.S. - T.S.S.)

$$= 4.489167 - (1.049167 - 2.361667)$$

$$= 4.489167 - (-1.3125)$$

$$= 5.8017$$

(6) Replication Mean Square $= \dfrac{\text{Replication S.S.}}{\text{d.f.}}$

$$R.M.S. = \frac{1.049167}{3}$$

$$= 0.3497$$

(7) Treatment Mean Square $= \dfrac{\text{Treatment S.S.}}{\text{d.f.}}$

$$T.S.S. = \frac{2.361667}{2}$$

$$= 1.18085$$

(8) Error Mean Square $= \dfrac{\text{Error Sums of Squares}}{\text{d.f}}$

$$E.M.S. = \frac{5.801667}{6}$$

$$= 0.96695$$

(9) Experimental F-value (R) = $\frac{\text{Replication M.S.}}{\text{Error M.S.}}$

E. F. Value (R) = $\frac{.3497}{.96695}$

= .36165

(10) Experimental F-value (T) = $\frac{\text{Treatment Mean Square}}{\text{Error Mean Square}}$

E.F. Value (T) = $\frac{1.18085}{0.96695}$

= 1.2212

APPENDIX N-2

Computation of the Analysis of Variance for the Average Weekly Increase In The Number of Pods from Initial Fruiting Up to Three-Month Period Per Treatment

(1) Correction Factor (C.F.) = $\frac{(\text{Grand Total})^2}{\text{No. of Blocks}}$

$$C.F. = \frac{(104.24)^2}{12}$$

$$= \frac{10865.977}{12}$$

$$= 905.49808$$

(2) Replication Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Treatments}}$ - C.F.

$$R.S.S. = \frac{(33.17)^2 + (19)^2 + (29.49)^2 + (22.58)^2}{3} - C.F.$$

$$= \frac{1100.2489 + 361 + 869.6601 + 509.8564}{3} - 905.49808$$

$$= \frac{2840.7654}{3} - 905.49808$$

$$= 946.9218 - 905.49808$$

$$= 41.42372$$

(3) Treatment Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Replication}}$ - C.F.

$$T.S.S. = \frac{(35.82)^2 + (42.34)^2 + (26.08)^2}{4} - 905.49808$$

$$= \frac{1283.0724 + 1792.6756 + 680.1664}{4} - 905.49808$$

$$= \frac{3755.9114}{4} - 905.49808$$

$$= 1251.9714 - 905.49808$$

$$= 346.4734$$

(4) Total Sums of Squares = Sums of Squares - C.F.

T.S.S. $= (11.83)^2 + (6.83)^2 + (11.33)^2 + (5.83)^2 +$

$= (12.17)^2 + (7.42)^2 + (11.08)^2 + (11.67)^2 +$

$(9.17)^2 + (4.75)^2 + (7.08)^2 + (5.08)^2 -$

905.49808

$= 139.9489 + 46.6489 + 128.3689 + 33.9889 +$

$148.1089 + 55.0564 + 122.7664 + 136.1889 +$

$84.0889 + 22.5625 + 50.1264 + 25.8064 -$

905.49808

$= 993.6604 - 905.49808$

$= 88.16232$

(5) Error Sums of Squares = Total S.S. - (R.S.S. - T.S.S.)

E.S.S. $= 88.16232 - (41.41372 - 346.4734)$

$= 88.16232 - (-305.0496)$

$= 393.21192$

(6) Replication Mean Squares $= \frac{\text{Replication Sums of Squares}}{\text{d.f.}}$

R.M.S. $= \frac{41.42372}{3}$

$= 13.807906$

(7) Treatment Mean Squares $= \frac{\text{Treatment Sums of Squares}}{\text{d.f.}}$

T.M.S. $= \frac{346.4734}{2}$

$= 173.2367$

(8) Error Mean Square = $\frac{\text{Error Sums of Squares}}{\text{d.f.}}$

$$E.M.S. = \frac{393.21192}{6}$$

$$= 65.53532$$

(9) Experimental F-value (R) = $\frac{\text{Replication M.S.}}{\text{Error M.S.}}$

$$E.F.\ Value\ (R) = \frac{13.807906}{65.53532}$$

$$= 0.2106941$$

(10) Experimental F-value (T) = $\frac{\text{Treatment M.S.}}{\text{Error M.S.}}$

$$E.\ F.\ Value\ (T) = \frac{173.2367}{65.53532}$$

$$= 2.6434096$$

APPENDIX N-3

Computation of the Analysis of Variance for The Average Length and Diameter of the Young Tender Pods Per Treatment

A. Average Length

(1) Correction Factor (C.F.) = $\frac{(\text{Grand Total})^2}{\text{No. of Blocks}}$

$$C.F. = \frac{(178.88)^2}{12}$$

$$= \frac{31998.054}{12}$$

$$= 2666.5045$$

(2) Replication Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Treatments}}$ - C.F.

$$R.S.S. = \frac{(46.24)^2 + (46.04)^2 + (44.20)^2 + (43.40)^2}{3} - 2666.5045$$

$$= \frac{2138.1376 + 2119.6816 + 1953.64 + 1883.56}{3} - 2666.5045$$

$$= \frac{8095.0192}{3} - 2666.5045$$

$$= 2698.3397 - 2666.5045$$

$$= 31.8352$$

(3) Treatment Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Replications}}$ - C.F.

$$T.S.S. = \frac{(59.08)^2 + (64.67)^2 + (55.13)^2}{4} - 2666.5045$$

$$= \frac{3490.4464 + 4182.2089 + 3039.3169}{4} - 2666.5045$$

$$= \frac{10711.972}{4} - 2666.5045$$

$$= 2677.98 - 2666.5045$$

$$= 11.4755$$

(4) Total Sums of Squares = Sums of Squares - C.F.

$$T.S.S. = (14.86)^2 + (16.45)^2 + (14.45)^2 + (14.16)^2 + (17.76)^2 + (14.12)^2 + (14.97)^2 + (15.18)^2 + (13.05)^2 + (15.09)^2 + (15.28)^2 + (13.03)^2 - 2666.5045$$

$$= 220.8196 + 270.6025 + 222.9049 + 200.5056 + 315.4176 + 199.3744 + 224.1009 + 230.4324 + 170.3025 + 227.7081 + 233.4784 + 169.7809 - 2666.5045$$

$$= 2685.4278 - 2666.5045$$

$$= 18.9233$$

(5) Error Sums of Squares = T.S.S. - (R.S.S. - T.S.S.)

$$E.S.S. = 18.9233 - (31.8352 - 11.4755)$$

$$= 18.9233 - 20.3597$$

$$= -1.4364$$

(6) Replication Mean Square = $\frac{\text{Replication Sums of Squares}}{\text{d.f.}}$

$$R.M.S. = \frac{31.8352}{3}$$

$$= 10.6117$$

(7) Treatment Mean Square = $\frac{\text{Treatment Sums of Squares}}{\text{d.f.}}$

$$T.M.S. = \frac{11.4755}{2}$$

$$= 5.7378$$

(8) Error Mean Square = $\frac{\text{Error Sums of Squares}}{\text{d.f.}}$

$$E.M.S. = \frac{-1.4364}{6}$$

$$= -0.2394$$

(9) Experimental F-value (R) = $\frac{\text{Replication Mean Square}}{\text{Error Mean Square}}$

$$\text{E. F. Value (R)} = \frac{10.6117}{-0.2394}$$

$$= -44.3264$$

(10) Experimentbal F-value (T) = $\frac{\text{Treatment Mean Square}}{\text{Error Mean Square}}$

$$\text{E.F. Value (T)} = \frac{5.7378}{-0.2394}$$

$$= -23.9672$$

B. Average Diameter

(1) Correction Factor (C.F.) = $\frac{(\text{Grand Total})^2}{\text{No. of Blocks}}$

$$C.F. = \frac{(24.745)^2}{12}$$

$$= \frac{612.31502}{12}$$

$$= 51.026251$$

(2) Replication Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Treatments}}$ - C.F.

$$R.S.S. = \frac{(6.216)^2 + (6.386)^2 + (6.027)^2 + (6.116)^2}{3} - 51.026251$$

$$= \frac{38.6387 + 40.7810 + 36.3247 + 37.4055}{3} - 51.026251$$

$$= \frac{153.1499}{3} - 51.026251$$

$$= 51.0500 - 51.026251$$

$$= 0.0237$$

(3) Treatment Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Replications}}$ - C.F.

$$T.S.S. = \frac{(8.324)^2 + (8.745)^2 + (7.676)^2}{4} - 51.026251$$

$$= \frac{69.2890 + 76.4750 + 58.9210}{4} - 51.026251$$

$$= \frac{204.685}{4} - 51.026251$$

$$= 51.1713 - 51.026251$$

$$= 0.145$$

(4) Total Sums of Squares = Sums of Squares - C.F.

$$T.S?S. = (2.189)^2 + (2.167)^2 + (1.86] + (2.042)^2 +$$

$$(2.295)^2 + (2.049)^2 + (2.038)^2 + (2.087)^2 +$$

$(1.902)^2 + (2.055)^2 + (2.196)^2 + (1.865)^2 - 51.0263$

$= 4.7917 + 4.6959 + 3.4596 + 4.1698 + 5.2671 +$

$4.1984 + 4.1534 + 4.3556 + 3.6176 + 4.223 +$

$4.8224 + 3.4782 - 51.0263$

$= 51.2327 - 51.0263$

$= 0.2064$

(5) Error Sums of Squares = T.S.S. - (R.S.S. - T.S.S.)

E.S.S. $= 0.2064 - (0.0237 - 0.1540)$

$= 0.2064 - (-0.1213)$

$= 0.3277$

(6) Replication Mean Square = $\frac{\text{Replication Sums of Squares}}{\text{d.f.}}$

R.M.S. $= \frac{0.0237}{3}$

$= 0.0079$

(7) Treatment Mean Square = $\frac{\text{Treatment Sums of Squares}}{\text{d.f.}}$

T.M.S. $= \frac{0.3277}{2}$

$= 0.0725$

(8) Error Mean Square = $\frac{\text{Error Sums of Squares}}{\text{d.f.}}$

E.M.S. $= \frac{0.3277}{6}$

$= 0.0546$

(9) Experimental F-value (R) = $\frac{\text{Replication Mean Square}}{\text{Error Mean Square}}$

E.F. Value (R) $= \frac{0.0079}{0.0546}$

$= 0.1447$

(10) Experimental F-Value (T) = $\frac{\text{Treatment Mean Square}}{\text{Error Mean Square}}$

$$\text{E.F. Value (T)} = \frac{0.0725}{0.0546}$$

$$= 1.3278$$

APPENDIX N- 4

Computation of the Analysis of Variance for the Total Yield in Kilograms of the Young Tender Pods Per Treatment

(1) Correction Factor (C.F.) = $\frac{(\text{Grand Total})^2}{\text{No. of Blocks}}$

$$C.F. = \frac{(124.995)^2}{12}$$

$$= \frac{15623.75}{12}$$

$$= 1301.9791$$

(2) Replication Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Treatments}}$ - C.F.

$$R.S.S. = \frac{(39.86)^2 + (28.84)^2 + (29.205)^2 + (27.088)^2}{3} - 1301.9791$$

$$= \frac{1588.8196 + 831.7456 + 852.9320 + 733.7597}{3} - 1301.9791$$

$$= \frac{4007.2569}{3} - 1301.9791$$

$$= 1335.7523 - 1301.9791$$

$$= 33.7732$$

(3) Treatment Sums of Squares = $\frac{\text{Sums of Squares}}{\text{Replications}}$ - C.F.

$$T.S.S. = \frac{(37.436)^2 + (52.601)^2 + (34.958)^2}{4} - 1301.9791$$

$$= \frac{1401.454 + 2766.8652 + 1222.0617}{4} - 1301.9791$$

$$= \frac{5390.3809}{4} - 1301.9791$$

$$= 1347.5952 - 1301.9791$$

$$= 45.6161$$

(4) Total Sums of Squares = Sums of Squares - C.F.

$$\begin{aligned} T.S.S. &= (14.005)^2 + (7.105)^2 + (9.993)^2 + (8.333)^2 + \\ &\quad (15.231)^2 + (13.588)^2 + (13.442)^2 + (10.340)^2 + \\ &\quad (10.624)^2 + (8.149)^2 + (7.77)^2 + (8.415)^2 - \\ &\quad 1301.9791 \\ &= 196.14 + 50.481 + 63.888 + 69.4389 + 231.9834 + \\ &\quad 184.6337 + 180.6874 + 106.9156 + 112.8694 + \\ &\quad 66.4062 + 60.3729 + 70.8122 - 1301.9791 \\ &= 1394.6287 - 1301.9791 \\ &= 92.6496 \end{aligned}$$

(5) Error Sums of Squares * T.S.S. - (R.S.S. - T.S.S.)

$$\begin{aligned} E.S.S. &= 92.6496 - (33.7732 - 45.6161) \\ &= 92.6496 - (-11.8429) \\ &= 104.4925 \end{aligned}$$

(6) Replication Mean Square = $\frac{\text{Replication Sums of Squares}}{\text{d.f.}}$

$$\begin{aligned} R.M.S. &= \frac{33.7732}{2} \\ &= 11.2577 \end{aligned}$$

(7) Treatment Mean Square = $\frac{\text{Treatment Sums of Squares}}{\text{d.f.}}$

$$\begin{aligned} T.M.S. &= \frac{45.6161}{2} \\ &= 22.8081 \end{aligned}$$

(8) Error Mean Square = $\frac{\text{Error Sums of Squares}}{\text{d.f.}}$

$$\begin{aligned} E.M.S. &= \frac{104.4925}{6} \\ &= 17.4154 \end{aligned}$$

(9) Experimental F-value (R) = $\frac{\text{Replication Mean Square}}{\text{Error Mean Square}}$

$$\text{E.F. Value (R)} = \frac{11.2577}{17.4154}$$

$$= 0.6464$$

(10) Experimental F-value (T) = $\frac{\text{Treatment Mean Square}}{\text{Error Mean Square}}$

$$\text{E.F. Value (T)} = \frac{22.8081}{17.4154}$$

$$= 1.3097$$

APPENDIX O

F - ratios for .05 (upper) and .01 (lower) levels of significance *

Degrees of freedom for smaller mean square	Degrees of Freedom for Greater Mean Square									
	1	2	3	4	5	6	8	12	24	∞
1	161.45 4052.10	199.50 4999.03	215.72 5403.49	224.57 5625.14	230.17 5764.08	233.97 5859.39	238.89 5981.34	243.91 6105.83	249.04 6234.16	254.32 6366.48
2	18.51 98.49	19.00 99.01	19.16 99.17	19.25 99.25	19.30 99.30	19.33 99.33	19.37 99.36	19.41 99.42	19.45 99.46	19.50 99.50
3	10.13 34.12	9.55 30.81	9.28 29.46	9.12 28.71	9.01 28.24	8.94 27.91	8.84 27.49	8.74 27.05	8.64 26.60	8.53 26.12
4	7.71 21.20	6.94 18.00	6.59 16.69	6.39 15.98	6.26 15.52	6.16 15.21	6.04 14.80	5.91 14.37	5.77 13.93	5.63 13.46
5	6.61 16.26	5.79 13.27	5.41 12.06	5.19 11.39	5.05 10.97	4.95 10.67	4.82 10.27	4.68 9.89	4.53 9.47	4.36 9.02
6	5.99 13.74	5.14 10.92	4.76 9.78	4.53 9.15	4.39 8.75	4.28 8.47	4.15 8.10	4.00 7.72	3.84 7.31	3.67 6.88
7	5.59 12.25	4.74 9.55	4.35 8.45	4.12 7.85	3.97 7.46	3.87 7.19	3.73 6.84	3.57 6.47	3.41 6.07	3.23 5.65
8	5.32 11.26	4.46 8.65	4.07 7.59	3.84 7.01	3.69 6.63	3.58 6.37	3.44 6.03	3.28 5.67	3.12 5.28	2.93 4.86
9	5.12 10.56	4.26 8.02	3.86 6.99	3.63 6.42	3.48 6.06	3.37 5.80	3.23 5.47	3.07 5.11	2.90 4.73	2.71 4.31
10	4.96 10.04	4.10 7.56	3.71 6.55	3.48 5.99	3.33 5.64	3.22 5.39	3.07 5.06	2.91 4.71	2.74 4.33	2.54 3.91
11	4.84 9.65	3.98 7.20	3.59 6.22	3.36 5.67	3.20 5.32	3.09 5.07	2.95 4.74	2.79 4.40	2.61 4.02	2.40 3.60
12	4.75 9.33	3.88 6.93	3.49 5.95	3.26 5.41	3.11 5.06	3.00 4.82	2.85 4.50	2.69 4.16	2.50 3.78	2.30 3.36

*Garett, op. cit., p. 463.

APPENDIX P

INFORMATION ON THE LEVEL OF SIGNIFICANCE[89]

To test the significance of the F-value for treatments, compare the calculated value of F with that found in the F-value at .05 and .01 levels with the corresponding degrees of freedom. If it exceeds the F-value at .05 and .01 levels, the difference between the treatment is significant and highly significant, respectively. If it fails, or will not exceed the probability at .05; the difference is not significant.

If the F-test has given highly significant results, critical difference (C.D.) is resorted to between two treatment means to make individual comparisons among treatments. Any difference between two treatment means of the computed C.D. or higher is significant at .05 level. It means that the difference in yield between treated plots can be safely attributed to the treatment and not to other causes.

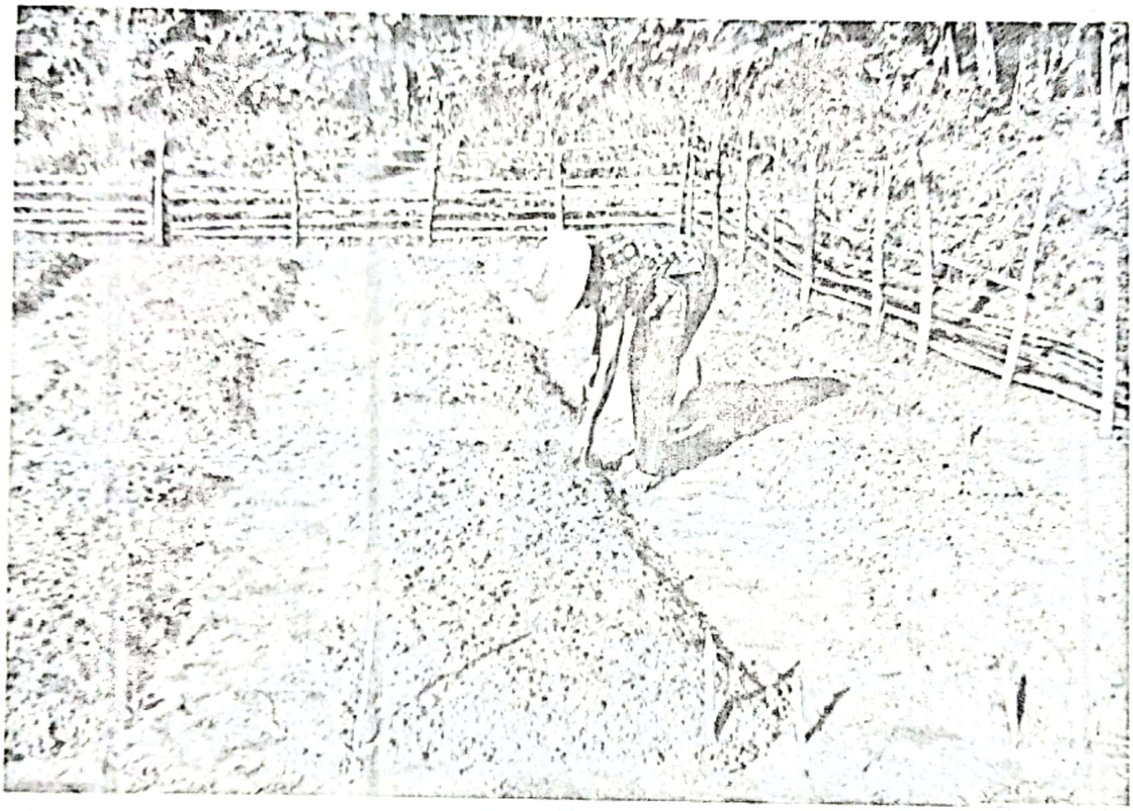
APPENDIX Q-1

(P i c t o r i a l)

Shown on this picture is the researcher working on the experimental lot. This was taken just after the plots were cultivated and ready for planting. A canal is being constructed for proper drainage.

APPENDIX Q-2

(P i c t o r i a l)



This picture shows the researcher planting the seeds of okra. Pegs seen on the picture played an important role during the initial stage of the experiment, for they were the guide in making the hills or plants in columns or in rows.

APPENDIX Q-3

(P i c t o r i a l)

The plants during the initial fruiting. Shown on the picture are the evaluators inspecting the pods of okra. From left to right are: Mr. Alejandro E. Cananua, Head Research Department and thesis adviser; Dr. Dominador Q. Cabanganan, Vice President and Dean of the Graduate Studies; the researcher; and Mr. Luisito M. Quitalig, MATVE Instructor and at the same time thesis consultant.

APPENDIX Q-4

(P i c t o r i a l)

The evaluators and the researcher herself pose in a very crowded place inside the experimental area. Plants in front of the group belong to the control group (treatment 3) or plants which did not have fertilizer. That is why, they are shorter and had smaller pods compared with those fertilized plants.

APPENDIX Q-5

(P i c t o r i a l)

The plants showing the full grown pods ready for harvest. As seen from the picture, pods and leaves are free from insects, pests and diseases.

CURRICULUM VITAE

NAME	:	THELMA CABADSAN-QUITALIG
ADDRESS	:	Guindapunan, Catbalogan, Samar
PLACE OF BIRTH	:	Wright, Samar
DATE OF BIRTH	:	October 12, 1958
PRESENT POSITION	:	Secondary School Teacher
STATION	:	Wright Community High School
CIVIL STATUS	:	Married

EDUCATIONAL BACKGROUND

Primary Education	- Catbalogan III, Elem. Sch. 1964-67
Intermediate Educ.	- Bunu-anan Elem. School 1967-1970
Secondary Education	- Samar Sch. of Arts & Trades, 1970-74
College Education (BSIE)	- Samar Sch. of Arts & Trades, 1974-78
Graduate	- Leyte Institute of Technology, 1979-82
	- Samar State Polytechnic College, 1982-1985

CIVIL SERVICE ELIGIBILITY

Career Sub-professional Exam. - November 11, 1977

Professional Board Exam. for Teachers - April 23, 1978

HONORS RECEIVED

First Honors . . . . Catb. III Elem. Sch., 1977

Salutatorian . . . . Bunu-anan Elem. Sch., 1970

With Honors (Subject Proficiency) - SSAT, 1977

SEMINARS AND WORKSHOP ATTENDED

Seminar Workshop on Special Education for Deviants (SPED)- Catbalogan, Samar, January 30-31, 1978

Regional Seminar-Workshop on Practical Arts Education in Secondary Schools - Catbalogan, Samar, August 20-23, 1979

Level 3 Mass Orientation of Secondary Officials and Teachers for Science and Mathematics - Catbalogan, Samar, March 5-9, 1979

Regional YCAP Seminar Workshop - Catbalogan, Samar, July 28-30, 1980

District Seminar-Workshop on Scouting - Wright, Samar, October 5-6, 1980

Gawaing-Kapulungan sa Pilipino sa Mabisang Pagpapahayag na idinaos sa Wright, Samar, Oktubre 13-15, 1982

Division Workshop on the Production of Low-Cost Teaching Devices in Population Education for Secondary Teachers - Catbalogan, Samar, November 3-5, 1982

Division Seminar On The Utilization of MECS Textbooks and Curriculum Frameworks - Catbalogan, Samar, November 12-17, 1984

District Re-Echo Seminar-Workshop on People's Forest and KSS Program Technologies - Wright, Samar, January 28-29, 1985

LITERARY ATTEMPTS PUBLISHED

Fairwell

It's Life

ARTICLES PUBLISHED

The Importance of BSIE

Community Survey - Credited as YCAP for Junior and Senior College Students (News Section)

CO-CURRICULAR ACTIVITIES

Secretary-Treasurer . . .	Cal-apog Youths Organization for Civic Action, Cal-apog, Catbalogan, Samar, 1970-1975
KB Comelec Chairman . . .	Bunu-anan Chapter, Bunu-anan, Catbalogan, Samar, 1974-1975
Public Information Officer . . .	Cal-apog Barangay Officials, Cal-apog, Catbalogan, Samar, 1974-1975
Secretary	BSIE Class Organization, SSAT, Catbalogan, Samar, 1974-1978
Chaperon Volleyball Girls	Samar Delegation, EVRAA Meet, Burauen, Leyte, SY 1982-1983
Secretary	SSPC Summer Student Council, 1983
Coach Volleyball Girls. .	WCHS Unit, District Meet, SY 1983-1984
Secretary-Treasurer . . .	Teachers Organization, Wright Community High School, Wright, Samar, 1983-1984
Board of Director	WCHS PTA, Wright, Samar, SY 1981-1982, 1982-1983, and 1983-1984
President	Several History Classes, Samar College, Catbalogan, Samar, 2nd Semester, 1983-1984
Treasurer	BSE Department, Samar College, Catbalogan, Samar, 1st Semester, 1984-1985

L I S T O F T A B L E S

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