COMPARATIVE AGRICULTURE RESEARCH PROJECT, 1985

by

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The Author

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ABSTRACT

The Accokeek Foundation has initiated a research project on Comparative Agriculture: an experiment designed to compare different farming systems ranging from biological (organic) systems to modern conventional systems with synthetic inputs. It will include both field and vegetable crops common to Southern Maryland and continue for a period of twelve years.

From the outset, the project has had two distinct categories: Field crops and Fresh Market Vegetable crops. The field crop study includes a spectrum of four farming systems, ranging in ecological soundness from continuous corn (T4) with high chemical inputs to a biological system (T3) with little or no synthetic chemical inputs. The latter is a two-year rotation, with legume grass meadows and winter legumes as a source of nitrogen and some tillage. The other two farming systems fall between these two. They allow for crop by crop comparisons three out of every four years and same crop comparisons every even numbered year.[1]

The vegetable crops study includes two farming systems and a no input system for control. The Biological system (BIOL) uses a legume winter cover crop as a source of nitrogen, and the Conventional Modern system (MAG) uses high synthetic inputs. The Control system (CON) utilizes no inputs save that which is provided naturally. All three utilize minimum tillage, and a three year rotation of three vegetable crops: sweet corn, tomatoes and muskmelons--all grown for fresh market.

Three sets of data have been measured and collected in 1985: crop and soil characteristics; weed, disease and insect data; and an economic analysis for each farming system. Since this is farming system research, no single factor is expected to be isolated from the study.[2] Therefore, no particular cause and effect relationship is anticipated in this first year of the study, nor is it included here.

A comparison of the field crop systems show that the Conventional plots performed best for both harvest and weed populations. The Biological soybeans had the largest weed population of all the field plots. No significant numbers of insects appeared in any of the sixteen field plots; therefore, no control measures were taken. The Continuous Corn and Biological soybeans could not be compared in this study because their harvested parts (dry corn and dry plant material) are very different from the dry soybeans.

The vegetable crop study showed that the farming systems gave a variable performance in each crop and system. The yields overall were highest in the Modern Agriculture plots. Weed control was best in the Modern Agriculture plots and poorest in the Control plots. Insect populations were lowest in the

Biological plots for all three crops. They were highest in the Modern Agriculture plots for tomatoes and the control plots for both the sweet corn and muskmelons.

INTRODUCTION

There are differences in opinion on what the basic assumptions associated with biological farming versus conventional, modern farming should be. For the purpose of this project we have defined biological farming as a crop management system that depends on a dynamic soil ecosystem, in which plant nutrients are derived from the topsoil and parent rock material.[3] Another definition is "organic farming is an agricultural technology which involves total elimination of the most damaging modern agricultural chemicals."[4]

On the other hand, the conventional modern system is one in which plant nutrients are derived from synthetic fertilizer as well as the removal of crop residues, repetitive crop production, and the use of pesticides.

One of the goals of state-of-the-art farming is to reduce the high input costs without sacrificing yields or quality of the crops.[5] One approach is to utilize a farming system which depends more on regenerative resources produced on site rather than purchased, manufactured, off-site resources.[6] This would be the ideal, because biological farming systems are in the minority of the farming styles that are operating in the United States. Studies of this type are needed to explore the avenues to future research. The greatest advances in agriculture in this century have centered on increases in farm production through studies that have utilized improved, high yielding, resistant hybrids coupled with the technology of modern agriculture. Similarly, an increase in the knowledge base on biological farming has the potential to lead to new research and new ideas for that research.[7]

The main objective of the Comparative Agriculture project is to demonstrate the comparative differences or similarities between a biological farming system and modern conventional farming systems. At present, we cannot predict what those qualities may be. The second objective is to provide a demonstration site, open to the public, where farmers and agriculture students and other visitors can observe the experiment in progress. The third objective is to make our findings available to the public through publication of the research results.

Our overall aim is to demonstrate that other system options are open to American farmers, and those presented are among the many choices available today. Our systems approach is representative of reasonable options for grain farmers and fresh market farmers in Southern Maryland and most of the mid-Atlantic seaboard.[8]

MATERIALS AND METHODS

Experimental Design

A twelve year study was initiated in 1985, and will continue through 1996 under the present long-range plans of the Accokeek Foundation. To show what the long term effects may be, the followiwng subjects will be addressed through intense study:

Program and Crop Management	Economics
Integrated Pest Management	Plant Nutrition

The two experiments are laid out in a completely randomized block design, see Figure l. The first subdivision is by crop type: 1)field crops, and 2) fresh market vegetables.

The field crop study design was formulated first, and the fresh market vegetable study design arose as an addendum to the original project.[9] Dr. Ray Weil, Associate Professor, Soil Fertility, University of Maryland, served as a field consultant, and set up the study design for the field crop experiment.

Mrs. Mary Ann Klein, Staff Horticulturist and Researcher, set up the study design for the vegetable crop experiment.

The field crop farming systems are as follows:

(T1) A no-till system with chemical inputs, 3 crop rotation over 2 years.

(T2) A conventional modern system with the use of synthetic chemicals and some tillage; 4 crop rotation, 2 years.

(T3) A biological system with legumes as a part of the rotation for nitrogen; some tillage.

(T4) Continuously tilled corn, a single crop, high chemical inputs.

Each plot is 35 x 100 feet. There are four repetitions of each system, sixteen total plots. The plot layout and rotation schedule for these is illustrated in Figure 2.

The fresh market vegetable experiment is laid out in a completely randomized block design with subplots of the three crops in each plot. The three systems were previously described: Biological (BIOL), Modern conventional (MAG), and Control (CON); see Figure 3. A rotation of crops in each subplot will proceed as follows:

1985	1986	1987	1988
Muskmelon	Sweet Corn	Tomatoes	Repeat 1985
Sweet Corn	Tomatoes	Muskmelons	" "
Tomatoes	Muskmelons	Sweet Corn	" "

Grassy buffer strips, 10 feet wide, between the plots control possible contamination by pesticides and fertilizer through drift and leaching. Grass roadways, 25 feet wide, along the field margins allow for easy access by vehicles and farm equipment. The buffer strips were seeded with a Kentucky fescue and were kept closely clipped to control weed growth.

Except for harvesting, and scouting for insect and disease pests, all operations utilized farm machinery.

Location and Climate

The Comparative Agriculture Research Project is located on an alluvial deposit of the Potomac river coastal plain on the National Colonial Farm in Accokeek, Maryland. The Farm is in Prince Georges county in Southern Maryland, approximately 20 miles south of Washington, D. C. The Potomac river lies about 100 feet from the north-west side of the research site, see Figure 1. The farm is situated on gradually sloping land surrounded by old and new forests and rural homesites kept in "scenic easements" for historic appearances' sake.

Southern Maryland has a fairly moderate and humid climate. The proximity to the Potomac river alters the weather only slightly if compared to weather data gathered by the United States Weather Service at Glendale Bell Station, Maryland.[10] The winter is usually short and very mild and the frost free days average 190 or more. The average annual temperature is 67.5 F., with temperature extremes of 5 F. to 95 F. over the year.

Precipitation averages 43.8 inches annually, and ranges from 2.75 inches to 4.91 inches monthly. Rainfall occurs fairly evenly throughout the year with significant increase in July and August. Snowfall averages about 20.4 inches annually.

Both 1983 and 1984 were dry years, and the trend continued in the summer months of 1985. By the end of September, 1985, there was a deficit of 10.87 inches of precipitation for the year. Spring-time temperatures averaged much above normal, and July, August, and September were slightly warmer than usual (see Table 1). Only October had above normal rainfall for the calendar year, 1985.

The research plot lies on a 7.2 acre field that was previously a lespedeza hay field with little chemical inputs in recent years. On the east lies a cornfield, and on the west lies a grove of 540 American chestnut trees. Neither of these two crop areas receives any chemical sprays as a part of their routine maintenance programs.

The soil is a Mattapex fine sandy loam. By field observation, Dr. Ray Weil confirmed the Mattapex fine sandy loam classification on October 16, 1984.[11] After the field was staked out into 16 field crop plots and 12 vegetable crop plots, soil cores were taken in each plot, and subsequently bulked, dried and sent to the soil testing laboratory at the University of Maryland at College Park.

Field Preparation and Planting

During the fall of 1984, both the vegetable and field test plots were seeded with a winter cover crop of rye. Soil samples were taken from the field test plots on December 14, 1984 and on March 21, 1985 from the vegetable crop plots. Summaries of the test results are shown in Tables 2 and 3.

Red clover was over seeded on 3/29/85 at the rate of 11.2 kg/ha (10 lb/a) on the T3 (biological) field plots.

The University of Maryland Soil Laboratory recommendations for fertilizer application were the basis for the amounts used on all the field crops, and on both the BIOL and MAG vegetable plots. No fertilizers or amendments were used on the CON. vegetable plots.

Table 4 lists the amounts and analysis of the fertilizers used on the vegetable plots. Table 5 lists the amounts and analysis of the fertilizers used on the field crops. Table 6 lists the amounts and types of herbicides used on the field crops.

Preparatory and planting operations continued with the sowing of seed and transplanting as follows:

Crop	Variety	Spacing Between Rows	Spacing In the Rows	Rate	Population
Field Corn	Medium Round Migrow	0.76m	21 cm	15 lb/a	25,375
Soybeans	Yellow Grain Type	0.76m	15 cm	60 lb/a	78,400
Tomatoes (TP)	Pik-Red	1.02m	1.02m	--	4,500
Muskmelon	Gold Star	1.02m	15 cm	3 lb/a	13,500
Sweet Corn	Silver Queen	0.76m	21 cm	12 lb/a	19,000

TP = Transplants

RESEARCH TOPICS

Program and Crop Management

Our approach to crop management has already been stated in the introductory section. To reiterate the objectives in general terms, we will approach this twelve year study with state-of-the-art resources.

Since this is a systems approach which covers a variety of crops, no direct parallels can be drawn between two crops, for example, field corn and soybeans. The cropping practices do have similarities, for example, a rye cover crop is used on all systems and crops and fertilization programs are the same where practical. Moreover, on systems where tillage is used, the frequency and type of tillage is the same.

Cultivation and Weed Survey

Cultivation was used in combination with herbicides for weed control on the continous field corn plots (T4) and the conventional soybean plots (T2). Herbicides alone were used on the no-till soybean plots (T1). Cultivation alone was used on the biological soybean plots (T3). (See Table 6).

In the fresh vegetable plots, Biological and Control. cultivation was used alone. Cultivation plus herbicide was used on the MAG plots (see Table 7 for the amounts and types of herbicide used).

A list of the weeds that were monitored in 1985 appears in Table 8, Common and Scientific Names of Common Weeds. In the text, the weeds are referred to by their common names.

Since this project was conducted on a former lespedeza hay field with a known weed-pest problem, a weed survey was completed on June 26 and 27, 1985. This was late enough in the season so that the cool season weeds were dormant. There was much variance over both the field and vegetable crop studies. See Tables 9 and 10 for the data from the weed surveys.

In the Vegetable Crop Weed Survey, Table 9, significant numbers of several weed species (40 or more in 20 row feet) were found in six of the BIOL vegetable plots, seven of the CON vegetable plots, and two of the MAG vegetable plots.

None of the perennial species occurred in significant numbers, however, the most common weed was pigweed, followed by Lamb's Quarters.

Also, in the field crop weed survey, significant numbers of several weed species were found in all four of the (T3) LG/BIOL, but not in the other system repetitions.

In the biological system, the only significant annual weed species was Queen Anne's Lace in one plot. Two perennial weed species were found: Bermuda grass and night shade. The most common weed was Bermuda grass followed by Queen Anne's Lace and Morning Glory. See Table 10 for specific information.

Cultivation and/or herbicide application ended by the first week of July at which time all the crops were putting on quick growth and their leaf canopies were quite large. More frequent cultivation may be needed on the biological plots on both projects to give weed control similar to that of plots on which herbicide was used.

Harvest and Yields

Fresh Vegetable Crops

The harvest of vegetable plots involved the use of a two person crew, hand picking each of the 36 plots, weighing on a spring type scale and recording the data for each plot. In each of the plots the central rows were harvested and the yields were expanded to the acre and hectare by U.S.D.A. approved conversion factors.[12] A complete analysis of the vegetable harvest is included in Table 11. This table also includes harvest dates, average yield/system and comparison yield figures from the Maryland Department of Agriculture Statistics for 1981 and 1982.

For comparative purposes the "Gold Star" Muskmelon yields were as follows:

MAG average = (90.40 cwt/a) 10,132 kg./ha.
BIOL average = (27.17 cwt/a) 3,046 kg./ha.
CON average = (46.05 cwt/a) 5,162 kg./ha.

Since these are non-irrigated fields, our yield goal was 115 cwt./acre.[13] Muskmelon yields were reduced due to the precipitation deficit during the months of June and July of 2.28 inches and 2.43 inches, respectively. Lack of moisture produced misformed fruits in all plots. These, we discarded as unsuitable for fresh market and are not a part of the yield. The harvest period for the muskmelons was August 20 through September 3, at which time there were no more fruits setting.

The Silver Queen sweet corn harvest period was August 20 through August 27. This short harvest window is typical for this variety because it quickly becomes mature especially during dry weather. [14] The sweet corn yields were as follows:

MAG average = (69.02 cwt/a) 7,735 kg./ha.
BIOL average = (43.56 cwt/a) 4,882 kg./ha.
CON average = (37.13 cwt/a) 4,161 kg./ha.

Our goal was 60 cwt/a [15] which was met on the MAG plots.

The Pik-Red tomato harvest proceeded from August 9 to August

27. Because July was a dry month, the fruits suffered from blossom end rot, a plant disease that is a moisture related problem.[16] Much of the early pickings were trashed. A survey for blossom end rot was done on August 1 and 2, see Table 12. In all the plots, the damage was restricted to the first blossom cluster. During the harvest, no further problems with blossom end rot occurred.

The tomato yields were as follows:

MAG average (76.82 cwt/a) 6,591 kg./ha.
BIOL average (18.99 cwt/a) 2,128 kg./ha.
CON average (23.97 cwt/a) 2,687 kg./ha.

Our yield goal was 95 cwt./acre. Some fruits were damaged by cracking during the August rains. The harvest on August 20 was the most affected, due to the rainstorm on August 18 and 19.

Weeds were a major problem in the tomato sub-plots. The late season weeds were as tall as the plants by mid-harvest. Ragweed and Jimson weed were the most prevalent pests.

Field Crops

The harvest of the field crops took place over an extended period. The first crop to be harvested was the biological legume-meadow crop (T3) on September 6, 1985. This crop was to be measured for hay. These four repetitions were cut at the soil level and windrowed for drying that same day. Unfortunately, the following Sunday, a three day rainstorm ensued and we lost the crop entirely.

The field corn was harvested on October 14, 1985. Two central rows were picked by hand in each of the 4 plots. On October 22 the field corn was shelled from the ears. The yields are reported in Table 13 along with the other field crops. Maryland grain farmers average yield is 6,725 kg./ha. (100 bu./a) Our yield average was 4,598 kg./ha. (68.37 bu./a) in the four replications. Some problems were encountered due to early season deer grazing and late season crow damage.

The soybeans in the T1/NT and the T2/CONV plots were harvested on October 24 and 25. Our goal was 27.83 bushels per acre, the state average. The soybeans were windrowed for about a week and later bundled, labeled and subsequently brought indoors. An electric-powered threshing machine was used to remove the grain from the pods. The yields are listed in Table 13.

The average yields for the soybean plots were:

T1/NT = 1052.75 kg./ha. (939.29 lb/a) (15.65 bu./a)
T2/CONV = 1050.14 kg./ha. (936.96 lb/a) (15.62 bu./a)

Plant damage was limited to early season deer grazing and insects.

Soil Fertility and Plant Nutrition

In order to gather meaningful data related to plant nutrient uptake efficiency, tissue samples were taken on July 26 on all 28 tests plots. Tissue samples were taken to the University of Maryland tissue lab for analysis. Tables 14 and 15 summarize the findings. By comparing the nutrient uptake to soil depletion levels from the soil tests done in February, 1986, (see Table 16 and 17) one may observe whether nutrients were available to the plants and if the crop, indeed, utilized the nutrient in its growth.

The organic matter level of all the plots was low, but consistent. It ranged from 1.3% to 1.6% on the average of each system. See Tables 2, 3, 16 and 17.

Because Nitrogen, Phosphorous and Potassium are the macronutrients of all plants, they will be addressed in each crop system under this section. Both Calcium and Magnesium uptake were high in the field and vegetable crops systems. In all plots, the soil analyses showed these nutrients tested at high levels overall. The pH of the test plots is consistent throughout, ranging from 5.8 to 7.1 at the extremes, but averaging at 6.4 to 6.5 for the systems. This is a well balanced pH level for crop production.

Field Crops

Continuous Corn (T4)

The corn leaf tissue samples were composed of twenty full ear leaves, taken from each plot. These, taken on July 26 when the corn was beginning to tassel and show silk, revealed that the uptake of Nitrogen was approximately 33% below the minimum level for sufficiency in corn (see Table 14). Phosphate and Potash uptake was 47% and 24% below minimum, respectively. Corn is known to be a heavy feeder and the Nitrate levels from the 1986 soil tests shows a very low Nitrate content compared to the other field crop systems (see Table 16). The soil samples were taken before fertilizer was applied for the 1986 season. The Phosphate content on the T4 plots in 1986 was 12 lbs/acre higher than in 1985. Therefore, the total Phosphate content of the soil is high enough, but it may exist in an unavailable form.

July, 1985 was a very dry and hot month, therefore, normal photosynthesis and Nitrogen uptake may have been suppressed since photosynthetic activity in plants shuts down when temperatures are above the range of 30 to 40 C.[17] Moreover, the heat of drought inactivates the enzymes which convert the Nitrates from the soil into other plant compounds containing Nitrogen. In the process, some of this can be lost as free Nitrogen gas.[18]

Soybeans No-Till (T1)

Of the three soybean experiments for 1985, the No-Till Soybeans performed best on the tissue analysis tests. (see Table 14). In all three soybean systems 40 mature, tri-foliate leaves were taken from each plot as samples. They were well above sufficiency levels for Nitrogen, Phosphorous, and Potash. The No-Till plots also enjoyed the highest yields at 939.29 lb/a. The No-Till soybeans were the largest statured plants throughout the growing season.

Conventional Soybeans (T2)

In the tissue analysis tests, the T2 soybeans were below sufficiency levels on Nitrogen by 4%, and Potash by 12%. From the soil tests taken in early 1986, Table 16, the Nitrate content of the CONV plots average was 19.7 lb/a vs. 17.8 lb/a in the No-Till plots. It is not apparent why the T2 soybean plants were not as efficient in their Nitrogen uptake as the No-Till crops.

Biological Legume (Soybeans) (T3)

The tissue analysis on this system revealed that Nitrogen, Phosphorous and Potassium were below sufficiency levels by 5, 4, and 9 %, respectively.

No nitrate fertilizer was added to the T3 plot soil in 1985. From the analysis in Table 18, it is apparent that the leaf tissue nitrogen level of 4.3% of the T3 soybeans is comparable to the T2 soybeans level of 4.35%. However, the T3 system had 14.8 lbs. of soil nitrates per acre in the pre-season soil test. Moreover, since no nitrate was added in 1985, this is a gain of 5.05 lb/a. However, both the Conventional and No-Till systems suffered nitrate losses of 19.45 and 20.3 lb/a, respectively. It would be well to document and analyze this in the future when the plots are again in soybeans.

Fresh Market Vegetable Crops

We combined the four repetitions of each system for the leaf tissue samples, so that each crop and system were represented. Forty separate, mature leaves of both the tomato and muskmelons were taken and combined as samples, as were the ear-leaves of the sweet corn. In all, twelve samples were sent to the University of Maryland laboratory for dry weight analysis. Table 15 gives a complete qualitative analysis of the tissue samples.

Ear-leaves of at least 20 inches in length were gathered from the sweet corn. The muskemlons were in the fruiting and blossoming stage of growth, and secondary vines were well developed at the main stem nodes. The tomatoes were in the fruiting and blossoming stage also, and were trailing onto the ground.

The Boron levels in all the vegetable plots were significantly depleted during the 1985 growing season. This depletion varied from a loss of 0.55 lb/a for BIOL to 0.41 lb/a for CON. See Tables 3 and 17. Boron should be included routinely as a soil ammendment with vegetable production in Maryland.[19] The recommendation for vegetable crops is to bring the Boron level to 2 lb/a.[20]

The greatest tissue uptake deficiency for the tomatoes was Phosphorous--range 72% below minimum for CON and 64% below for MAG. Sufficiency levels are listed in Table 15.

The sweet corn showed mixed results in the tissue uptake analysis. For Nitrogen, it ranged from 19% below minimum for CON to 15% above minimum for the MAG plots.

Along with tomatoes, muskmelons need high levels of Phosphorous. The tissue uptake analysis showed a range of 32% below minimum for CON to 20% below for MAG.

Table 19 shows the Nitrate efficiency of the vegetable plots. The Nitrogen uptake in the muskmelon leaf samples was consistently high in all three systems. Both the BIOL and CON soils at pre-season, 1986 were much higher in Nitrate content than were the MAG soils. Further testing is needed to draw any conclusions from the data presented so far.

<u>Integrated Pest Management</u>

Integrated Pest Management is used in this context to mean that necessary controls are applied "to shift with the balance of nature those elements that may have an adverse impact to man to one that favors him while minimizing any effects on the ecological system."[21] This is a broad, general definition which encompasses the control of disease, weed, and insect pests. In some cases, it may include factors of the environment that may easily be corrected; for example, water-related induced plant injury which may be corrected by irrigation. On the other hand, some environmental problems such as acid rain damage are beyond the scope of this report.

In order to collect data for the Comparative Agriculture Project several surveys were conducted over the growing season. These were directed to insect pest population rises and remissions, a mid-season weed survey, and the water related effects on the tomatoes.

Early in the growing season, we experienced damage from deer and rodents, but no actual surveys were tallied on these minor pests. We used a biological form of control to deter deer: human hair bundles in nylon net and fashioned into "hobo bags", and attached to the stakes marking the perimeter of the project.

Insect Pest Surveys

A list of the insects that were monitored in 1985, appears in Table 20, Common and Scientific Names of Insect Pests and Their Host Crops. In the text, the insects are referred to by their common names.

Tomatoes

Insect scouting for the Colorado Potato beetle on Tomatoes began on June 11, two weeks after transplanting. Economic threshold levels were not reached until June 17 when three BIOL, three MAG, and three CON plots exceeded twenty adult beetles or large larvae on ten plants/plot. The highest large larvae counts were found on June 17 as follows: 32 large larvae in plot 2 (MAG), and 23 in plot 3 (CON). After spraying Rotenone on June 18, the scouting thereafter revealed low population levels on both the BIOL and MAG plots. We observed two broods of Colorado Potato beetles during the growing season, but threshhold levels were never achieved after the first hatch-out. Populations of Colorado Potato beetles were also low on the control plots on July 17, when the last scouting survey on tomatoes was conducted (see Table 21).

Sweet Corn

Scouting for insect pests began in the sweet corn plots on July 22, when data was collected for European Corn Borers (see Table 22). The plants were then in the "knee-high" stage. Some damage from European Corn Borers was apparent, but the population counts were low and leaf area chewing was less than 1% in all the plots. No sprays were needed on any of the plots.

At the time of silking and tasseling, about August 5, 1986 Japanese beetles, Dusky Sap beetles and Green Stink Bugs were the only apparent insects found in the sweet corn plots. No significant damage resulted, and no corrective action was necessary.

Corn Root Worm scouting was conducted on September 3, 1986, approximately two weeks after the last harvest. University of Maryland guidelines state that the procedure is to survey adjacent plants in two rows in the center of the field. No Corn Root Worm adults were sighted in any of the fresh market sweet corn plots. Therefore, no corrective action was needed in 1985.

Muskmelons

The only insect pests of any significance during the 1985 season were Striped and Spotted Cucumber beetles. Scouting began on July 11 and 12 when the vines were in the 7 to 8 leaf node stage (see Table 23). Threshhold levels were reached by July 23, at which time the BIOL and MAG plots were sprayed with Rotenone liquid (82 fl. oz./a) and Sevin 80S (1.25 lb/a), respectively.

Cucumber beetles carry serious disease pests with them, so scouting and control of these insects populations are the first line of defense against the extremely destructive disease, bacterial wilt of cucurbits.[22]

Field Corn

On June 20, the scouting survey for the European Corn Borer was conducted on all the Field Corn plots. We used the guidelines provided by the University of Maryland Integrated Pest Managment Newsletter, 1985. The populations of this pest were very low and never caused enough injury to require a whorl treatment of spray. Later sprays are usually not effective because the insects are well inside the corn stalks where a treatment spray could not penetrate easily. See Table 24 for the survey results.

No other insect pest surveys were conducted on the field corn because a visual assessment of corn pests revealed that populations of Flea Beetles and Cut Worms were low overall. Due to the fact this is a new tillage area, this situation could change in future years. In 1986, for example, all the field test plots will be in field corn, so population levels of insect pests in all corn plots could increase. A more complete corn pest study is therefore being planned for 1986.

Soybeans

The soybeans were scouted on July 30, 1986 when they were in the range of the late vegetative to early flowering stage of growth. The pest population levels did not approach the lowest threshhold level for soybean leaf defoliation. Therefore, no sprays were applied during the 1986 growing season. Again, we believe this was due to the newness of the plantings and the scouting should proceed with great care in future years.

Disease Surveys

Our treatment of diseases with the Comparative Agriculture project was a "wait-and-see-what-happens" approach. This is not to say there was no concern, but since highly disease resistant, varieties were chosen, no great problems with diseases were expected.

We did experience drought stress with tomatoes (blossom-end rot) and poorly developed fruit on the muskmelons.

The tomato blossom-end rot resulted in loss of the fruits on the first blossom cluster. Rains followed closely behind this loss, and none of the later crop suffered from this disease (see Table 12).

The muskmelon fruit set was poor during mid-late July, but after the rains of late July, the fruit set improved as did the fruit quality. No bacterial wilt problems became apparent because the insect populations of the Striped and Spotted Cucumber Beetles was held under control by the spraying done on July 24th. No fungal diseases were present but it would be well to keep a close watch for powdery mildew and gummy stem blight, in addition to good periodic surveys for Striped and Spotted Cucumber Beetles in future years to keep these diseases in check.

Weeds

The weed survey was previously included in the cultivation section. Let me restate here, the importance of cultivation as a good crop management practice. Both diseases and insect pests will increase with the rises in weed populations. Closer timing of regular cultivations before the crop plants reach a size where cultivation is impossible is a recommended future practice.

Economic Analysis

Tables 25 and 26 cover the cost analysis of the two crop systems studies. See Tables 11 and 13 for a yield comparison versus the cost per acre by system in the Economic Analysis Tables.

RESULTS AND DISCUSSION

Because this was the initial year of the project study, the harvests may not have been what they might be in future years. As the staff becomes more familiar with the study and the crops grown, results should become more favorable.

Cultivation practices were similar in both the field and vegetable plots and their respective systems. The exception was the no-till field crop systems (T1) in which herbicide was used instead of cultivation.

Pre-emergence herbicides were used to control weeds on the MAG vegetable plots of tomatoes, sweet corn and muskmelons. Pre-emergence herbicides were used on the field crop plots, CONV (T2) and CT/CORN (T4), whereas, pre-emergence plus post-emergence herbicides were applied to the No-till(T1) plots.

In the vegetable plots, weed control was best in the sweet corn MAG plots. The most difficult weed to control with herbicide was pigweed followed by morning glory. Pigweed was the most prevalent species in the BIOL and CON plots followed by Lamb's quarters.

In the field plots, weed control was best in the CONV soybeans (T2) followed by No-till (T1) and CT/CORN (T4). Morning glory and night shade were the most difficult weeds to control by herbicide. Of these, the Biological plots had the greatest number of weeds, with Bermuda grass and Queen Anne's lace as the most prevalent species.

The best yields for the vegetable plots occured in the MAG system. They were muskmelon, 90.40 cwt/acre or 79% of goal; sweet corn, 69.02 cwt/acre or 115% of goal; and tomatoes 76.82 cwt/acre or 81% of goal.

The field crops had yields of CT/CORN (T4), 68.37 bu/acre, or 68.4% of goal; SB/NT (T1), 15.65 bu/acre, or 56.2% of goal; SB/CONV (T2), 15.62 bu/acre, or 56.1% of goal.

In the vegetable plots the fertilizer treatments were very different between the MAG and BIOL plots. This was true in the field crop systems also when BIOL (T3) is compared to no till (T1) and CONV (T2). The No-till and CONV received the same fertilizer treatment.

Plant nutrition was assayed by using dry leaf tissue analysis on all the crops. In the field crops, the field corn showed the most deficiency of the macro-nutrients: Nitrogen, Phosphorous and Potash. The No-till soybeans (T1) faired best of the three soybean systems on this test. The conventional soybeans (T2) were next, and were followed by the BIOL soybeans (T3).

In both field and vegetable crop systems Calcium and Magnesium uptake levels were adequate.

In the leaf tissue analysis for the vegetable crops, the results were quite variable. Tomatoes were deficient in their uptake of Nitrogen, Phosphorous and Potash in all three systems. Sweet corn was deficient in Nitrogen uptake in all three systems, but ony CON was deficient in Phosphorous and Potash uptake. Muskmelons performed best overall, but show deficiency in Phosphorous uptake in all three systems.

Boron tested low in all vegetable systems and all three field crops in the 1985 and 1986 soil analyses.

Integrated Pest Management included surveys for both insects and disease in both the field and vegetable crop systems.

Significant pest levels occurred in both the tomatoes and muskmelon plots. Colorado Potato Beetles on tomatoes rose to above threshhold levels in three out of four plots for each representative systems. Subsequent sprays brought these under control in the BIOL and MAG plots.

Striped and Spotted Cucumber Beetles on muskmelons rose to above threshhold levels in all four repetitions of each system. Follow up sprays achieved good control in the BIOL and MAG plots, thereafter.

There were no significant insects in the sweet corn plots and no sprays were used.

The field corn plots were surveyed for early season corn pests. European Corn Borers were found on all four repetitions, but never achieved threshhold levels. No sprays were used.

The three systems of soybeans were surveyed for Mexican Bean Beetles, Bean Leaf Beetles Green Clover Worms and Spider Mites. In all systems and repetitions, the population levels remained below threshhold. No sprays were used.

Disease problems were limited to drought stress on the tomatoes and muskmelons. Late summer rains helped on the fruit quality of both crops. No diseases were apparent in the field crops.

An Economic Analysis of the field crops showed that the continuous corn (T4) was the most costly to produce per acre $136.13; followed by No-till soybeans (T1), $80.99; Conventional Soybeans (T2), $61.65; and Biological Soybeans, $46.25.

In the vegetable crop systems the BIOL was more expensive to produce overall. Muskmelons led the list in expenses with BIOL at $496.53/acre and MAG $473.65/acre. Tomatoes were second with BIOL at $247.77/acre and MAG, $166.62/acre. Sweet corn was least expensive with BIOL, $231.35/acre and MAG, $166.26/acre.

In the fall of 1985, both the BIOL vegetable plots and the BIOL (T3) field plots were sown with red clover at the rate of 10 lb./a. On subsequent observations, no stand of clover was ever sighted on any of these test plots. Germination may have been surpressed by cold temperatures.

RECOMMENDATIONS

The Comparative Agriculture Research Project of 1985 indicated that several revisions in our practices may be helpful toward improved results in subsequent years.

To improve the fertilization program, utilize Fish Emulsion plus Sea Weed Extract on all the BIOL plots, both field crops and vegetable crops. This should lessen the costliness of the BIOL vegetable crop systems and improve the nutrition of the BIOL field crops.

To improve weed control, greater attention to cultivation is needed. Careful selection and application of herbicides in the conventional plots should continue. The weed survey could be expanded to early, mid and late season species to better understand the experiment as an on going eco-system and each plot as a sub-system of the whole.

To provide effective control of pigweed, morning glory and nightshade, careful selection of herbicide and timeliness of its application should be utilized. Newer, more recently certified herbicides may prove beneficial on those plots where they may be used.

The initiation of IMP management tools, namely, a Black Light Trap and an Pheromone Trap would be useful. Both of these are available from the IPM office at the University of Maryland, College Park. Survey results on these can indicate population outbreaks on field corn and sweet corn, before the pests reach damaging levels. Better timing of pest scouting and sprays are the benefits to be derived.

The Economic Analysis of the field crops revealed there should be no changes, except for herbicides. The Economic Analysis of the vegetable crops showed that a large portion of the cost/acre was due to expensive seed and fertilizer. Another variety of muskmelon should be selected because the seed is too costly. The change to Fish Emulsion plus Sea Weed extract fertilizers on all the BIOL plots should bring down production costs in these systems.

A more permanent system of marking the plots with a color coded accessory added to identify each system would be beneficial.

T A B L E S

Table 1.--Comparative Weather Conditions, 1985[1,2]
National Colonial Farm and Glendale Bell Station

	Max. °F.	Min. °F.	Mean °F.	Precip. Total, in.
January[3]				
NCF	40.11	25.1	32.6	2.36
Glendale Bell	44.0	22.4	33.2	3.06
Departure	(-3.9)	2.7	0.60	(-.70)
February				
NCF	48.39	30.07	39.23	3.33
Glendale Bell	47.1	23.8	35.4	2.75
Departure	1.29	7.56	3.83	(-.58)
March				
NCF	58.77	39.07	48.92	1.90
Glendale Bell	56.6	31.1	43.9	3.70
Departure	2.17	7.97	5.02	(-1.80)
April				
NCF	75.0	49.70	62.35	0.31
Glendale Bell	68.2	40.3	54.2	3.52
Departure	6.8	9.4	8.15	(-3.21)
May				
NCF	79.0	58.96	68.98	3.025
Glendale Bell	76.9	49.9	63.4	3.94
Departure	2.1	9.06	5.58	(-0.92)
June				
NCF	83.86	64.36	74.11	1.59
Glendale Bell	84.2	58.2	71.2	3.87
Departure	(-0.34)	6.16	2.91	(-2.28)
July				
NCF	86.67	69.61	78.29	1.88
Glendale Bell	88.1	62.9	75.6	4.31
Departure	(-1.43)	6.71	2.7	(-2.43)
August				
NCF	85.51	68.12	76.81	3.065
Glendale Bell	86.9	62.1	74.5	4.91
Departure	(-3.82)	6.02	2.32	(-1.845)

	Max. °F.	Min. °F.	Mean °F.	Precip. Total, in.
September				
NCF, 1985	81.17	62.87	72.02	2.53
Glendale Bell	80.9	55.1	68.0	3.66
Departure	0.2	8.04	4.02	(-1.13)
October				
NCF	70.0	53.0	61.5	4.51
Glendale Bell	70.1	43.0	56.6	3.30
Departure	0.10	10.0	4.90	1.21
November				
NCF	63.43	48.50	55.96	3.30
Glendale Bell	58.4	34.1	46.3	3.34
Departure	5.03	14.4	9.66	(-0.04)
December				
NCF	54.30	34.07	44.18	3.47
Glendale Bell	47.3	25.9	36.7	3.39
Departure	7.0	8.17	7.4	0.08
Annual totals				
NCF	68.85	50.29	59.57	32.88
Glendale Bell	67.4	42.4	54.9	43.75
Departure	1.45	7.89	4.67	(-10.87)

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[1] Source: "Climatography of the United States No. 81 (By State) Monthly Normals of Temperature, Precipitation and Heating and Cooling Degree Days, 1951-80."

[2] Soil Survey, Prince Georges County, Maryland, April, 1967, p. 3, 4. Precipitation records for period 1945-60.

[3] January through April precipitation figures U.S. Weather Service, Glendale Bell Station, direct communication, 1/27/86.

Table 2.--Soil Analysis Field Crops, 1985

Plot ID and Crop/Farming System

Chemical Analysis	IT1 SB/CONV	IIT1 SB/CONV	IIIT1 SB/CONV	IVT1 SB/CONV	T1 AVE. SB/CONV
pH	6.4	6.5	6.3	6.4	6.4
Magnesium	238	278	254	264	258.5
Phosphate	25	31	22	23	25.25
Potash	84	97	73	117	92.75
Boron	1.45	1.51	1.35	1.11	1.355
Calcium	1200	1280	880	1000	1090
Cation Exchange Capacity (meq.)	5.5	5.8	4.7	5.1	5.27
Copper	0.9	0.9	0.8	0.7	0.825
Magnanese	23	28	27	34	28
Nitrates	12	6	11	12	10.25
Organic Matter (%)	1.5	1.5	1.2	1.5	1.425
Sol. Salts (ppm.)	119	119	119	119	119
Zinc	2.0	1.85	1.8	2.2	1.95

	IT2 SB/CONV	IIT2 SB/CONV	IIIT2 SB/CONV	IVT2 SB/CONV	T2 AVE SB/CON
pH	6.3	6.5	6.1	6.3	6.3
Magnesium	269	300	228	224	255.25
Phosphate	30	30	29	22	27.75
Potash	85	120	87	85	94.25
Boron	1.25	1.45	1.57	1.18	1.365
Calcium	1100	1260	760	820	985
Cation Exchange Capacity (meq.)	5.4	6.2	4.5	4.4	5.125
Copper	0.9	1.0	0.8	0.7	0.85
Manganese	21	28	26	31	26.5
Nitrates	12	15	17	8	13
Organic Matter (%)	1.6	1.6	1.4	1.5	1.525
Sol. Salts (ppm.)	119	119	119	119	119
Zinc	1.6	2.0	2.0	2.0	1.9

	IT3 LG/BIOL	IIT3 LG/BIOL	IIIT3 LG/BIOL	IVT3 LG/BIOL	T3 AV LG/BIOL
pH	6.6	6.3	6.5	6.2	6.4
Magnesium	244	262	275	238	254.75
Phosphate	22	25	48	30	31.25
Potash	96	97	137	99	107.25
Boron	1.35	1.51	1.45	0.82	1.28
Calcium	1160	920	1500	900	1120
C.E.C. meq.	5.1	5.	1500	4.9	54.25
Copper	0.8	1.0	0.8	0.8	0.85
Manganese	19	27	30	30	26.5
Nitrates	1.0	9	13	7	9.75
Organic matter (%)	1.3	1.8	1.5	1.5	1.52
Sol. Salts (ppm.)	119	119	119	119	119
Zinc	1.3	2.0	2.2	1.8	1.825

	IT4 CORN/CT	IIT4 CORN/CT	IIIT4 CORN/CT	IVT4 CORN/CT	T4 AVE CORN/C
PH	6.6	6.4	6.4	6.4	6.45
Magnesium	275	246	250	236	251.75
Phosphate	38	34	23	35	32.5
Potash	85	108	109	105	101.75
Boron	1.45	1.25	1.51	0.93	1.28
Calcium	1400	1240	920	920	1120
C.E.C. meq.	6.1	5.8	4.7	4.8	5.35
Copper	0.8	1.0	1.0	0.8	0.9
Manganese	23	28	31	7	12.5
Nitrates	10	13	20	7	12.5
Organic Matter (%)	1.5	1.7	1.2	1.8	1.55
Sol. Salts (ppm)	119	119	119	119	119
Zinc	1.6	2.1	1.6	2.0	1.82

Table 3.--Soil Analysis, Fresh Vegetables, 1985*

Chemical Analysis	A1 VEG/BIOL	A5 VEG/BIOL	A9 VEG/BIOL	A12 VEG/BIOL	AVERAGE BIOL
pH	6.7	6.6	6.8	6.5	6.65
Magnesium	300	300	300	282	295.5
Phosphate	38	52	77	44	52.75
Potash,	114	92	136	104	111.5
Boron	1.40	1.11	1.45	1.18	1.28
Calcium	1380	1500	1780	1080	1435
Nitrates	8	4	6	6	6

	A2 VEG/MAG	A6 VEG/MAG	A8 VEG/MAG	A11 VEG/BIOL	AVERAGE MAG
pH	6.8	6.5	7.1	6.4	6.7
Magnesium	291	300	300	280	292.75
Phosphate	38	44	113	37	58
Potash	129	99	165	118	127.75
Boron	1.35	1.11	1.40	1.25	1.27
Calcium	1300	1360	1940	1080	1420
Nitrates	25	10	6	2	10.7

	A3 VEG/CON	A4 VEG/CON	A7 VEG/CON	A10 VEG/CON	AVERAGE CON
PH	6.7	6.8	6.8	6.4	6.67
Magnesium	300	300	300	297	299.25
Phosphate	41	43	49	37	42.5
Potash	119	137	116	118	122.5
Boron	1.30	1.18	1.18	1.25	1.22
Calcium	1320	1380	1640	1280	1405.0
Nitrates	8	5	2	4	4.75

* Each plot contained all three vegetable crops: tomatoes, sweet corn, and muskmelon

Table 4. -- Fertilizer Applied To The Vegetable Plots On May 27, 1985, (by weight unless otherwise stated)

Vegetable	System	N-P-K Percent	kg/ha	lb/a
Sweet Corn	MAG	0-40- 5	454	405
" "	"	0- 0-50	258	230
" "	"	34- 0- 0	436	390
Tomatoes	MAG	10-20-20	1515	1351
Muskmelon	MAG	9-40- 5	568	508
"	"	0- 0-50	398	355
"	"	34- 0- 0	312	313
Sweet Corn	BIOL	0-20- 0	1818	1622
" "	"	2- 1- 1*	1515	1351
" "	"		374 l/ha	40 gal/a
Tomatoes	BIOL	0-20- 0	1818	1622
"	"	2- 1- 1	1515	1351
"	"		374 l/ha	40 gal/a
Muskmelon	BIOL	0-20- 0	1818	1622
"	"	2- 1- 1	1515	1351
			374 l/ha	40 gal/a

* Low analysis fertilizer of the organic type usually performs like a high analysis chemical fertilizer. Source: _Necessary Trading Co. Catalog_, 1984, p. 24.

Table 5.--Fertilizer Applied To The Field Crop Plots

Date	Crop	System	N-P-K lb/a	kg/ha	lb/a
6/4	Soybeans	T1	27-120-60	232	207
"	"	T2	27-120-60	232	207
"	"	T3	0-80-0	89.7	80
5/7	Field corn	T4	129-120-65	349.16	314

Table 6.--Herbicide Applied to the Field Crop Plots
On May 10, 1985
By Volume or Weight

Crop	System	Chemical(s)	Per hectare	Per Acre
Soy beans	T1	Dual 8E	2.34 l.	2 pt.
		Lexone	1.12 kg.	1 lb.
		Roundup	234 l.	2 pt.
Soybeans	T2	Dual 8E	2.34 l.	2 pt.
		Lexone	1.12 k.	1 lb.
Soybeans	T3	n/a	--	--
Field Corn	T4	Dual 8E	2.92 l.	2.5 pt.
		Aatrex	2.92 l.	2.5 pt.

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n/a = not applied

Table 7.--Herbicide Applied To The
Modern Agriculture Vegetable Plots

Vegetable	Herbicide	Amount/Acre
Sweet Corn	Dual 8E	3 pt.
Sweet Corn	Aatrex	1.25 pt.
Tomatoes	Enide 90 WP	6.67 lb.
Muskmelon	Prefar 4 EC	1.5 gal.

Table 8. -- Common and Scientific Names of Common Weeds, 1985

Common Name	Scientific Name
Bermuda Grass	Cynondon dactylon
Lamb's Quarters	Chenopodium album
Morning Glory	Ipomoea spp.
Nightshade	Solanum carolinense
Pigweed	Amaranthus retroflexus
Plantain	Plantago spp.
Queen Anne's Lace	Daucus carota L. Subsp. carota
Smart weed	Polygonum pensylvanicum
Trumpet vine	Campsis radicans
Witch Grass	Panicum dichotomiflorum

Table 9.--Weed Survey, Vegetable Crops, 1985
(Number of Weeds in 20 row feet)

Crop and Weeds	Plot ID/ System			
	A1/BIOL.	A5/BIOL.	A9/BIOL.	A12/BIOL.
Muskmelons				
Bermuda Grass	1	18	15	4
Lambs Quarters	82 (1)	17	7	7
Morning Glory	2	22	5	3
Nightshade	2	1	3	-
Pigweed	19	61	19	4
Plantain	-	-	-	1
Queen Anne's Lace	6	2	5	13
Smartweed	-	-	-	192
Trumpetvine	1	1	-	-
Witch Grass	-	-	-	1
Sweet Corn				
Bermuda Grass	6	6	18	6
Lambs Quarter	4	4	22	11
Morning Glory	5	16	-	5
Night Shade	2	1	-	-
Pigweed	4	101	15	1
Queen Anne's Lace	1	2	2	12
Trumpet Vine	3	-	3	6
Tomatoes				
Bermuda Grass	19	10	34	2
Lambs Quarters	7	13	29	11
Morning Glory	6	17	1	-
Night Shade	1	2	4	-
Pigweed	17	82	44	1
Queen Anne's Lace	4	4	17	15
Trumpet Vine	6	4	-	5
Witch Grass	-	-	3	-

(1) The underlined data entries represent significant weed species levels as noted in the text.

Crop and Weeds	A3/CON	A4/CON	A7/CON	A10/CON
Muskmelons				
Bermuda Grass	4	6	-	18
Lamb's Quarters	10	9	-	16
Morning Glory	9	18	11	1
Night Shade	-	2	1	-
Pigweed	8	13	40	3
Plantain	-	-	-	-
Queen Anne's Lace	-	-	3	1
Trumpet Vine	3	3	-	1
Misc. Others	-	-	-	-
Sweet Corn				
Bermuda Grass	12	-	1	28
Lamb's Quarters	2	-	3	-
Morning Glory	8	8	3	3
Night Shade	-	-	-	-
Pigweed	6	13	46	2
Plantain	-	-	-	-
Queen Anne's Lace	-	1	-	7
Trumpet Vine	-	3	-	4
Witch Grass	-	-	-	2
Misc. Others	-	-	-	-
Tomatoes				
Bermuda Grass	9	13	24	11
Lamb's Quarters	9	6	5	28
Morning Glory	11	7	7	5
Night Shade	-	3	1	1
Pigweed	42	73	114	32
Plantain	-	-	-	-
Queen Anne's Lace	2	6	8	16
Smartweed	-	-	-	(*)
Trumpet Vine	4	1	-	6
Misc. Others	-	-	-	1

(*) Too Large To Count.

Crop and Weeds	A1/MAG	A5/MAG	A9/MAG	A12/MAG
Muskmelons				
Bermuda Grass	-	1	2	-
Lambs Quarters	6	-	4	-
Morning Glory	10	13	5	7
Night Shade	-	4	-	6
Pigweed	4	47	22	-
Plantain	-	-	-	-
Queen Anne's Lace	5	7	1	5
Trumpet Vine	8	-	2	1
Misc. Others	-	-	-	-
Sweet Corn				
Bermuda Grass	-	-	5	2
Lambs Quarters	-	-	-	-
Morning Glory	-	1	-	-
Night Shade	-	2	1	4
Pigweed	-	-	-	-
Plantain	-	-	-	-
Queen Anne's Lace	-	-	-	-
Trumpet Vine	2	-	2	5
Misc. Others	-	-	-	-
Tomatoes				
Bermuda Grass	5	4	-	6
Lambs Quarters	-	3	-	9
Morning Glory	9	18	8	7
Night Shade	2	4	1	-
Pigweed	3	40	-	-
Plantain	-	-	-	-
Queen Anne's Lace	2	8	7	8
Trumpet Vine	1	1	1	1
Misc. Others	-	-	-	1

Table 10.-- Weed Survey, Field Crops, 1985
(number of weeds in 20 row feet)

Plot ID and Crop/System	Bermuda Grass	Lamb's Quarters	Morning Glory	Night Shade	Pig Weed	Queen Anne's Lace	Other Weeds	Tot Wee
IT1 SB/NT	1	--	1	4	--	--	--	6
IIT1 SB/NT	--	--	1	--	--	--	--	1
IIIT1 SB/NT	--	--	--	8	--	--	--	8
IVT1 SB/NT	1	--	2	4	--	--	1	8
IT2 SB/CONV	--	--	2	1	--	--	--	3
IIT2 SB/CONV	--	--	--	--	--	--	--	--
IIIT2 SB/CON	--	--	3	--	--	--	--	3
IVT2 SB/CONV	--	--	2	--	--	--	--	2
IT3 LG/BIO	58	--	16	--	10	25	--	109
IIT3 LG/BIO	59	4	38	1	28	14	1	145
IIIT3 LG/BIO	9	--	38	2	37	35	--	121
IVT3 LG/BIO	21	7	5	--	--	45	--	78
IT4 CORN/CT	--	1	4	8	--	--	3	16
IIT4 CORN/CT	--	--	3	--	--	--	12	15
IIIT4 CORN/CT	--	--	2	4	--	--	4	10
IVT4 CORN/CT	--	1	1	2	--	--	7	11

Table 11.--Vegetable Harvest, 1985

Sweet Corn Harvest, Biological Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre*	Kg/ha
8/20	1	4.75	1034.55	10.35	1159.52
	5	8.75	1905.75	19.06	2135.96
	9	4.0	871.20	8.71	976.44
	12	8.0	1742.40	17.42	1952.88
8/23	1	3.6875	803.14	8.03	900.16
	5	9.5	2069.10	20.69	2319.05
	9	2.0	435.6	4.36	488.22
	12	4.1875	912.04	9.12	1022.21
8/27	1	6.3125	1374.86	13.75	1540.94
	5	6.3125	1374.86	13.75	1540.94
	9	1.5	326.70	3.27	366.17
	12	5.5	1197.90	11.98	1342.61
Totals	1	14.75	3212.55	32.13	3600.63
	5	24.5625	5349.71	53.50	5995.95
	9	11.5	2504.70	25.05	2807.26
	12	29.1875	6357.04	63.57	7124.97
Averages		20.0	4356.00	43.56	4882.20

*1981 Maryland Seasonal Average 69 cwt/acre
1982 Maryland Seasonal Average 50 cwt/acre
Source: Maryland Agriculture Statistics Summary for 1983, p. 24.

2yr. Ave. 59.5 cwt/acre

Sweet Corn Harvest, Modern Agriculture Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre	Kg/ha
8/20	2	7.3125	1592.66	15.93	1785.05
	6	17.5	3811.5	38.12	4271.93
	8	12.5625	2736.11	27.36	306.10
	11	9.0	1960.2	19.60	2196.99
8/23	2	5.25	1143.45	11.43	1281.58
	6	10.4375	2273.29	22.73	2547.90
	8	11.3125	2463.86	24.64	2761.49
	11	13.875	3021.98	30.22	3387.04
8/27	2	12.625	2749.73	27.50	3081.90
	6	13.5	2940.3	29.40	3295.49
	8	5.375	1170.68	11.71	1312.10
	11	8.0	1742.4	17.42	1952.88
Totals	2	25.1875	5485.83	54.86	6148.5
	6	41.4375	9025.09	90.25	10115.32
	8	29.25	6370.65	63.71	7140.22
	11	30.875	6724.58	67.25	7536.91
Average		31.6875	6901.54	69.02	7735.25

Sweet Corn Harvest, Control Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre	Kg/ha
8/20	3	6.75	1470.15	14.70	1647.74
	4	5.75	1252.35	12.52	1403.63
	7	8.5	1851.3	18.51	2074.94
	10	1.4375	313.09	3.13	350.91
8/23	3	5.3125	1157.06	11.57	1296.83
	4	5.625	1225.13	12.25	1373.13
	7	10.0	2178.0	21.78	2441.10
	10	2.875	626.16	6.26	701.80
8/27	3	11.5	2504.7	25.05	2807.27
	4	6.875	1497.38	14.97	1678.26
	7	2.75	598.95	5.99	671.20
	10	0.8125	176.96	1.77	198.34
Totals	3	23.5625	5131.91	51.32	5751.84
	4	18.25	3974.85	39.75	4455.01
	7	21.25	4628.25	46.28	5187.34
	10	5.125	1116.22	11.16	1251.06
Average		17.0469	3712.81	37.13	4161.32

Muskmelon Harvest Modern Agriculture Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre*	Kg/ha
	2	10.0	3267.00	32.67	3661.65
	6	10.375	3389.51	33.90	3798.96
	8	10.4375	3409.93	34.10	3411.05
	11	9.4375	3083.23	30.83	3455.68
8/23	2	2.75	898.43	8.98	1006.96
	6	3.375	1102.61	11.03	1235.81
	8	4.1875	1368.06	13.68	1533.32
	11	6.625	2164.39	21.64	2425.85
8/27	2	-----	-------	-----	-------
	6	3.0	980.1	9.80	1098.50
	8	9.0	2940.3	29.40	3295.49
	11	2.0	653.4	6.53	732.33
9/3	2	12.625	4124.59	41.25	4622.84
	6	13.5	4410.45	44.10	4943.23
	8	5.375	1756.01	17.56	1968.14
	11	8.0	2613.60	26.14	2929.32
Totals	2	25.375	8290.01	82.90	9291.44
	6	30.25	9882.68	98.83	11,076.51
	8	29.00	9474.30	94.74	10,618.80
	11	26.0625	8514.62	85.15	9543.19
Averages		27.6719	9040.40	90.40	10,132.48

*1981 Maryland Seasonal Average = 80 cwt/acre
1982 Maryland Seasonal Average = 150 cwt/acre
Source: Maryland Agriculture Statistics Summary for 1983, p. 24

2 yr. Ave: 115 cwt/acre

Tomato Harvest, Modern Agriculture Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre*	Kg/ha
8/9	2	5.75	1878.52	18.79	2105.45
	6	9.25	3021.98	30.22	3387.04
	8	5.0	1633.5	16.34	1830.83
	11	2.5	816.75	8.17	915.41
8/12	2	6.0	1960.2	19.60	2196.99
	6	5.75	1878.53	18.79	2105.46
	8	3.25	1061.78	10.62	1190.04
	11	1.75	571.73	5.72	640.79
8/15	2	5.0	1633.5	16.34	1830.83
	6	4.0	1306.8	13.07	1464.66
	8	3.0	980.1	9.80	1098.50
	11	2.75	898.43	8.98	1006.96
8/20	2	2.3125	755.49	7.55	846.75
	6	1.5625	510.47	5.10	572.13
	8	7.75	2531.93	25.32	2837.79
	11	6.5	2123.55	21.24	2380.07
8/23	2	3.0	980.1	9.80	1098.50
	6	2.1875	714.66	7.15	800.99
	8	6.125	2001.04	20.01	2242.77
	11	2.5	816.75	8.17	915.41
8/27	2	0.625	204.19	2.04	228.86
	6	4.0	1306.8	13.07	1464.66
	8	1.5	490.05	4.90	549.24
	11	2.0	653.4	6.53	732.33
Totals	2	22.687	7411.84	74.12	8307.86
	6	26.749	8738.90	87.39	9794.56
	8	26.625	8698.39	86.98	9749.16
	11	18.0	5880.6	58.81	6590.98
Average		23.515	7682.35	76.82	8610.38

*Maryland Statistics Ave.
1980 - 86 cwt/acre
1981 - 95 cwt/acre
1982 - 105 cwt/acre
3yr. Ave. = 95.33 cwt/acre
Source: Maryland Agriculture Statistics for 1983, p. 24.

Tomato Harvest, Control Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre	Kg/ha
8/9	3	1.5	490.05	4.90	549.25
	4	1.25	408.38	4.08	457.71
	7	0.6	196.02	1.96	219.70
	10	2.25	735.08	7.35	823.88
8/12	3	--	--	--	--
	4	3.75	1225.13	12.25	1373.13
	7	2.0	653.4	6.53	732.33
	10	1.75	571.73	5.72	640.79
8/15	3	2.5	816.75	8.17	915.41
	4	1.5	490.05	4.90	549.25
	7	2.75	898.43	8.98	1006.96
	10	--	--	--	--
8/20	3	0.75	245.03	2.45	274.63
	4	0.25	81.67	0.81	91.54
	7	1.44	470.45	4.70	527.28
	10	1.125	529.25	5.29	593.18
8/23	3	0.125	58.81	0.58	65.91
	4	0.625	294.03	2.94	329.55
	7	4.125	1940.60	19.41	2175.02
	10	0.75	352.84	3.53	395.46
8/27	3	0.5	235.22	2.35	263.63
	4	0.5	235.22	2.35	263.63
	7	1.5	705.67	7.06	790.91
	10	0.8125	382.24	3.82	428.41
Totals	3	5.375	1756.01	17.56	1968.14
	4	7.875	2572.76	25.73	2883.55
	7	94.15	3075.88	30.76	3447.45
	10	6.687	2184.64	21.85	2448.54
Average		7.338	2397.33	23.97	2686.93

Muskmelon Harvest, Biological Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre	Kg/ha
8/20	1	3.125	1020.93	10.21	1144.26
	5	0.75	245.03	2.45	274.63
	9	0.208	67.95	0.68	76.16
	12	7.1875	2348.16	23.48	2349.28
8/23	1	--	--	--	--
	5	1.0	326.70	3.27	366.17
	9	--	--	--	--
	12	2.25	735.08	7.35	736.20
8/27	1	--	--	--	--
	5	1.1875	387.96	3.88	434.83
	9	--	--	--	--
	12	9.3125	3042.39	30.42	3409.91
9/3	1	--	--	--	--
	5	2.75	898.43	8.98	1006.96
	9	--	--	--	--
	12	5.5	1796.85	17.97	2013.91
Totals	1	3.125	1020.94	10.21	1144.27
	5	5.6875	1858.11	18.58	2082.57
	9	0.208	67.95	0.68	76.16
	12	24.25	7922.48	79.22	8879.52
Average		8.31763	2717.37	27.17	3045.63

Muskmelon Harvest, Control Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre	Kg/ha
8/20	3	4.5	1470.15	14.70	1647.74
	4	1.25	408.38	4.08	458.33
	7	10.4375	3409.93	34.10	3821.84
	10	9.5	3103.65	31.04	3478.57
8/23	3	1.25	408.38	4.08	457.71
	4	1.1875	387.96	3.88	434.83
	7	5.0	1633.50	16.34	1830.83
	10	3.675	1200.62	12.01	1345.65
8/27	3	3.0	980.10	9.80	1098.50
	4	1.25	408.38	4.08	457.71
	7	2.25	735.08	7.35	823.88
	10	--	--	--	--
9/3	3	4.625	1510.99	15.11	1693.52
	4	6.75	2205.22	22.05	2405.22
	7	1.0	326.70	3.27	366.17
	10	1.6875	551.31	5.51	617.91
Totals	3	13.375	4369.61	43.70	4897.46
	4	10.4375	3409.93	34.10	3821.85
	7	17.6875	5778.51	57.79	6476.55
	10	14.8625	4855.58	48.56	5442.13
Average		14.0906	4605.25	46.05	5161.56

Tomato Harvest, Biological Plots

Date	Plot #	lb/2 rows	lb/acre	cwt/acre	Kg/ha
8/9	1	0.25	81.675	0.82	91.54
	5	2.75	898.425	8.98	1006.95
	9	0.6	196.02	1.96	219.70
	12	1.25	408.37	4.08	457.70
8/12	1	--	--	--	--
	5	2.2	718.74	7.19	805.56
	9	--	--	--	--
	12	4.0	1306.8	13.07	1464.6
8/15	1	--	--	--	--
	5	1.5	490.5	4.91	549.75
	9	1.0	326.7	3.27	366.17
	12	4.0	1306.8	13.07	1464.66
8/20	1	--	--	--	--
	5	0.3125	102.09	1.02	114.42
	9	1.0	326.7	3.27	366.17
	12	2.82	921.29	9.21	1032.58
8/23	1	0.44	143.7	1.44	161.06
	5	3.18	1038.9	10.39	1164.40
	9	1.5	490.05	4.90	491.17
	12	2.44	797.15	7.967	893.45
8/27	1	0.875	285.86	2.86	320.39
	5	0.75	245.03	2.45	274.63
	9	1.13	369.17	3.69	413.77
	12	0.25	81.67	0.82	91.54
Totals	1	1.565	511.29	5.11	576.05
	5	10.692	3493.08	34.93	3915.04
	9	5.23	1708.64	17.09	1915.04
	12	14.75	4822.09	48.22	5404.60
Average		5.812	1898.78	18.99	2128.15

Table 12.--A Survey of Blossom End Rot on Pik Red Tomatoes, 1985

Plot ID/System	Number of Affected Fruits	Number of Plants Surveyed	Blossom Cluster #
A1/BIOL	4	10	1
A5/BIOL	4	10	1
A9/BIOL	4	10	1
A12/BIOL	4	10	--
BIOL Average	4	10	--
A2/MAG	4	10	1
A6/MAG	6	10	1
A8/MAG	9	10	1
A11/MAG	5	10	1
MAG Average	5.75	10	--
A3/CON	2	10	1
A4/CON	1	10	1
A7/CON	4	10	1
A10/CON	3	10	1
CON Average	2.5	10	--

Table 13.-- Harvest of Field Crops, 1985
by volume and weight

Plot ID	Bu/Acre	kg/ha	lb/acre
	Continuous Field Corn, 10/22		
IT4	51.34	3452.50	3080.39
IIT4	71.56	4812.57	4293.87
IIIT4	70.94	4770.72	4256.53
IVT4	79.65	5356.59	4779.26
Averages	68.37	4598.09	4102.51
	No Till Soybeans, 10/30		
IT1	14.931	964.74	863.44
IIT1	14.935	1004.36	896.11
IIIT1	16.802	1129.91	1008.13
IVT1	16.491	1108.99	989.46
Averages	15.616	1052.75	939.29
	Conventional Soybeans, 10/30		
IT2	15.635	1051.44	938.12
IIT2	16.491	1108.99	989.46
IIIT2	15.246	1025.29	914.78
IVT2	15.091	1014.85	905.47
Averages	15.616	1050.14	936.96

Table 14.--Plant Tissue Analysis, 1985
Field Crops (percent dry weight)

Chemical Analysis	Repetition I	II	III	IV	Sufficiency(1)(2) Levels
Soybeans/T1					
Nitrogen	4.7	4.5	4.3	4.4	4.51-5.50
Phosphorous	0.28	0.28	0.29	0.28	0.26-0.50
Potash	1.7	1.8	1.7	1.7	1.71-2.50
Calcium	0.91	0.97	1.0	0.93	0.36-2.00
Magnesium	0.45	0.47	0.47	0.47	0.26-1.00
Soybeans/T2					
Nitrogen	4.3	4.4	4.4.	4.3	4.51-5.50
Phosphorous	0.26	0.24	0.25	0.26	0.26-0.50
Potash	1.5	1.3	1.5	1.6	1.71-2.50
Calcium	1.2	1.3	1.1	0.96	0.36-2.00
Magnesium	0.58	0.61	0.52	0.50	0.26-1.00
Legumes/T3					
Nitrogen	4.1	4.3	4.1	4.5	4.51-5.50
Phosphorous	0.26	0.24	0.22	0.27	0.26-0.50
Potash	1.5	1.5	1.6	1.6	1.71-2.50
Calcium	1.1	1.1	1.1	1.0	0.36-2.00
Magnesium	0.53	0.54	0.52	0.48	0.26-1.00
Corn/T4					
Nitrogen	1.8	2.0	1.8	1.7	2.76-3.50
Phosphorous	0.13	0.15	0.12	0.13	0.25-0.40
Potash	1.2	1.3	1.4	1.3	1.71-2.25
Calcium	0.85	0.87	0.86	0.85	0.21-0.50
Magnesium	0.47	0.39	0.34	0.39	0.21-0.40

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(1) Source: Suficiency Range for soybean--Soil Testing and Plant Analysis, Part II Plant Analysis, 1967. SSSA Spec. Pub. 2. SSSA, Madison, WS.

(2) Source: Sufficiency range for corn--from publication in footnote above

Table 15.-- Plant Tissue Analysis, 1985
Vegetable Crops (percent dry weight)

Chemical Analysis	Farming System			Sufficiency(1)(2) Levels
	BIOL	MAG	CON	
MUSKMELON				
Nitrogen	3.9	3.6	3.5	2.0-3.0
Phosphorous	0.19	0.20	0.17	0.25-0.40
Potash	2.3	2.4	1.8	1.8-2.5
Calcium	7.2	8.5	8.0	5.0-7.0
Magnesium	1.1	1.2	1.2	1.0-1.5
SWEET CORN				
Nitrogen	2.2	2.4	2.1	2.6-3.5
Phosphorous	0.22	0.23	0.19	0.20-0.30
Potash	2.0	1.9	1.5	1.8-2.5
Calcium	0.27	0.33	0.33	0.15-0.30
Magnesium	0.21	0.27	0.28	0.20-0.30
TOMATOES				
Nitrogen	2.9	3.0	2.6	3.0-6.0
Phosphrous	0.15	0.18	0.14	0.50-0.80
Potash	2.0	1.7	1.0	2.5-4.0
Calcium	4.0	4.9	4.1	4.0-6.0
Magnesium	0.93	1.1	0.95	0.6-0.9

(1) Source: The Vegetable Grower's News, September, 1981. "Plant tissue Analysis: diagnostic tool to increase yields of Vegetable Crops," by Charles R. O'Dell, Extension Specialist, Department of Horticulture, U.P.I. and S.U.

(2) The sufficiency levels are average ranges, and it is not unusual to find values above or below these with no apparent problems with crop growth or yield. (Dr. Charles McClurg, personal communication, February 24, 1986.)

Table 16 -- Soil Analysis, Field Crops[1], 1986
Soil Depth 0-15 cm (0-6 in.)
Units = Pounds/Acre unless otherwise stated

Chemical Analysis	Plot ID and Crop Farming System: IT1/NT	IIT1/NT	IIIT1/NT	IVT1/NT	AVE./NT
pH	6.1	6.1	6.4	5.8	6.1
Magnesium	201	211	219	169	200
Phosphate,	44	28	51	47	42.5
Potash,	87	108	102	164	115.25
Ash, %	2.6	3.0	2.8	2.8	2.8
Boron	1.12	0.91	0.78	1.05	0.97
Calcium	880	860	1080	640	865
Cation Exchange	--	--	--	--	--
Capacity, meq.	4.7	4.6	5.0	4.4	4.7
Copper	1.2	0.9	0.7	0.8	0.9
Manganese	23	35	26	38	30.5
H_2O, %	0.6	0.6	0.4	0.6	0.55
Nitrates	12.0	26.3	14.7	18.8	17.8
Organic Matter %	1.5	1.8	1.2	1.9	1.6
Zinc	2.3	2.1	2.2	2.6	2.3

	IT2/CONV	IIT2CONV	IIIT2/CONV	IVT2/CONV	AVE./CONV
pH	6.1	6.1	6.4	6.1	6.2
Magnesium	214	23	219	185	213
Phosphate	51	44	51	59	51.25
Potash,	84	102	102	120	102
Ash, %	2.6	2.9	2.8	2.4	2.7
Boron	0.98	1.11	0.78	0.72	0.90
Calcium	740	940	1080	740	875
Cation Exchange	--	--	--	--	--
Capacity, meq.	4.3	5.2	5.0	4.4	4.7
Copper	1.0	1.0	0.7	0.7	0.85
Manganese	23	31	26	27	26.8
H_2O, %	0.6	0.6	0.4	0.4	0.5
Nitrates	28	24.5	14.7	11.7	19.7
Organic Matter,%	1.5	1.6	1.3	1.3	1.43
Zinc	2.3	2.3	1.7	4.0	2.6

Chemical Analysis	IT3/BIOL	IIT3/BIOL	IIIT3/BIOL	IVT3/BIOL	AVE./BIOL
	Plot ID and Crop/Farming System				
pH	6.5	6.4	6.3	6.2	6.35
Magnesium	189	232	240	186	212
Phosphate,	31	29	59	35	41
Potash,	83	75	122	107	97
Ash, %	2.4	2.7	3.0	2.4	2.6
Boron	1.05	0.98	0.97	0.69	0.92
Calcium	1000	1200	1340	920	1115
Cation Exchange	--	--	--	--	--
Capacity, meq.	4.6	5.6	6.1	4.8	5.3
Cooper	0.9	0.9	0.8	0.8	0.85
Magnanese	19	21	32	38	27.5
H_2O, %	0.4	0.8	0.4	0.6	0.55
Nitrates	16.7	15.8	7.9	18.8	14.8
Organic Matter,%	1.4	1.4	1.7	1.5	1.5
Zinc	1.5	1.6	2.4	1.5	1.8

Chemical Analysis	IT4/C.C.	IIT3/C.C.	IIIT3/C.C.	IVT3/C.C.	AVE./C.C.
pH	6.4	6.4	6.3	6.0	6.3
Magnesium	187	228	203	190	202
Phosphate,	29	37	29	82	44.25
Potash,	114	68	61	131	93.5
Ash, %	2.6	2.8	2.8	2.8	2.75
Boron	0.81	0.85	0.81	0.77	0.81
Calcium	960	1120	840	840	940
Cation Exchange	--	--	--	--	--
Capacity, meq.	4.7	5.3	4.4	5.1	4.9
Copper	0.8	0.9	0.8	0.6	0.77
Magnesese	21	25	19	35	25
H_2O, %	0.6	0.6	0.8	0.6	0.65
Nitrates	6.3	3.8	4.5	5.3	5.0
Organic Matter, %	1.4	1.4	1.1	1.7	1.4
Zinc	1.5	1.6	1.3	3.1	1.9

[1] All field test plots will be in field corn, 1986

Key
NT = no till
CC = Continuous Corn
CONV = Conventional
BIOL = Biological

Table 17. - Soil Analysis, Vegetable Crops, 1986
Soil Depth 0-15 cm (0-6 in.)
Unit = Pounds/Acre

Chemical Analysis	Plot ID and Crop/Farming System				
	A1/BIOL	A5/BIOL	A9/BIOL	A12/BIOL	AVE./BIOL
pH	6.6	6.5	7.0	6.8	6.7
Magnesium	201	227	296	160	221
Phosphate	75	36	89	77	69
Potash,	167	106	165	102	135
Boron	0.92	0.63	0.65	0.72	0.73
Calciuim	940	980	1620	860	1100
Cation Exchange	--	--	--	--	--
Capacity, meq.	4.4	4.8	6.4	3.8	4.85
Nitrates	26.9	11.6	12.8	6.0	14.3
Organic Matter %	1.5	1.3	1.4	1.2	1.35

	A2/MAG	A6/MAG	A8/MAG	A11/MAG	AVE./MA
pH	6.4	6.3	6.6	6.8	6.5
Magnesium	246	210	186	160	200.5
Phosphate	123	35	65	77	75
Potash	197	81	151	102	133
Boron	1.16	0.70	0.76	0.72	0.84
Calcium	1140	860	1000	860	965
Cation Exchange	--	--	--	--	--
Capacity, meq.	5.5	4.6	4.6	3.8	4.6
Nitrates	3.0	9.3	11.4	6.0	7.5
Organic Matter %	1.3	1.3	1.3	1.2	1.275

	A3/CON	A4/CON	A7/CON	A10/CON	AVE./CON
pH	6.7	6.8	6.6	6.8	6.7
Magnesium	237	258	221	251	242
Phophate,	31	38	40	94	51
Potash,	85	102	110	166	116
Boron	0.49	0.93	1.01	0.86	0.82
Calcium	1020	1180	1080	1500	1195
Cation Exchange	--	--	--	--	--
Capacity, meq.	4.7	5.2	4.9	6.1	5.2
Nitrates	8.0	4.1	16.0	25.5	13.4
Organic Matter %	0.9	1.3	1.4	1.6	1.3

Table 18 -- Comparison Levels of Nitrate Efficiency
Soybeans Plots: T1, T2, T3
(Pounds per acre unless otherwise stated)

Nitrogen measure	NT/T1	CONV/T2	BIOL/T3
Nitrate level, pre-season, 1985	10.25	13.0	9.75
Nitrogen added as fertilizer in 1985	27.00	27.00	0.00
Total Nitrate, 1985	37.25	40.0	9.75
Nitrate level, pre-season, 1986	17.80	19.70	14.80
Nitrate depletion (gain) in 1985	19.45	20.30	(5.05)
Leaf tissue analysis, percent nitrogen	4.475	4.35	4.30

Table 19.--Comparison Levels of Nitrate Efficiency,
Averages, Fresh Vegetable Plots
(Pounds per acre unless otherwise stated)

Nitrogen Measure	BIOL	MAG	CON
Nitrate level, pre-season, 1985------	6.00	10.75	4.75
Fertilizer added, 1985-----	27.00	152.00	0.00
Total Nitrate, 1985---	33.00	162.75	4.75
Nitrate level, pre-season, 1986------	14.30	7.40	13.40
Nitrate depletion (gain), for 1985--------------	18.70	155.35	(8.65)
Leaf tissue analysis, muskmelon, percent N--	3.90	3.60	3.50

Table 20.--Common and Scientific Names of Insect Pests And Their Host Crops, 1985

Common Name	Scientific Name	Host Crop
Colorado Potato Beetle	Leptinotarsa decemlineata	Tomato
European Corn Borer	Heliothus zea	Corn
Japanese Beetle	Popillia japonica	Corn, et.al.
Dusky sap Beetle	Carpophilus lugubris	Corn
Green Stink Bug	Acrostermum hilare	Tomato, et.al.
Corn Root Worm and Spotted Cucumber Beetle	Diabrotica undecimpunctata howardi	Corn and Muskmelon
Striped Cucumber Beetle	Acalymma vittata	Muskmelon
Mexican Bean Beetle	Epilachna varivestis	Soybean
Bean Leaf Beetle	Cerotoma trifurcata	Soybean
Green Clover Worm	Plathypena scabra	Soybean
Spider Mites	Tetranychus telarius	Soybean, et.al.

Table 21.--Insect Scouting, Tomatoes for Colorado Potato Beetle
Threshhold = 20 adults and/or larvae/10 plants

Date & Plot ID	Adults	Eggs	Newly Hatched	Small Larvae	Large Larvae	Totals	Recommenc Action *
6/11/85							
BIOL							
1	3	4	1	3	2	13	--
5	1	1	1	3	1	7	--
9	--	3	-	2	-	5	--
12	1	1	-	2	-	4	--
MAG							
2	-	2	-	3	5	10	--
6	2	7	3	6	1	28	--
8	1	5	1	6	--	13	--
11	4	4	--	--	--	8	--
CON							
3	3	2	--	4	2	11	--
4	1	1	--	1	--	3	--
7	--	7	--	1	--	8	--
10	--	3	--	1	--	4	--
6/17/85							
BIOL							
1	0	10	11	5	6	32	spray
5	--	8	--	1	6	14	--
9	2	--	--	62	1	63	spray
12	--	--	--	16	6	22	spray
MAG							
2	1	26	6	24	32	97	spray
6	1	67	33	56	5	162	spray
8	2	--	28	51	9	90	spray
11	0	5	15	0	0	20	--
CON							
3	1	24	6	10	23	64	n/a
4	--	--	4	20	--	24	n/a
7	--	--	--	75	--	75	n/a
10	--	5	11	--	--	16	n/a

*sprayed plots 1,2,5,6,8,9 on 6/18/85 with Rotenone and #12 on 6/20/86.

n/a = Not applied.

Table 21.(cont'd.)--Insect Scouting, Tomatoes for Colorado Potato Beetle
Threshhold = 20 adults and/or larvae/10 plants

Date & Plot ID	Adults	Eggs	Newly Hatched	Small Larvae	Large Larvae	Totals	Recomm[illegible] Action
6/19/85							
BIOL							
1	--	--	--	1	5	6	--
5	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--
12	--	--	--	--	1	1	--
MAG							
2	--	15	--	--	10	25	--
6	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--
11	--	10	10	--	15	35	--
CON							
3	--	--	18	2	11	31	n/a
4	--	--	--	--	--	--	n/a
7	--	--	--	1	27	28	n/a
10	--	--	--	--	5	5	n/a
7/17/85							
BIOL							
1	--	--	--	--	1	1	--
5	--	--	--	--	2	2	--
9	--	--	--	--	--	--	--
12	--	--	--	--	3	--	--
MAG							
2	--	--	--	--	2	2	--
6	--	--	--	--	3	3	--
8	--	--	--	--	2	2	--
11	2	--	--	--	--	2	--
CON							
3	--	--	--	--	2	2	--
4	--	--	--	--	5	5	--
7	2	--	--	--	11	11	--
10	--	--	--	--	5	5	--

Table 22.--Insect Scouting, Sweet Corn, for European Corn Borer
(Survey: 10 consectutive plants in two rows in each plot)

Date	Plot ID	Plants with apparent damage	Small Larvae	Large Larvae	Action Needed*
7/22	BIOL/A1	2	2	--	none
	BIOL/A5	--	--	--	none
	BIOL/A9	--	--	--	none
	BIOL/A12	--	--	--	none
	MAG/A2	3	4	--	none
	MAG/A6	1	3	--	none
	MAG/A8	1	--	--	none
	MAG/A11	6	3	--	none
	CON/A3	3	2	--	none
	CON/A4	2	1	--	none
	CON/A7	5	7	1	none
	CON/A10	3	3	--	none

*Decision process if less than 10% of the leaf area is affected = light damage.
Source: 1985 "Commercial Vegetable Production Recommendations", Cooperative Extension Service, University of Maryland Extension Bulletin 236 (revised), January, 1985.

Table 23.--Insect Scouting, Muskmelons, for Cucumber Beetles (1), (2)

Date	Plot ID	Cucumber Beetle	Squash Bugs	Misc. Others	Apparent Damage	Recomme Action
7/11	BIOL A1	--	--	2	insign.	none
7/11	BIOL A5	--	--	1	none	none
7/11	BIOL A9	--	--	4	insign.	none
7/12	BIOL A12	--	--	2	none	none
7/11	MAG A2	--	--	--	none	none
7/11	MAG A6	--	--	13	insign.	none
7/11	MAG A8	--	--	1	insign.	none
7/12	MAG A11	--	--	1	insign.	none
7/11	CON A3	--	--	1	none	none
7/11	CON A4	--	--	--	none	none
7/11	CON A7	--	--	--	none	none
7/12	CON A10			1	none	none
7/23	BIOL A1	12	--	--	> 5% foliage	spray
7/23	BIOL A5	10	--	--	" " "	"
7/23	BIOL A9	10	--	--	" " "	"
7/23	BIOL A12	23	--	--	" " "	"
7/23	MAG A2	16	-	--	> 5% foliage	spray
7/23	MAG A6	15	--	--	" " "	"
7/23	MAG A8	18	--	--	" " "	"
7/23	MAG A11	9	--	--	" " "	"
7/23	CON A3	27	--	--	> 5% foliage	spray
7/23	CON A4	30	--	--	" " "	"
7/23	CON A7	15	--	--	" " "	"
7/23	CON A10	16	--	--	" " "	"

1 University of Maryland Scouting Guidelines are to survey ten row feet of plants. If above one beetle in ten row feet = threshold. Survey: 20 plants/plots; therefore, threshold = eight beetles/plot

2 On July 11 & 12 the plants were in the 7-8 leaf node stage and were beginning to run and flower.

Table 24.--Insect Scouting, Field Corn, for European Corn Borer (Survey: 10 consecutive plants in ten rows)

Date	Plot ID	Plants with apparent damage	Newly Hatched	Small Larvae	Large Larva	Action Needed
6/20	I T4	3	--	2	--	none
	II T4	12	2	12	6	none
	III T4	16	45	24	2	none
	IV T4	10	1	7	--	none

[1] Decision process: if more than 30% of the plants are affected, begin whorl treatment. Source: 1985 Integrated Pest Management Newsletter, University of Md., College Park, Md. Report #6.

Table 25.--Economic Analysis, Field Crops
(Cost per Acre Basis)

Item and Crop	Amount/acre	Cost/acre
CORN/CT:		
Seed------------------	15 lb.	$18.94
Fertilizer------------	314 lb.	92.60
Lime------------------	NA	----
Fuel and oil----------	5.9 x 1.10 plus 15%	7.46
Herbicide-------------	2.5 pt. ea of Aatrex & Dual 8E	17.13
Total------------		$136.13
SB/CONV:		
Seed------------------	60 lb.	$10.60
Fertilizer------------	300 lb.	26.10
Lime------------------	NA	----
Fuel and oil----------	4.7 gal. x 1.10 plus 15%	5.95
Herbicide-------------	2 pt. Dual 8E & 1 lb. Lexone	19.00
Total------------		$61.65
SB/NT:		
Seed------------------	60 lb.	10.60
Fertilizer------------	300 lb.	26.10
Lime------------------	NA	----
Fuel and oil----------	2 gal. x 1.10 plus 15%	2.53
Herbicide-------------	2 pt. Dual 8E, 1 lb. Lexone, & 2 pt. Roundup	41.76
Total------------		$80.99
SB/BIOL:		
Seed------------------	60 lb.	$10.60
Fertilizer------------	300 lb.	29.70
Lime------------------	NA	----
Fuel and oil----------	4.7 gal x 1.10 plus 15%	5.95
Herbicide-------------	NA	----
Total------------		$46.25

NA = Not Applied

Table 26.--Economic Analysis, Fresh Vegetables
(Cost per acre basis)

Crop & Item	Modern Agriculture Amount	Modern Agriculture Cost	Biological Amount	Biological Cost	Control Cost
Sweet Corn:					
Seed---------	12 lb.	$29.50	12 lb.	$29.50	29.50
Fertilizer---	1205 lb.	97.40	2973 lb.	179.70	NA
Lime---------	NA	----	NA	----	NA
Fuel and oil-	10 gal. x $1.10 + 15%	12.65	10 gal. x $1.10 + 15%	12.65	12.65
Herbicide----	3 pt. Dual 8E & 1.25 pt. Aatrex	22.71	NA	----	NA
Microp-------	NA	----	1 qt.	9.50	NA
Insecticide--	NA	----	NA	----	NA
Fungicide----	NA	----	NA	----	NA
Total-----		$166.26		$231.35	$42.15
Tomatoes:					
Seed--------	1/2 oz.	$23.50	1/2 oz.	$23.50	23.50
Fertilizer--	1515 lb.	64.03	2973 lb.	179.70	NA
Lime--------	NA	----	NA	----	NA
Fuel & oil--	10 gal. x $1.10 + 15%	12.65	10 gal. x $1.10 + 15%	12.65	12.65
Herbicide---	6.67 lb. Enide 90 WP	44.02	NA	----	NA
Microp------	NA	----	1 qt.	9.50	NA
Insecticide-	82 fl. oz. Rotenone liq.	22.42	82 fl. oz. Rotenone liq.	22.42	NA
Fungicide---	NA	-----	NA		
Total----		$166.62		$247.77	$36.15
Muskmelons:					
Seed--------	3 lb.	$267.20	3 lb.	$267.20	267.20
Fertilizer--	1176 lb.	134.57	2973 lb.	179.70	NA
Lime--------	NA	----	NA	----	NA
Fuel & oil--	14 gal. x $1.10 + 15%	17.71	14 gal. x $1.10 + 15%	17.71	17.71
Herbicide---	1 1/2 gal. Prefar 4EC	45.00	NA	----	NA
Microp------	NA	----	1 qt.	9.50	NA
Insecticide-	1.25 lb. Sevin 80S	3.32	82 fl. oz. Rotenone liq.	22.42	NA
Fungicide---	3 lb. Dithane M-45	5.85	NA	----	NA
Total----		$473.65		$496.53	$284.91

NA = Not Applied

F I G U R E S

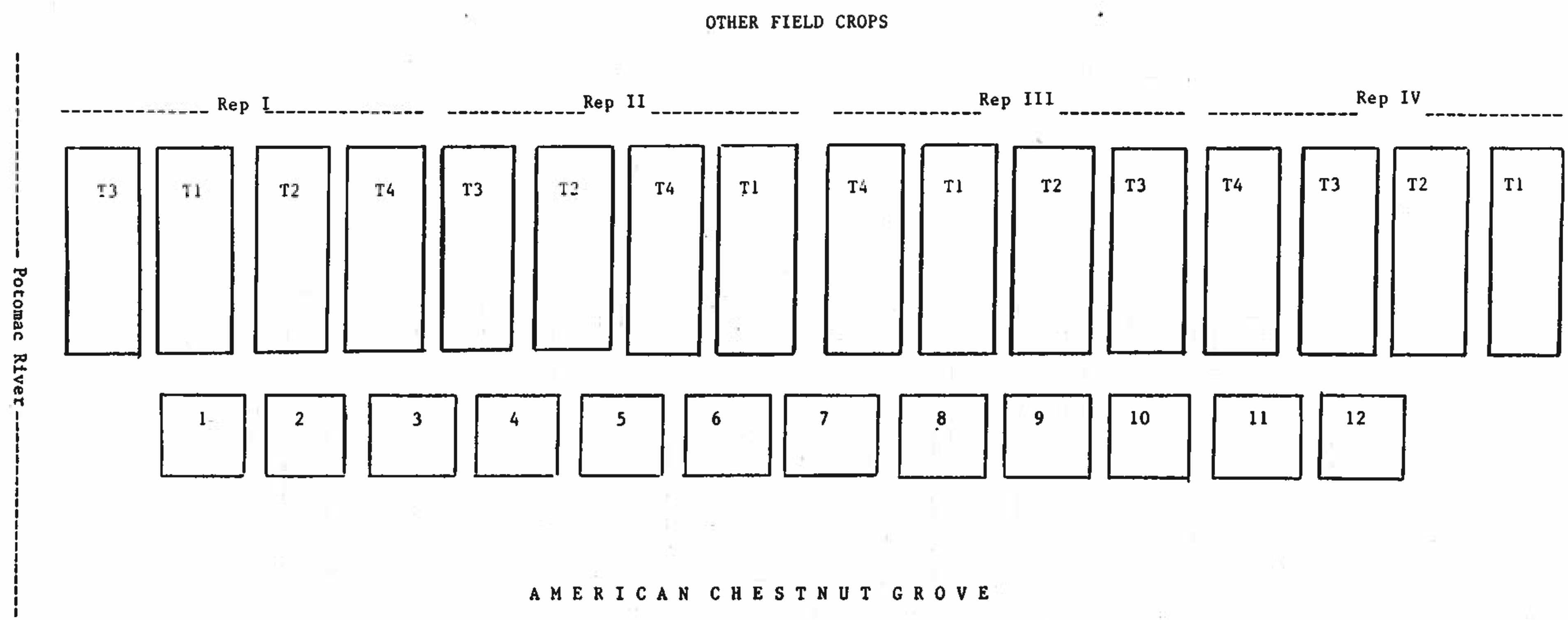
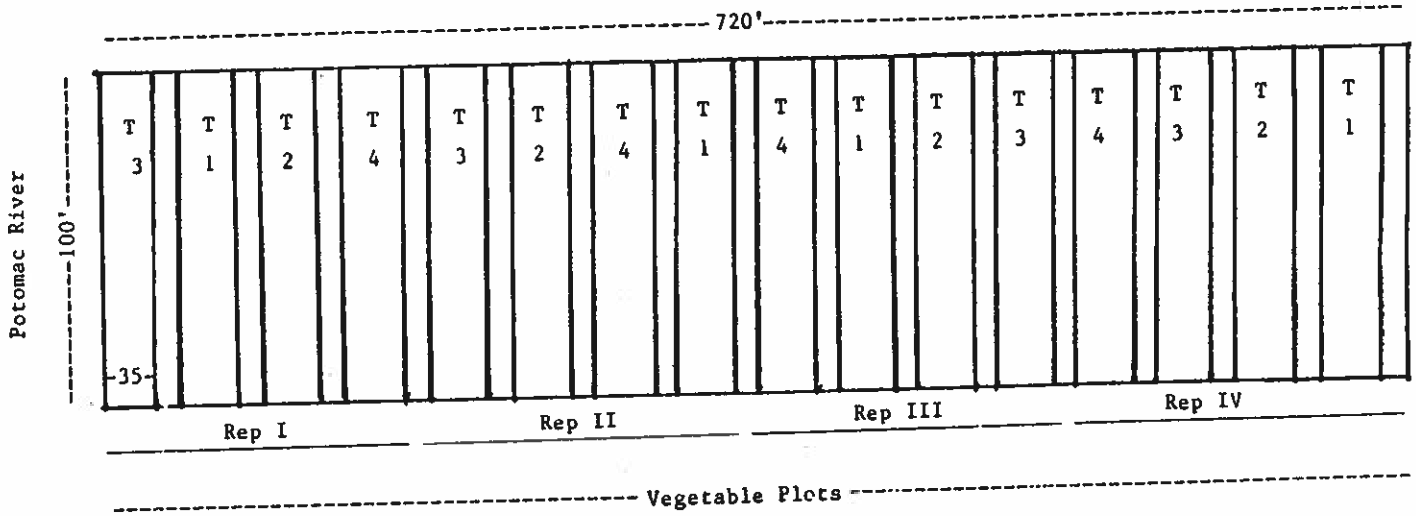


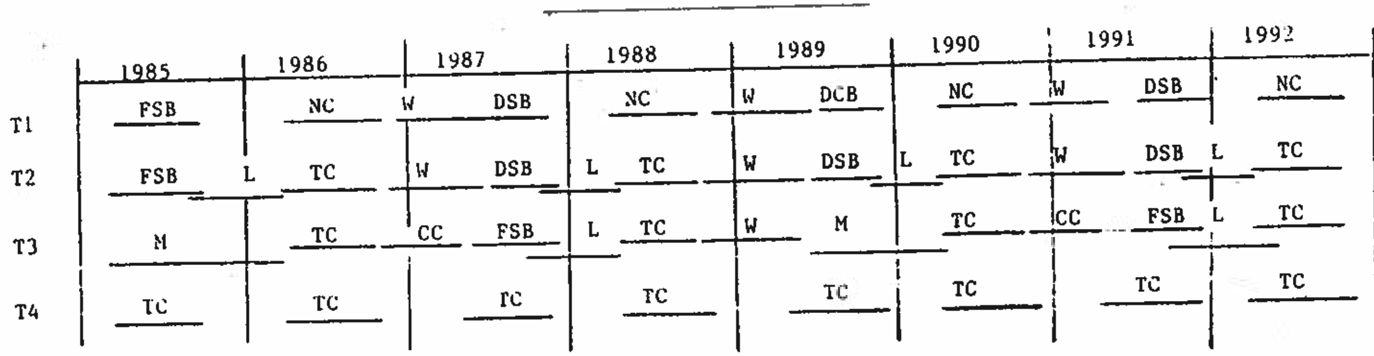
Figure 1. -- Comparative Agriculture Research Project-1935
Field and Vegetable Plots Layout

Figure 2.--Comparative Agriculture, 1985

Field Plots Layout



Field Crop
Rotation Schedule



FSB= full season soybeans. NC = no-till corn. W = winter wheat. DSB = double crop soybeans.
L = winter legume. TC = tilled corn. M = meadow/green manure. CC = rye cover crop.

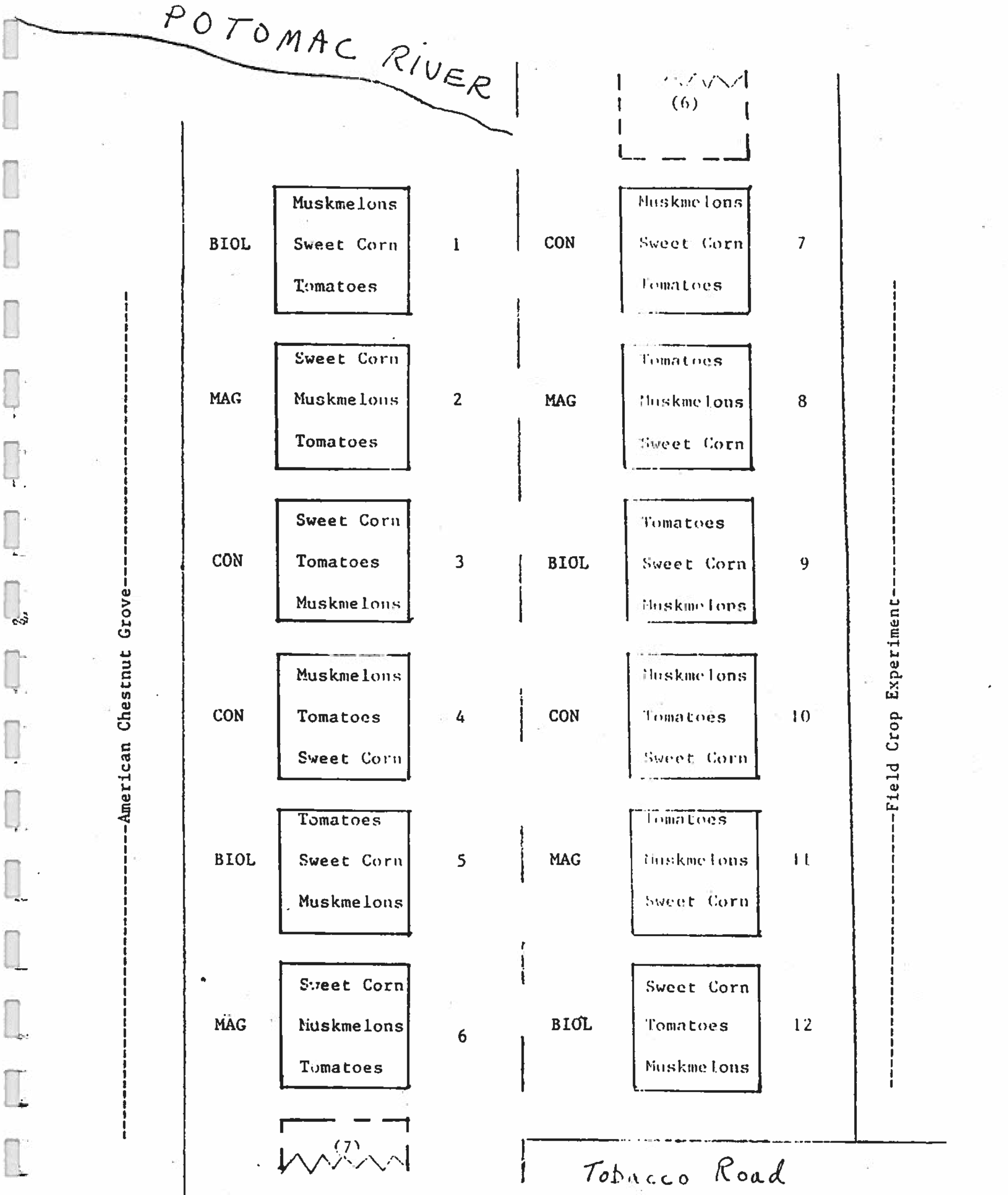


Figure 3.--Comparative Agriculture, 1985
Vegetable Plots Layout
(Each plot = 40 x 40 ft., with 10 ft. alleyways)

KEY
BIOL = Biological
CON = Control
MAG = Modern Agricultu

FOOTNOTES

1 Weil, Ray, Ph.D. letter of October, 18, 1984.

2 Lockeretz, William, _et.al._, _Conversion Project Annual Report, 1981_, p. 2.

3 _Ibid._, p. 3.

4 Oelhaf, R. C., and John Wysong, "Technical and Economic Considerations in Organic vs. Conventional Farming," p. 2.

5 _Ibid._, p. 1.

6 Youngberg, I. Garth, Executive Director, Institute for Alternative Agriculture, Inc., speech delivered, October, 1983, Virginia Association of Biological Farmers' Fall meeting.

7 Oelhaf, _op. cit._, p. 2.

8 Weil, _op.cit._

9 Secretary's notes, Accokeek Foundation Research Committee Meeting, April 6, 1985.

10 _Climatography of the United States, No. 81, (by State) Monthly Normals of Temperature, Precipitation and Heating and Cooling Degree Days, 1951-80,_ "Maryland and District of Columbia."

11 Weil, _op. cit._

12 _Crops and Soils_, March, 1985, last page.

13 _Maryland Agricultural Statistics, Summary for 1983_, p. 28.

14 Walsh, John, Charles County Extension Agent, personal communication, August, 1985.

15 _Maryland Agricultural Statistics, Summary for 1983_, p. 28.

16 Reed, L. B., and Raymond E. Webb, _Insects and Diseases of Vegetables in the Home Garden_, p. 43.

17 Nelson, Paul V., _Grenhouse Operation and Management_, "Light and Temperature," p. 316.

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