PRODUCTION AND CROPPING STYLES: AN ANALYSIS OF RESULTS OF INTERVENTION ON COOPERATORS AND DEMONSTRATION FARMS IN LAKE BALINSASAYAO

Rowe V. Cadeliña *

INTRODUCTION

The Silliman University Research Action Development Program in the Uplands (SURADPU) has two major concerns on the aspect of technological development: first, to improve the farmers' cropping and land use practices that will enable them to conserve soil on their farms; second, to increase the productivity of their farms. After two years of implementation of SURADPU in Lake Balinsasayao area, data on the following from farming cooperators have been collected: crops planted annually; total annual production; total number of crop varieties planted in one year; total length of soil protection devices installed (i.e. rockwalls, hedgerows, contour canals, bench terrace, [illegible] number of varieties of nitrogen fixing crops planted; number of years farm has been cultivated; percent slope of farm cultivated; total area of farm; length of stay of farmer in the community; number of labor force in the household; and number of persons in the household of farmer cooperators.

Assuming that rainfall and other biophysical factors are the same in various farm communities of the area, we wanted to find out how the socially based factors affect each other to produce a particular profile of cropping styles and production [illegible]

The intervention that SURADPU has implemented on the cooperators' farms is assumed to be a given factor which is uniformly accessible to the subjects of this study.

THEORETICAL FRAMEWORK

Land management style is complex involving a number of components, such as, crop sequencing, intensity of cropping, crop mixing and conservation practices, among others.

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Such complex could be altered by some intervention activiti that may be introduced into the community. Considering th subjects of the study are farmers who comprise the clientele o SURADPU, the present land use practices of these farmers ca be assumed mainly to be the results of these interventions.

What inhibits or what facilitates implementation of the pre ent land use practices are relevant questions to pursue towa our concern for the development of farming systems in the islan Sociologically, factors such as household size, number of lab force in the household, length of stay in the community, numb of years farms have been cultivated and total area of farms cu tivated, could affect the overall patterns of land use practice The acceptance of various soil protection systems will sure hinge on a number of these sociological factors. Some biological related conditions in the farm such as farm slopes may al serve as a significant limiting factor on land use practices.

Hence, a number of these characteristics will have a predi tive value on farming activities, vis-a-vis production. Obvious such value will allow one to design plans and programs intend to improve land use practices and production. The assumpti is — the higher the level of our understanding of the nuances o land use systems traditionally practiced or introduced, the mo effective and the more successful in intervention designs.

LAND USE STYLE

The data bases were collected: (1) case data from two far ers; (2) census data from 12 cooperating farmers.

Case Studies

Two case farmers were studied. One case farmer w born and raised in the area. His father migrated to the comm nity in the 1920s. His (the case farmer) wife with whom he h five children, the eldest of which is 12 years old, was also bo in the same community. The children next to the eldest are bel 10 years old. By using age 10 as the cut-off point for classifi tion of household members in the labor force, this indicates t there are 3 members in their productive working age.

The other is a migrant who came to the community with his family around three years ago. They cultivate a farm that was already claimed by an earlier occupant. With his social network, the farmer managed to arrange for free use of a portion of the land with the owner. He works in a 1.5-hectare land.

The couple has five children one of whom is already in a productive working-age category. Like the first case, this couple has three members in the household labor force.

Case 1: The farm was first opened in 1968. After its first clearing, it was planted with corn. Toward the end of the first year of occupation, root crops such as *karnabal* (*Xanthosoma violaceum* Schott) and *ubi* (*Dioscorea esculenta* Crantz.) were planted. Then, the farm was left to rest. In 1972, *abaca* (*Musa textilis* Nee) was planted. Since then, various crops were planted (see Figure 1).

His plot has an area of 22,000 square meters with various soil protection devices, such as contoured hedgerows, rockwalls and contoured bench terraces. In a period of 14 months (February 1985 to March 1986), 23 different crops were planted in the farm. There were 96 planting times made during this period (see Table 1). This suggests an average of seven planting "episodes" per month.

Certain crops have high frequency of planting "episodes.' Such crops have usually high market price and are easy to transport. For instance, sweet pepper (*Capsicum annum* L.) has the highest frequency during the whole period of observation (15 times). Such high frequency of planting does not, however, provide enough time to cultivate wider area hence its minimum area (12 sq. m.) of cultivation is considered rather low, although the maximum is 320 sq. m. (see Table 1).

The reason for low acreage of cultivation of crops like sweet pepper (*Capsicum annum* L.) can be explained by factors other than the frequency of planting. For instance, the mungbeans (*Phaseolus radiatus* L.) which has one of the lowest planting frequency, has also a very low acreage. This suggests that other factors affect acreage. Productivity, sensitivity to pests and market price affect the decision to maintain or expand farm acreage, the farmer reported.

Capsicum annum is one crop that commands a very high price in the market but because of its extremely high susceptibility to local pests, the farmers reduce the risk by not planting too large an area separated into different plots. Since those plots cannot be cultivated at the same time, the farmer produces a system where plots are not in turn, planted at the same time. The farmers reported that schedule of planting can also affect the incidence of local pests on crops. By planting crops at different times, the distribution and the spread of pests can be controlled.

There is one apparent lesson we can learn from the farming style of Case farmer no. 1. Pests risk is handled by diversifying space sites of a particular crop as well as by distributing temporal incidents of the planting episodes. Since pests occur in a cycle, staggering the planting episodes of a highly marketable crop, reduces the risk attendant to a synchronic system of planting. Another risk and hazard the farmer faces emanates from a socioeconomic source. As discussed in another paper (see Cadeliña 1986), even subsistence farmers in the upland depend on a market system to allow them to convert their products into cash for goods they do not locally produce but are very essential for their survival. Hence certain products with very high market value is preferred (see Table 2). These preferred crops are planted more often than others. Prices of these crops depend on the manner the middlemen fix the prices. However, even for most preferred crops, prices of farm products are fluctuating. There are times when prices go up or down and the farmer prefers to have the products available when the price is high. The problem is they do not know exactly when the price will go up.

Case farmer no. 1 handles this problem by planting the most preferred crops as often as possible but on different dates. Such scheme allows the farmer to harvest his crop during different times hence allowing the farmer to hit the best price during any harvesting period. Such strategy improves his chances of getting higher cash return from his crop.

Another apparent style of cropping is the continuous planting of various crops during the whole year (see Figure 1). Case farmer no. 1 planted his crops throughout the year except in the month of July. The absence of planting activities during this month may be explained by the extremely high rainfall during this period. Rainfall data collected in 1983 showed that the months of July and August had the highest participation level (see Table 1). However, the ability of the farmer to plant continuously during the whole year depends on the availability of rainfall. Since Lake Balinsasayao physically allows precipitation to take place even during summer months, farmers still have better chances to grow crops during these months. Figure 1 shows that even during the summer months (January to May), a tremendous variety of crops can still be planted. It is only in the months of February during 1985 and 1986 when the lowest number of crops planted was registered. Such fluctuation is explained by labor availability in the household and other commitments of the farmer.

There is one crop that has been reported to be planted only once before but continues to surface in the list of products sold by the farmer at present. This is "sayote" (*Secheum edule*). Figure 1 shows that the last time this crop was planted was in 1984. During the last two years, this has never been reported as being planted again. This crop deserves a special report in the context of farm management around the Lake Balinsasayao area.

Secheum edule is a vine. The very ripe fruit with seed still intact is usually planted on the edge of the farms, or on ecotones toward the end of a cropping period. In this zone, part of the primary forest and the secondary vegetation areas provide the planting site. It loves the shade that the primary and the secondary forest cover provides. Once it starts to grow, it keeps on germinating new plants (as the nature unharvested fruits drop to the ground) even without maintenance. As long as wild animals do not destroy the stock, the crop grows forever and continues to produce the vegetable fruit. Its vines creep and continue to seek diffused lights. A farm that is not subjected to firing will continue to produce *Secheum edule*.

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For more than a year, Case Farmer No. 1 never replanted (February 1985-March 1986) *Secheum edule* but still continues to harvest the fruit and leaf tops. Farmers consider the crop as an insurance crop during the time when they are not able to work. It is therefore a mainstay crop in Lake Balinsasayao farms. Although its price is one of the lowest, the limited labor input that is required after it has been planted makes the overall returns still a little bit higher. The major problem is its transport to the market place. The fruit vegetable is quite heavy and the price per kilo is low (see Table 2). One has to bring a tremendous volume of the product before a substantial amount can be produced. Its transport cost further reduces the profit margin of the farmers.

Nevertheless, in unexpected events such as illness and other emergency cases, *Secheum edule* provides a suitable buffer against cash shortage. Despite its low market price and high transport cost, the product still allows the farmer to draw in the badly needed cash and other goods. Hence, it has to become a regular feature in the crop repertoire of the farm. In this case, the farmer does not necessarily keep the plant for profitability but for security. In this regard, cropping involves two major considerations: profitability and security.

Needless to say, there are trade-offs to take into account. The farmers can be assumed to know exactly which side of the trade-off he should stand after evaluation of the pros and cons are done.

If we take the sum of the areas for all plots planted to various crops in Table 1, it is very apparent that the farmer does not cultivate the total farm area of 22,000 sq. m. in 14 months. During this period, the farmer has only cultivated 14,497 sq. m. which is 66% of the total. Considering such factors as fallowing, shifting farm sites and farming scale, the farmer needs around two years before he can make use of his entire farm area. With his present cropping style, the farmer can allow his farm to fallow for around one year to restore partly its natural fertility.

Permanent crops like abaca (*Musa textilis* Nee) were planted in his farm in 1972. Other permanent crops were planted very lately along the side of contoured rockwalls. These trees serve as suitable support system to the rockwalls. Tree crops like *Coffea arabica* L., *Theobroma cacao* L., breadfruit, *atis, chicos,* and *lanzones* (*Lanzium domesticum*) are lined along rockwalls. Eventually, the crown of these trees will help protect the ground soil underneath from direct rain drops reducing splash erosion. These permanent crops are envisioned by the farmer to increase his level of farm production.

Case No. 2: His farm was opened by the original cultivator in the 1930s but was abandoned in the 1960s. It has not been cultivated again until the farmer came in the early 1980s. With a friendly arrangement, the farmer was allowed by the owner to cultivate part of the site. He requested to make use of only 15,000 sq. m. The site has no permanent crops and was all covered with cogon grasses when he started cultivating it.

In his farm, the following soil protection devices are found: (1) contoured rockwall; (2) contoured hedgerows; (3) contoured bench terraces.

Case Farmer No. 2 is different from Case Farmer No. 1 in the kind of crops planted and the extent of the diversity of crops. While Case No. 2 farmer has maintained a certain level of diversity of crops planted in his farm, Case No. 1 farmer has gone into a kind of specialized farming by concentrating on the production of vegetables (see Figure 2). For instance, he has planted root crop only once; corn, twice (see Table 4). Only 600 sq. m. was planted with corn and another 600 meters with root crops.

Just like Case No. 1, Case No. 2 seems to be responding to the marketability of products when a particular crop is chosen for planting (see Table 5). The top three crops that are planted (tomatoes, corn and *carnabal*) are also the top three crops "price-wise." Profitability as the motivation for the selection of crops is very apparent.

Unlike Case No. 1, Case No. 2 has never planted *Secheum edule,* considered the cheapest crop. However, as we saw it earlier, *Secheum edule* serves as an excellent insurance crop. Since Case Farmer No. 2 has not planted this security crop, does he consider only profit and not security?

This can be answered by looking at the kind of crops that he has planted. Eggplant (*Solanum melongena* L.) ranks last in the line of crops for Case No. 2. Unlike other crops planted by Case No. 2, *Solanum melongena* L. is semi-perennial. It can last for two years if properly maintained. It is more pest resistant compared with other crops. It is capable of having a sustained increasing production for almost two years before it finally stops bearing fruit with lesser input. Hence, it still serves as a security crop for Case No. 2. Asked why he is not planting *Secheum edule,* he said that the crop is too difficult to transport and is cheap compared to *Solanum melongena* L.

Case No. 2 is a good example in point where the trade-offs between profitability and security concerns are handled. Since he cannot have his cake and eat it too, he opts for a crop that provides some amount of security and profitability. He takes *Solanum melongena* L. more seriously than does Case No. 1. Case No. 1 cultivates only, on the average, 124 sq. m. of plot for *Solanum melongena* L., with a range of 56 to 371 sq. m. for production. Case No. 2, on the other hand, cultivates significantly wider area than Case No. 1. On the average, he cultivates 313 sq. m. with a range of 100 to 420 sq. m. (see Table 4). The details of his cultivation acreage are seen in Table 5.

While Case No. 2 has a unique strategy of maintaining crop diversity in his farm, he has also maintained a specialized motif for his farm. For Case No. 1 we saw an obvious attempt to keep crop diversity at a high level. Oddly enough, no specific motif can be discerned. Case No. 2 maintains a prevailing motif (that of "vegetable line-up"), and still keeps a certain level of diversity. Case No. 2's farm can therefore be considered as a vegetable producing farm. For this reason, we see only something like eight varieties of plants in his farm while around 23 different varieties were noted for Case No. 1. Such varieties does not seem to provide an sense of direction for his farm. In fact, one is led to believe that production will be decreased although very high level of security can be expected.

For Case No. 2, a sense of direction is manifested. The goal is to improve productivity and profitability. There is still a certain amount of security although not as high as what we might find for Case No. 1. For instance, Case No. 2 has not yet planted any permanent tree crops for long term security and productivity while Case No. 1 has already moved farther in this area. Case No. 2 is highly engrossed in assuring for himself a good profit margin by concentrating his efforts on crops with high returns. In addition, extensive soil protection devices are put up. This latter activity is, however, also undertaken by Case No. 1.

Like Case No. 1, Case No. 2 does not cultivate his entire 15,000 sq. m. of land. Under the present cropping style of Case No. 2 only around 38% (5,669 sq. m.) of his total land area is cultivated. With this, it will take him around three years to cover the entire farm area. Given this period, his cultivated plot can have at most around three years of resting before it has to be cultivated again. This fallow period is very much longer than his Case No. 1 counterpart.

It was mentioned earlier that Case No. 2 is more profit-oriented rather than security-oriented. This is an impression we get from the way the two farmers manage their farms. Let us see whether this is demonstrated by the production level of the farmers.

For 11 months, the total farm production of Case No. 2 was documented by weighing all the products. Similar procedure was done for Case No. 1, but the process went on for only 10 months. The data revealed that Case No. 1 produced only 1,131 kilo of various products while Case No. 2 produced more than twice as much as Case No. 1. Around 2,943 kilograms of various farm products were produced by Case No. 2 during a period of 11 months. Even if we give an allowance of one month for Case No. 1 (an average monthly production of 113 kilograms), the difference still showed the same magnitude.

Production data sugest that the farming style of Case No.2 wa more profitable than that of Case No. 1. This confirms our im pression of higher advantage probably due to the latter's croppin style and choice of crops.

Given the farming experience of the two cases, two styles o farm management are also apparent. One is profit geared wi minimum security consideration and the other is security geare with minimum profit consideration. Theoretically, a third sty must be possible (i. e. high profit and high security consideratio However, considering that it is difficult to have both at the sa time, farmers usually end up with trade-off that will allow the to provide an optional survival chances.

From the two cases considered, security measures are st imperative. However, the manner and intensity of implemen tion differ. Again, such differences can probably be explain by the way they reckon waiting time for outcome. It appears th for Case No. 1 long-term results are enough while Case No short-term results matter more. Considering that Case No. 2 is recent migrant, the more pressing need should be satisfied im mediately.

Assuming that these impressions are valid, the results differentiated philosophies can be tested over time. The questi that we can ask at this time is: Will the production level of t long-term oriented farmer turn out to be higher than that of t short-term oriented farmer five years from now? Given o present research program in the University, this condition c be documented in the next five years. Five years is an adequ time to measure changes in the production level between the t cases since most of the long-term crops will already be produc during this time. Assuming that these farmers will not move other places, we hope these data can be documented five ye hence.

Census Study

While case study allows us to see the details of the proce involved in the way the farmers manage their farms, it how does not allow us to see the relationships between a number factors operating on a macro level. The applicability of certain observations to a larger population can only be achieved when a larger number of cases are observed and monitored.

After a census was made to get a profile of the 12 participating farmers, it was found out that a farmer cultivates an average of 1.4 hectares. An average of 6 persons live in each farming household. Around four of them belong to the labor force, the rest are dependents. They have been living in the community for 36 years on the average and their farms have been cultivated for around 24 years. This suggests that their present farms were not originally theirs.

On the average, their farms are found on areas with a percentage slope of 43 %. These comprise a marginal land which is very sensitive to erosion caused by human activity.

On the average, these farms consist of 452 meters protected by various forms of soil protection devices. These are planted to a number of varieties of crops, on the average, 14. Among these plants, three different varieties, on the average, are nitrogen fixers. The following table summarizes the general characteristics of three farmers.

Somewhere in the initial part of this paper, a number of variables were identified as possible factors affecting various farm management styles. Ten variables were identified: number of persons in household (NOPH); number of labor force in household (NOLFOH); length of stay of farmer in the community (LOSFAC); total area of farms (TAF); percentage slope of farm (PESFARM); number of years a farm has been cultivated (NOYFAC); number of varieties of nitrogen fixing crops planted (NOVIFIX); total length of farm covered by soil protection devices (TOLSOP); total number of crops planted (TONCROP); and total weight in kilograms of all products produced in one year (TOTALL). The question we have to raise is: How are these variables related to each other?

A census was made for 12 farmers who are active participants of the project. Planting and production patterns of farming activities of these farmers were monitored for 12 months.

Table 7 shows our initial statistical analysis to determine the level of correlation between these 10 variables. Using .75 and above as cut-off point for acceptable coefficient value of correlation, Table 8 lists these correlated variables, and the nature of their correlations and the percentage of the variance of the dependent variable as explained by the independent variable.

The way a farmer manages his farm is assumed to be affected by the size of the farm. Table 8 shows, however, that farm area is negatively correlated with the slope of the farm. In other words, as the farm gets steeper, the farmer tends to generally get a smaller area of farm on the sites. This is expected considering the increasing marginality of the farm as its slope gets steeper. The utility value of the land diminishes reducing the interest of the farmer to till this type of land. Since there is no direct correlation of percentage slope of farms with other variables of land management styles, this suggests that its effect on the way the farmer manages his farm is indirect. The correlation coefficient of percentage slope of farm with other variabels on land management such as number of varieties of nitrogen fixing plants planted, total length of soil protection devices installed, and total number of crops planted is, however, very weak and negligible.

The longer the farmer stays in the community, the more likely he is going to introduce more varied types of nitrogen fixing pants on his farm. Similar kind of relationship between the number of varieties of nitrogen fixing plants and the total area of farm own exists. Positive correlation exists between these variables. This may be due to the fact that there is a tendency for farmers who have stayed in the area longer to have accumulated more farm land. However, the correlation coefficient between total area of farm and the length of stay of farmer in the community is quite low (r=.411). Such coefficient of correlation suggests a very low coefficient of determination taking only around 17% of the total variance of the dependent variable explained by the independent variable.

Farmers who have stayed in the community longer tend to have planted more varied crops in their farms. This would be a result of the cumulative effects of gradual planting of permanent tree crops. And, as the number of crops in the farms increases, the more number of varieties of nitrogen fixing plants are introduced. This could be due to the "exhaustion effect" (i. e. when almost all possible plant varieties shall have been planted), so that a good number of the new plants tried could only be the nitrogen fixers. Plants that were introduced earlier were non-leguminous ones. As the project encourages the farmers to try new ones, most of those who have already maintained a highly diverse crops in the farm will have little option but the leguminous ones, which are considered to be popular as soil enrich (nitrogen fixers).

One of the assumptions held earlier was that the availability of labor force in the household can largely affect the activity of farming households for the introduction of soil conservation measures on their farms. Statistical test does not support this assumption. Table 7 shows an extremely low negative correlation of these variables (r=.092). Instead, it is the total household size that has a better correlation with the implementation of soil protection devices. Total length of area covered by soil protection devices installed (TOSOP) when correlated with number of persons in household (NOPH) yielded a rather high correlation coefficient (r=.641). The bigger the household size, the more soil protection devices are put up on the farm. Since putting up of soil protection devices is easier done when people work in groups, the bigger the household size, the more excellent the psychological support provided to the farmers compared to when a farmer puts up the devices by himself. It appears that it is the conviviality of people during the process of working that encourages the participants to accomplish more work in putting up the soil protection devices.

It was, however, thought initially that the availability of labor in the household is a function of household size. If this is correct then we can assume that perhaps those larger households have better chances of deploying labor force to the farm to do the work. Statistical test, however, does not confirm this. Table 7 shows that the number of labor force in the household has a very weak correlation with household size.

Attempts were made to establish some predictive values of the various independent variables on the dependent variables. Table 9 presents this. The total number of crops planted in the farm has the best predictor for planting more varieties of nitrogen fixing plants. The more crops a farmer plants in his farm, the more likely that he will have planted more varieties of leguminous plants and vice versa. The total land area of the farm ranks next and followed by the length of stay of farmer in the farm as predictor for the number of variety of nitrogen fixing plants.

Demonstration Farm (Demo farm)

Aside from monitoring the cropping styles of the farmer cooperators, we also documented the manner by which our demo farms were cropped. The purpose of our demo farm is to test a number of cropping systems and to measure actual production length of time for crops to mature, cropping and harvesting "episodes" and production level.

Three demo sites were developed. Each site has an average area of 3,000 square meters. One has a percentage slope of 60, the other 70, and the third 10. Soil fertility of these demo sites were exhausted and hence soil needs rehabilitation. In a period of four months, 14 different crops were planted on an area of 1,786 square meters (see Table 10). These were 21 different times or episodes of planting involving differentiated areas of plot. The largest, 224 sq. m. were planted to cassava; and the two smallest plots having an area of 17 square meters each, were planted with tomatoes and bush beans.

For the 21 different planting "episodes," around 85 sq. m. on the average, were planted for every planting activity. Considering that there are only, on the average, five planting episodes in one month, this suggests that more plants can still be planted during this period if a farmer really wants to optimize plot utilization. Remember that with this rate, he is only cultivating 85 sq. m. for every plot of crop. Since there is an interval of around 6 days be-

between planting activities, this further indicates that a farmer is still in a position to expand his clearing larger than 85 sq. m. Hence, under the planting rate from our three demos, there are two possibilities that the farmer can do which in either case would increase his production considering other factors equal. First, he can increase his cultivation so that it will be larger than his present size of 85 sq. m. Second, he can have more varieties of crops planted such that increase in diversity of crops may improve the quality of his farm by increasing fertility and production eventually.

One lesson we have learned from our demo farms' system of cropping is that there is still much room for improving the optimal level of cultivating the farm for maximum production. Since the demo farm was operated on a one-man labor basis, this suggests that a household with two members of the labor force can double the rate of cultivation of our demo. This would logically suggest doubling of production.

Since diversity of crops (especially when leguminous plants are introduced) has been found in other places to be more advantageous to production than the specialized ones, this would suggest an increasing improvement of the farm productivity. Our data somewhere in this paper suggest that as the crops in the farm get more diversified, the more likely that these farms will have more leguminous crops planted. In totality, a highly diverse cropping system will always be a more profitable style of utilizing land.

Since most subsistence crops are early maturing ones, it is therefore possible that a number of crops can be planted in a series on the same plot. Table 11 shows the number of days that keep a plot occupied before it is ready for another crop.

A plot could be planted a number of times depending on the kinds of crops a farmer plants. Table 11 shows that some crops will require less than 100 days which include harvesting and field preparation before a plot can be made ready for second cultivation if the scale of production is kept at the level of our demo plot. For wider cultivation, it will require a little longer period. On the basis of our experience with the demo plots, a factor of two-man days at most including drying is required to cultivate a 500 sq. m. plot.

Since it is not advisable to plant similar crops in a series in the same piece of land, a farmer therefore can combine a number of crops which have short maturing time thereby increasing the frequency of cropping. Assuming that there is a cumulative effect of production from frequency of cropping, the higher the frequency, the larger will be its absolute total production. Since this serializing of crops will emphasize rotation of different crops, not repetition, it is anticipated that the level of production can be kept at an optimal level. Various leguminous crops (see Table 10) can easily be rotated with other non-leguminous ones.

PRODUCTION

Given the farmers' cropping style, how much are they producing from their farms? To measure production, crude weights of products were taken. No attempts were made to determine the relative caloric efficiency of different crops.

Three categories of studied units will again be analyzed separately, i. e. case studies, census study and demo plot study.

Case Number One: Table 12 shows the level of production of Case No. 1 for every crop and for all crops on a monthly basis. The total producton for every crop during a period of 10 months is also shown.

In a period of 10 months, the farmer produced more than one ton (1,130.975 kilograms). Assuming that he is producing around 113 kilograms per month (see Table 12), in a period of 12 months he must be producing approximately 1,357 kilograms of food crops. Since there are 7 persons in the househod, the per capita annual production for this household is approximately 194 kilograms. This suggests that for every member in the household, there is only around one-half kilogram of food products coming from 21 different crops available to a person every day. Considering the diversity of these crops, the nutritional value of these crops must be relatively good.

The greatest bulk of his production comes from a major carbohydrate producer root crop (*Xanthosoma violaceum* Schott.). This is followed by a fruit vegetable rich in vitamins, squash (*Cucurbita maxima* Duch.). Slightly over 5% of its total production comes from a protein rich vegetable, Baguio beans (*Phaseolus vulgaris* L.). If we take all the products derived from various varieties of leguminous or bean products (see Table 13), its contribution to the total household production is something like 7%.

The monthly production pattern is, however, not constant. Figure 3 shows that the highest production took place in September 1985; and the yowest — in July 1985, November 1985 and February 1986 during the period when the household production was monitored. It should be noted that the months of January and February 1986 were abnormal months. A strong rain and wind hit the area continuously during the last two weeks of January and continued toward the first two weeks of February. Plots on valleys were inundated by deep waters and the crops on the hillside were leveled to the ground by strong winds. In fact the center of the Project was covered by water up to its rooftop. Farm activities and field activities of the farmers and the field workers respectively have to be suspended temporarily.

It took the farmers another month to recover from the calamity. This suggests that our production level during this period of monitoring had been abnormally reduced.

Case Number Two: Unlike Case Number 1, Case Number 2 has fewer crops than Case Number 1 but with more production than the former. The production level of Case Number 2 is more than twice that of Case Number 1. However, this does not necessarily disprove our contention that crop diversity increases production. We should remember that Case Number 2 has actually diversified his crops (with nine crops) but on a level lower than that of Case Number 1. While Case Number 1 has planted 21 different crops, Case Number 2 has only nine. This seems to suggest that crop diversification requires certain level to be reached beyond which no much difference can be experienced between the number of varieties. Beyond this threshold diversification the only factor that will make the difference in their level of producion will be maintenance of the farm. Our qualitative observation seems to support this for the two case studies we made. For practical considerations, therefore, farmers should be warned that diversification of crops alone is not a sole guarantee for increased production. There are other factors to consider and one of these is farm maintenance.

Table 14 shows the level of production for every crop and all crops on a monthly basis. While Case Number 1 had his largest production in *Xanthosoma violaceum* (a carbohydrate—rich rootcrop). Case Number 2 has no production from this crop as yet. It was noted earlier that Case Number 2 planted this rootcrop very lately only. Case Number 3 has a completely different farming style and interest from Case Number 1 (see Table 15). Tomato (*Lycopersicon esculentum* L.) has the highest contribution to his total production followed by eggplant (*Solanum melongena* L.), some of the lowest from the farm of Case Number 1. This level of crop diversity has provided him (Case Number 2) certain amount of security and his choice of crops and the maintenance of his farm have provided him some amount of profitability.

Case Number 2's farming style is surely more profitable than Case Number 1. With its production level of 2,928 kilograms in 11 months, this suggests an annual yield of approximately 3,1[illegible] kilograms. With his seven members in the household, this provides a per capita annual supply of 456 kilograms. This provides a daily supply of food per household of 1.2 kilograms, more than double than that of Case Number 1.

A question that may be raised for Case Number 2 is: Where does he get his carbohydrate supply? It is very apparent that of the total yield of 11 months, Case Number 2 produced only 18 kilograms of corn (*Zea mays* L.). The rest are vegetables. This is surely not enough for his carbohydrate needs. As mentioned earlier, Case Number 2's choice motif in farming is "vegetable production." He has mainly specialized in vegetable production but diversified it by planting those vegetables that provide better price and yield security. The first three crops, as we saw earlier have more stable and higher price and less sensitive to pests. *Capsicum annum* L. which has the highest price, although fluctuating, is also very sensitive to pests unlike *Solanum melogena* L., Baguio beans, and *Lycopersicon esculentum* L. If we look at Table 15, it is very apparent that it has the lowest ranking. Case Number 2 converted his higher cash returns from high priced vegetable by purchasing corn grits for his carbohydrate needs. He claims that this is more efficient.

Case Number 2 is an excellent example where trade-offs are adequately handled to bring optimal profitability to his household. Evidence on production suggests that the style of farming he has selected, as we saw earlier, provided him a better deal for his concern for survival.

How fluctuating is his production during the entire 11-month of documentation? Figure 3 shows a highly erratic production for Case Number 1. Case Number 1 and Case Number 2 are exposed to the same climatological factors. They all had to go through the one-month conflagration discussed earlier. Hence, their difference is only in their style of managing their farms. Figure 4 is telling a lot.

Security is usually measured on the basis of frequency and acuteness of dip or fluctuation of production level. While Figure 3 only shows one major fluctuation or dip in production, it reflects a highly acute one. For instance, in the month of February, when a strong rain and wind hit the area, its production for the whole month went down to as low as 12 kilograms; while for Case Number 1, production during this month went down to only 60 kilograms. The fluctuation for Case Number 2 went down to five times lower than that of Case Number 1.

After the fluctuation, the recovery rate for the two cases seems to be the same. It is difficult to assess what happened between the two cases during the next few months since we were forced to stop the monitoring of the first case due to the worsening peace and order condition in the area where Case Number 1 resides. These two case studies were purposely done on two farmers inhabiting the two opposite sides of the lake, situated around three kilometers apart. For Case Number 2, its production durin the second month after the February calamity went to as hig as seven times that of February. In May, the third month afte this went up to around 14 times.

In the fourth month, however, fluctuation in production agai took place but this time within the manageable level of the farme This low production still provides a per capita production for th household members around 39 kilograms of food resources. Th means a daily supply for every household member of more tha 1 kilogram. This is still twice as much as what Case Number produces during the entire period of monitoring.

For Case Number 2 on the whole, it seems to suggest th there is more certainty in the generation of food from a mo diverse cropping system. This is reflected by the intensity in th dip of its production during the flood months. The highly diver cropping system still produces five times more than the less d verse one during this period of difficulty.

This is precisely the point we want to make. Different far ers have different ways of handling contingencies. The issues profitability and security will have to be dealt with in a mo balanced fashion. While it is true that the absolute production February went to as low as 12 kilograms only, the savings th the farmer must have been making from the good months allow him to absorb the deficit during the month of misfortune.

Census Study

From the 12 farmers who have been monitored on producti on a monthly basis beginning August 1985 to July 1986, 23 d ferent crops have been produced and recorded. Table 16 shows th level of production of these crops by the 12 farmers.

Our two case studies are typical farmers of the locality reflected by the pattern of production from the 12 farmers. T top producing crop of our census is *Xanthosoma violaceum* Sch (which is also the top product of Case Number 1), while *Lyco sicon esculentum* Mill, is the second top producer for the 12 fa ers (which is also the top product of Case Number 2). There is a certain degree of agreement between our case and census studies in the prioritization and choice of crops by the farmers. This suggests a certain degree of commonality between farmers in the Lake Balinsasayao area in the way they select and produce crops.

However, the mean production level between our case studies and the census study is quite different. The mean production of Case Number 1 is within the range of the mean production of the 12 farmers while that of our Case Number 2 is outside and higher than the maximum limit for mean production of the 12 farmers. This suggests that Case Number 2 is an extreme case representing the most successful farmer in terms of productivity of his farm.

On a gross level, what are the factors that affect production level in the household? Nine different variables were tested with production level: number of persons in household (NOPH); number of labor force members in household (NOLFOH); length of stay of farmer in the community (LOSFAC); total area of farm (TAF); percentage slope of farm (PESFARM); number of years farmer is cultivating farm (NUYFAC); number of varieties of nitrogen fixing trees (NOVNIFIX); total length of soil protection devices installed (TOLSOP); and total number of crops planted (TONCROP). Table 17 shows the results.

If we use .5 as a minimum acceptable value, there are only four variables that are correlated with total production. These are LOSFAC, NUYFAC, NOVNIFIX and TOLSOP. The negative relationship between production level and LOSFAC as well as NUYFAC is expected since it was assumed that the longer the farmer cultivates his farm without proper conservation measures, the more degraded his farm becomes. Hence lower production is expected. Since there is a positive correlation between LOSFAC and NUYFAC (see Table 17), there must be a negative correlation between these two variables and production level.

An unexpected negative correlation between production and number of varieties of nitrogen fixing crops planted, however, exists. This is puzzling since it was assumed initially that the leguminous crops planted, the better the soil condition will be. The present soil condition may be explained by the following possible conditions:

(1) Since the soils are already degraded as indicated by the relationship between NUYFAC, LOSFAC and production, it is possible that the increasing number of leguminous plants on their farms are recent developments as results of the Program and hence its effects on production are not yet demonstrated. Thus low production on degraded farms will still continue until the effects of the nitrogen fixers are felt by the crops;

(2) Since the nutrient rehabilitation process by nitrogen fixers is a complex process, its effects on the farms cannot be immediately felt. Closer observation on the farm shows that most of these nitrogen fixers are very recent introductions;

(3) It is possible that these nitrogen fixers may not actually be fixing nitrogen since other necessary elements are absent. Some plants do not fix nitrogen when rhizobium is not adequate; and

(4) Other nutrients which nitrogen fixers cannot provide could be inadequate (i. e. molybdenum).

Since these conditions are still hunches, they call for further investigation in the field.

There is a positive correlation between total production and total length of soil protection devices installed. The more soil protection devices put up on the farms, the higher the total production experienced. Since the effects of the soil protection devices are immediate, i. e. soils being trapped from erosion including its nutrients; the effect on plants, especially for the short term subsistence crops, must be immediate. Personal experience with their farmers showed that in areas where soils are trapped and preserved, there is a great physical difference of crops with those growing on eroded farms.

Of the four factors affecting total production, number of years farmer cultivates his farm is the best predictor for total production. This factor explains around 67% of the variance on the household production. The following figure shows the various regression curve of total production as affected by the three independent variables (LOSFAC, NUYFAC, TOLSOP). The change in production caused by the increase in the total length of soil protection devices installed on the farm is still very slight. Although the relationship is positive, we can expect only a very slight increase in production at present. What does this imply? Does this mean that soil conservation input will have only very limited impact on production? Not necessarily. While it is true that the impact as of the moment is still negligible, at least the beginning of its impact can already be felt. Most of these soil protection devices are barely a year old. It should be remembered that the effect of conservation is cumulative and this can be better assessed using longitudinal measures rather than synchronic micro measurements.

Demo Farm

As mentioned earlier, one of the concerns we wanted to measure is the productivity of certain crops per area and per unit of time. With this, we hope to identify the most productive crop in the area. The argument is that the farmers will have a better deal with their life if the most adapted crops in the area are chosen for optimal production.

The performance of the crops in our demo is not really challenging. This is not surprising since we have purposely selected a site that is marginal in fertility and in slope. Nevertheless, our data still show that different crops indeed have different levels of productivity.

Of the 15 crops we have tried under three different slopes (see Table 18), *Lycopersicon esculentum* Mill. has the highest production, yielding more than six tons per hectare in one year. This is assuming that a farm is cultivated continuously in one year and planted with tomatoes. This is followed by bush beans (*Phaseolus lunatus* L.), more than five tons. *Zea mays* L. planted in three different slopes consistently produced more than 2 tons although one that was planted on a less sloping plot produced around 500 kilograms more than that planted in a more sloping one. Habicrueles (*Dolichos lablab* L.), another leguminous plant yielded more than one ton on a 60% slope demo plot while a 70% slope yielded only one ton less than that of the 60% slope farm. Although the slope difference between these demo farms is negligible, the difference in the soil condition (i. e. fertility) between these sites is tremendous. The one with the steep slope has a highly degraded soil.

The most productive crops in the demo plots represent the ones with a rather complete nutrient composition (i. e. with carbohydrate, protein and vitamins). If these crops are picked out by the farmers, these will be nutritionally beneficial to them and to their farms. Two leguminous crops are top producers and they are highly marketable with profitable prices.

IMPLICATIONS FOR DEVELOPMENT

The farming styles delineated in our study are indicated in at least any of these forms; proft orientation, security orientation and combination of profitability and security orientation. High diversity of crops on the farm provides adequate buffer to failure hence even in periods of critical conditions, certain amount can be expected. Our data show that fluctuation of products in this case is not very deep compared to the less diverse cropping systems.

Profitability orientation is short term based but this can be achieved to a certain degree by conservation measures. Developing a particular theme or motif on the farm means that a farmer can concentrate production of highly marketable crops with better market price but keep a number of related crops so that certain amount of crop diversity is maintained on the farm. This a style that attempts to combine security and profitability.

Among subsistence farmers, however, profitability is not their major concern. Our data show that among the Lake Balinsasayao farmers nobody has gone into profitability considerations as a basis for selecting a particular cropping system. Profitability tends to develop a cropping style that concentrates on very few crops with high yield and market price. On the basis of our production data from our demo, *Lycopersicon esculentum* Mill. is a top producer with a fairly good price but nobody has ever concentrated on this crop. Bush beans (*Phaseolus lunatus* L.) ranks

...nt but still this not come up as the cropping focus for our farmers. While it is true that the first crop ranks high for Case Number 2 the rest of the crops he planted indicate that he does not concentrate on one variety.

Hence, among subsistence farmers, it appears that the combination of profitability and security should be the major consideration when adaptive cropping style has to be developed. The motif of cropping for Case Number 2 is ideal but it is still sensitive to extreme physical and social conditions. It can still go down to nothing on production when a number of stresseors take place. Case Number 1 tends to perform better than Case Number 2 on extreme conditions. While it is true that fluctuation still iakes place in Case Number 1, yet it is not as deep as in Case Number 2 (see Figure 6). Even during illness of a farmer, it is very apparent that production can still go on.

Monthly production that are lower than the mean are sources of problems. The mean issue for security measures is how to reduce the production decline from the mean and keep its frequency of occurrence very low. This can easily be checked by increasing the variety of crops.

One strategy of increasing diversity of crops is to introduce a number of security crops on farm edges which are less disturbed by cultivation. Short maturing crops are usually planted at the center or strategic site of the farm. These constitute the profitable ones while those on the fringes are the security ones. Case Number 1 has introduced crops such as *Secheum edule* L. and *Xanthosoma violaceum* L. at the fringes of his farms.

Another strategy is to plant cash tree crops on boundaries. Many fruit bearing trees can be inroduced such as *Coffee arabica* and *Theobroma cacaea* L. Case farmer Number 1 has planted a good amount of these crops along boundary lines and edges of contoured rockwalls, contoured canal, and contoured bench terraces.

While there is a rather low correlation between the effect of soil erosion and fertility control measures and a negative one of the planting of leguminous crops and its effects on production, this does not necessarily negate the fact that these factors should be taken seriously. Considering that these measures have been introduced only very lately, their effects are still quite difficult to assess. More and continuing efforts toward measuring these phenomena are therefore imperative.

The data strongly suggest that there is a need to double up intervention efforts on farms that have been cultivated for a long time. It is not surprising therefore, to find these farms at this time to be having the lowest production level due to soil degradation caused by continuing human activity without proper conservation mesaures introduced. These farms should be given top priority by any programs that assist farmers to increase their production and conserve their resources. This does not, however, suggests that the new clearings be left out. In fact similar attention should be given to these sites before production begins to decline. Needless to say, as the cultivation period is lengthened without introducing appropriate soil conservation measures, production will eventually be reduced.

As farmers are encouraged to diversity crops on the farms the more likely they are going to plant more leguminous crops. This will obviously allow them to provide enough restorative crops for soil fertility and productivity. Therefore, extension workers should provide them a list of the names of leguminous plants and the seeds. This list should put priority on nitrogen fixers for nutrient improvement of the soil as well as for improving the food quality for human consumption. Since farmers shall have planted all that are available to them as they diversify, any assistance programs that will provide such list of crops with the corresponding seed supply will be very useful to farmers. In this way, we are creating an opportunity for the farmers to increase the number of leguminous crops in their fields.

SUMMARY AND RECOMMENDATIONS

The following major points should be emphasized:

(1) subsistence farmers in the upland prefer those cropping styles that provide security and profitability;

(2) Cropping styles that provide profitability only, entail greater risks and hazards to the farmers;

(3) Cropping styles that will allow opportunities to obtain profit and security for the farmers should be developed;

(4) Production decline is associated with length of cultivation of the farm without proper conservation measures hence activities should be geared toward rehabilitation of such farms;

(5) New farms need similar attention so that soils can be conserved before they are lost. The longer the farms tilled without protection measures the more losses it will incur;

(6) Since there is no relationship yet existing between percentage slope of farm and the total length of soil protection measures, this suggests that there is a need for more efforts to encourage farmers owning sloping lands to install these mechanisms. In fact, a negative correlation coefficient is existing between these variables;

(7) While it is true that there is less interest of farmers in highly sloping lands (negative correlation between area of farm owned and percentage slope of farms) there are still farmers who have cultivated highly sloping lands. They should be given more attention in implementing soil protection measures.

The inconclusive evidence concerning the relationship between total production and the implementation of the soil protection devices and the increasing variety of leguminous crops planted on the farm requires further documentation. If these factors do not in fact highly affect production then we may be wasting our efforts in installing these measures and diversifying crops using leguminous crops as the diversifiers. Intuition and common sense suggest that they do not in fact affect production. For more authoritative claims, however, we need more empirical evidence.

Land Ar

Crops
1. Caps
2. Bagu annu
3. Cucu maxi
4. Habi
5. Zea
6. Lycop escul
7. Xanth violac
8. Manik escule
9. Pecha
10. Phase radiat
11. Allium
12. Nicoti tubacu
13. String
14. Sword
15. Millet
16. Cajanu
17. Alogba
18. Ananas comosu
19. Sacchar officina
20. Oryza s
21. Musa paradisi
22. Solanum melong
23. Okra

APPENDIX

Table 1

Area Distribution of Crops on a 2.2 Hectare Farm Case During a 14-Month Period

Crops	Number of Times Crop Planted or Number of Plot Crop Planted From Feb. 1985 to March 1986	Minimum Area (Sq. Meters)	Maximum Meters) Area (Sq.	Mean Area (Sq. Meters)	Coefficient of Variation
Capsicum					
Baguio beans	10	20	320	112.9	.85
annum L.	15	12	323	109.7	.97
Cucurbita					
maxima Duch.	6	66	371	198.5	.52
Habichuelas	5	20	234	112.5	.83
Zea mays L.	12	16	192	82.1	.66
Lycopersicon					
esculentum Mill.	8	19	371	225.5	.53
Xanthosoma					
violaceum Schott.	7	42	1,125	331.1	1.12
Manihot					
esculenta Schott	4	20	66	43.0	.62
Pechay	9	40	371	210.0	.47
Phaseolus					
radiatus L.	2	10	66	38.0	*
Allium cepa L.	2	75	100	87.5	*
Nicotiana					
tabacum L.	1	NAP	NAP	90.0	*
String beans	1	NAP	NAP	236.0	*
Sword beans	1	NAP	NAP	132.0	*
Millet	2	9	192	100.5	*
Cajanus cajan L.	2	66	68	67	*
Alogbati	1	NAP	NAP	371	*
Ananas					
comosus L.	2	20	175	97.5	*
Saccharum					
officinarum L.	1	NAP	NAP	175	*
Oryza sativa L.	1	NAP	NAP	65	*
Musa					
paradisiaca L.	1	NAP	NAP	130	*
Solanum					
melongena L.	2	56	371	213.5	*
Okra	1	NAP	NAP	378	*

Table 2

Frequency of Episodes and Rank of Planting Compared With Prices Per Kilogram and Rank of Prices of Selected Products Commonly Marketed (Case 1)

Selected Crops	Planting Episodes: Frequency in a period of 14 Months	Planting Episodes: Rank	Price Pattern (Pesos): Range of Price Per Kilogram	Price Pattern (Pesos): Rank
1. Capsicum annum L.	15	1	P12-P25	1
2. Lycopersicon esculentum Mill.	8	3	P 5-P12	3
3. Cucurbita maxima Duch.	6	4	P 2-P 5	4.5
4. Baguio beans	10	2	P 6-P15	2
5. Secheum edule	NI	NI	P 3-P 4	4.5
6. Solanum melongena L.	2	5	P 5-P 8	6

Table 3

Rainfall Pattern During 1983

Months	Rainfall (Mm)
January-February	308
March-April	37
May-June	217
July-August	984
September-October	668
November-December	674

Table 4

Area Distribution of Crops in a 1.5 Hectare Farm Case During an 11-Month Period

Crops	No. of Times Crop Planted or No. of Plot Crop Planted From August 1985 to June 1986	Minimum Area (Sq. Meters)	Maximum Area (Sq. Meters)	Mean Area (Sq. Meters)	Coefficient of Variation
Lycopersicon esculentum Mill.	7	10	310	182	.72
Zea mays L.	2	300	315	308	*
Xanthosoma violaceum Schott.	1	NAP	NAP	600	*
Baguio beans	5	10	600	134	1.94
Solanum melongena L.	3	100	420	313	.34
Momordica charantia L.	1	NAP	NAP	30	*
Pechay	1	NAP	NAP	30	*
Capsicum annum L.	5	20	600	134	1.94

Table 5

Specific Schedule of Planting and Acreage of Plots for Various Crops (Case No. 2)

Crops Planted	Area Planted (Sq.M.)	Date Planted
1. Tomatoes	300	15 June 1986
2. Tomatoes	300	16 June 1986
3. Corn	300	17 June 1986
4. Carnabal	600	23 April 1086
5. Baguio beans	600	30 April 1986
6. Baguio beans	16	10 Feb. 1986
7. Corn	315	17 Feb. 1986
8. Tomato	147	19 Feb. 1986
9. Eggplant	420	24 Feb 1986
10. Ampalaya	200	2 Jan. 1986
11. Tomatoes	200	2 Dec 1985
12. Baguio beans	10	2 Dec. 1985
13. Baguio beans	20	18 Dec. 1985
14. Pechay	30	18 Dec. 1985
15. Bell pepper	150	30 Dec. 1985
16. Tomato	310	16 Oct. 1985
17. Bell pepper	142	15 Oct. 1985
18. Baguio beans	24	1 Oct. 1985
19. Bell pepper	315	1 Oct. 1985
20. Eggplant	419	12 Sept. 1985
21. Tomatoes	10	11 Sept. 1985
22. Bell pepper	20	4 Sept. 1985
23. Tomatoes	10	29 Aug. 1985
24. Eggplant	100	29 Aug. 1985
25. Bell pepper	32	14 Aug. 1985

Table 6

Descriptive Statistics or Selected Variables of the 12 Farms Censused

Selected Variables	Mean	Minimum	Maximum	Coefficient of Variation
Number of persons in household	5.67	4.00	7.00	.21
Number of labor force available in household	3.50	2.00	6.00	.47
Number of years farmers live in the community	36	3	60	.59
Total area of farm	1.42	1.00	2.00	.35
Percentage slope of farm	43	28	55	.25
Number of years farmers cultivate farms	23.50	10	45	.58
Number of varieties of nitrogen fixing trees	2.50	0	5	.83
Total length (in meters) of various forms of soil conservation devices installed on farms	45.67	230	800	.42
Total number of crops planted on the farm	13.83	7	24	.51

Table 7

Correlation Matrix of 10 Selected Variables

	NOPH	NOLFOH	LOSFAC	TAF	PESPFARM	NUYFAC	NOVNIFIX	TOLSOP	TONCROP	TOKILALL
NOPH	1.000									
NOLFOH	.201	1.000								
LOSPAC	-.078	.578	1.000							
TAF	.448	.186	.411	1.000						
PESFARM	-.300	-.331	-.049	-.756	1.000					
NUYFAC	.158	.830	.696	.128	.033	1.000				
NOVNIFIX	.319	.382	.812	.834	-.436	.409	1.000			
TOLSOP	.641	-.092	-.531	.150	-.415	-.481	-.108	1.000		
TONCROP	.062	.266	.820	.799	-.410	.303	.960	-.258	1.000	
TOKILALL	-.082	-.400	-.767	-.184	-.321	-.816	-.532	.681	-.479	1.000

Table 8

Identified Correlated Variables and the Level of Variance Explained by Independent Variables

Variables	r	r2	Percentage of Variance of Dependent Variable as Explained by Independent Variable
Percentage slope of farm and total area of farm	-.756	.572	57.20%
Number of years farming the farm and number of labor force in household	.830	.689	68.90%
Number of varieties of nitrogen fixing plants and length of stay in the farm	.812	.659	65.90%
Number of varieties of nitrogen fixing plants and total area of farm	.834	.696	69.60%
Total number of crops and length of stay of farmers in the community	.820	.672	67.20%
Total number of crops and number of nitrogen fixing plants	.960	.922	92.20%
Total number of crops and total area of farm	.799	.638	63.80%
Total kilograms of products produced and length of stay in the community	-.767	.588	58.80%
Total kilograms of products produced and number of years farmer stay in the farm	-.816	.666	66.60%

Table 9

Correlation Coefficient (r), Coefficient of Determination (r^2) and Regression Equation of Various Variables

Independent Variable	Dependent Variable	r	r2	Regression Equation
Percentage slope of farm	Total area of farm	-.756	.572	Y=2.932+-.035X
Number of persons in household	Total length of soil protection device	.641	.411	Y=122.727 + 101.364X
Number of labor force in the household	Number of years cultivating the farm	.830	.869	Y=-.481+6.852X
Length of stay in the farm	Number of Varieties of nitrogen fixing plants	.812	.659	Y=-.349+.079X
Total area of farm	Number of varieties of nitrogen fixing plants	.834	.695	Y=-2.483+3.517X
Total number of crops	Number of Varieties of nitrogen fixing plants	.960	.922	Y=-1.388+.281X
Length of stay of farmers in the community	Total number of crops planted on the farm	.820	.673	Y=3.988+.273X
Total area of farm	Total number of crops planted	.799	.639	Y=-2.483+11.5[illegible]

Table 10

Cropping and Production Patterns of Demo Plots (Lake Balinsasayao)

[illegible]	Demo Site (2)	Date Planted (3)	Area Planted (Sq.M.) (4)	Harvesting Episodes: No. of Episodes (5)	First Day of Harvest (6)	Last Day of Harvest (7)	Total Quantity Harvested (Kg) (8)	Estimated Quantity Harvested From One Hectare 10,000/ Col. 1 x Col.8) (Kgs) (9)
[illegible]								
[illegible] L.	1	4/17/86	168	1	8/23/86	8/23/86	2.5	149
[illegible]								
[illegible] L.	1	7/85	224	1	8/23/86	8/23/86	3	134
[illegible]	1	4/18/86	60	1	6/27/86	6/27/86	.5	83
[illegible] L.	1	5/2/86	80	1	7/30/86	7/30/86	2.5	313
[illegible] L.	1	5/2/86	44	1	8/29/86	8/29/86	2	455
[illegible] L.	1	6/2/86	44	3	9/13/86	9/24/86	7	1,591
[illegible]	1	4/1/86	60	1	7/30/86	7/30/86	2	333
[illegible]								
[illegible] Mill.	1	6/27/86	80	2	9/8/86	9/19/86	.4	50
[illegible]	1	5/20/86	44	2	9/9/86	9/19/86	2.5	568
[illegible]	1	4/18/86	20	4	7/28/86	9/19/86	.9	450
[illegible]	1	4/24/86	18	7	7/29/86	8/30/86	3.4	1,889
[illegible]								
[illegible]	1	5/18/86	60	1	7/14/86	7/14/86	.5	83
[illegible]								
[illegible] Mill.	1	6/23/86	18	9	8/5/86	9/13/86	5.3	2,944
[illegible]								
[illegible] Jacq.	1	5/23/86	155	1	7/25/86	7/25/86	5.5	355
[illegible]								
[illegible] L.	1	4/9/86	155	2	8/19/86	9/4/86	4.0	258
[illegible]	1	4/28/86	155	1	9/4/86	3.5	236	
[illegible]								
[illegible] Mill.	1	6/19/86	60	7	8/18/86	9/14/86	2.5	417
[illegible]	1	7/8/86	44	2	9/7/86	9/10/86	.25	57
[illegible]	2	5/29/86	117	1	7/25/86	7/25/86	1.50	128
[illegible] L.	3	4/22/86	160	1	8/4/86	8/4/86	15	938

Table 11
Estimated Number of Days Required for a Plot Before it Becomes Ready for An-other Crop.

Crops	Number of Days Required From Planting to Final Harvest	Number of Man-Days Required to Cultivate a 500 Square Meter Land (Including Drying)	Total Number of Days Required To Make a 100 Square Meter Plot Ready For Planting	Estimated Number of Croppings Per Year
1. Colocasia esculenta L.	126	2	128	3
2. Manihot esculenta L.	395	2	397	1
3. Baguio beans	63	2	65	5
4. Zea mays L.	107	2	109	3
5. Bulb onion	119	2	121	3
6. Lycopersicon esculenium Mill.	84	2	86	4
7. Habitchuelas	88	2	90	4
8. Leafy onion	151	2	153	2
9. Bush beans	80	2	82	4
10. Phaseolus radiatus L.	78	2	80	4
11. Cucurbita maxima Duch.	62	2	64	6
12. Ipomea batatas L.	145	2	147	2
13. Peanut	126	2	128	3
14. Okra	62	2	64	6

Table 12

Production Pattern of Case # 1

Months Harvested (Kilograms)

[illegible]	June 1985	July 1985	Aug 1985	Sept 1985	Oct 1985	Nov 1985	Dec 1985	Jan 1986	Feb 1986	Mar 1986	All Months
[illegible] beans	12.25	9.5	0	.125	0	1	0	20	8	10	60.875
[illegible]ita [illegible] Duch.	19.50	22	58.5	53	49.5	0	12.5	9	0	0	224
[illegible] L.	29.8	0	0	0	65	10.5	0	0	2	0	107.3
[illegible]chuelas	2	0	.125	0	0	0	0	0	0	0	2.125
[illegible]	10	0	5	16	44	24	48.5	4	12	70	233.5
[illegible] L.	4	0	0	.125	4.75	5	0	7	10.8	9	40.675
[illegible] L.	.5	5.25	16.25	15.5	5.63	0	0	0	16.5	0	59.630
[illegible]rsicon [illegible]	3.0	4	.75	.625	0	0	0	0	0	0	8.375
[illegible] L.	16	14.25	6.5	2.5	0	0	0	0	0	0	39.250
[illegible] beans	5	3	1.125	0	0	0	0	0	0	0	9.125
[illegible] L.	2	0	0	0	0	0	0	0	0	0	2
[illegible] L.	0	0	19	0	0	0	0	0	0	0	19
[illegible]	0	0	.87	12	0	0	0	0	0	0	12.87
[illegible]	0	0	0	30	0	0	0	0	0	0	30
[illegible] L.	0	0	0	3.5	9	5	7	0	0	0	24.5
[illegible]	0	0	76	58.5	0	0	0	10	0	0	144.5
[illegible]	0	0	0	30	0	0	0	0	0	0	3
[illegible]	0	0	0	0	0	2	0	0	0	0	3
[illegible] L.	0	0	0	0	0	.5	0	0	3	0	3.5
[illegible]	0	0	0	0	0	0	8	0	8	11	27
[illegible]	0	0	0	0	0	0	51.75	26	0	0	77.75
[illegible]	104.05	58	184.12	194.88	177.88	48	127.75	76	60.30	100	1,130.975

Table 13

Relative Proportion and Ranks of Products to Total Production During 10 Months of Participatory Monitoring (Case No. 1)

Products	Percent of Product to Total Production	Rank
1. Xanthosoma violaceum Schott.	20.6	1
2. Cucurbita maxima Duch.	19.8	2
3. Secheum edule L.	12.8	3
4. Zea mays L.	9.4	4
5. Pechay	6.9	5
6. Baguio beans	5.4	6
7. Momordica charantia L.	5.3	7
8. Colocasia esculenta L.	3.6	8
9. Capsicum annum L.	3.5	9
10. Alogbate	2.7	10
11. Ipomea batatas L.	2.4	11
12. Manihot esculenta L.	2.2	12
13. Musa paradisiaca L.	1.7	13
14. Allium cepa L.	1.1	14
15. String beans	.8	15
16. Lycopersicon esculentum Mill.	7	16
17. Solanum melongena L.	.4	17
18. Sikwa	.3	18
19. Habitchuelas	.2	19
20. Phaseolus radiatus L.	.1	20
21. Cajanus cajan L.	.1	21
	100.0 (1,130.975 kg.)	

Table 11

Production Pattern of Case # 2

Months Harvested (In Kilograms)

Crops Harvested	Aug 1985	Sept 1985	Oct 1985	Nov 1985	Dec 1985	Jan 1986	Feb 1986	Mar 1986	Apr 1986	May 1986	Jun 1986	All Months
1. _Lycopersicon esculentum_ Mill.	197	174	3	45	49	4	0	0	10	540	10	1,032.00
2. _Zea mays_ L.	0	0	0	0	0	0	0	0	0	80	0	80.00
3. _Xanthosoma violaceum_ Schott.	0	0	0	0	0	0	0	0	0	0	0	0
4. _Capsicum annum_ L.	0	2.5	9.5	9	17.25	3	0	0	0	0	0	41.25
5. Pechay	0	0	0	0	0	6	10	0	0	0	0	16.00
6. Baguio beans	39	13	90.5	64.5	22	6	0	0	101	26	10	372.00
7. _Solanum melongena_ L.	0	0	11.5	91	106	12	2	60.5	309	209	90	891.00
8. _Momordica charantia_ L.	109	50	19	1	0	0	0	0	0	6	141	326.00
9. _Cucurbita maxima_ Duch.	0	0	33	43	57	0	0	0	0	16.5	20	169.50
All Crops	345	239.5	166.5	253.5	251.25	31	12	60.5	420	877.5	271	2,927.75

Table 15

Relative Proportion and Ranks of Products to Total Production During 11 Mon
of Participatory Monitoring (Case No. 2)

Crops Harvested	Percent of Product to Total Production	Ran
1. Lycopersicon esculentum L.	35	1
2. Solanum melongena L.	30	2
3. Baguio beans	13	3
4. Momordica charantia L.	11	4
5. Cucurbita maxima Duch.	6	5
6. Zea mays L.	3	6
7. Capsicum annum L.	1	7
8. Pechay	.5	8
9. Xanthosoma violaceum L.	0	9
Total	99.5	

Mean Household Production Leve (In Kilograms) of Various Crops From 12 Farmers Censused on a MOnthly Basis From August 1985 to July 1986

Products	Minimum	Maximum	Mean	Coefficint ofVariation	Rank
Xanthosoma violaceum Schott.	0	1,462	588.6	.99	1
Cucurbita maxima Duch.	3.5	224	133.0	.70	4
Secheum edule L.	0	257	123.3	.81	5
Zea mays L.	0	295	92.1	1.19	9
Pechay	0	78	15.6	1.99	15
Baguio beans	0	372	95.0	1.46	8
Momordica charantia L.	0	326	79.1	1.56	10
Colocasia esculenta L.	0	123	36.7	1.21	11
Capsicum annum L.	0	56	26.8	.86	12
Alogbate	0	30	5.0	2.44	18
Ipomea batatas L.	0	225	109.4	.87	6
Manihot esculenta L.	0	52	12.8	1.69	16
Musa paradisiaca L.	0	399	108.3	1.36	7
Leafy onion	0	13	4.1	1.56	19
String beans	0	65	12.4	2.10	17
Lycopersicon esculentum Mill.	0	1,032	215.9	1.89	2
Solanum melongena L.	0	891	159.6	2.25	3
Sikwa	0	3	.5	2.40	22
Habitchuelas	0	2	.7	1.57	21
Phaseolus radiatus L.	0	2	.3	2.67	23
Cajanos cajan	0	18	3.5	2.09	20
Dioscorea esculenta Crantz.	0	69	19.5	1.59	13
Other Products (Miscellaneous)	0	78	16.8	1.89	14
Total Production	1,043	2,848	1,852.3	.35	

Table 17

Coefficients of Correlation (r) and Determination (r^2) Between Production Le
and Nine Other Selected Variables.

Other Selected Variables	r	r^2
NOPH	-.082	.0067
NOLFOH	-.400	.1600
LOSFAC	-.767	.5883
TAF	-.184	.0339
FESFARM	-.321	.1030
NUYFAC	-.816	.6659
NOVNIFIX	-.532	.2830
TOLSOP	.681	.4638
TONCROP	-.479	.2294

Table [illegible]

Estimated Annual Production From A One Hectare Demo Farm (Lake Balinsasayao)

Crops Planted (1)	% Slope of Demo Site (2)	Length of Time From Planting to Harvesting (Days) (3)	Estimated Number of Cropping In One Year With Estimated 30 Day Cultivation Period (4)	Estimated Quantity Produced Per Harvest Per Hectare (5)	Estimated Annual Production From One Hectare (Col. 4 x Col. 5) (6)
1. Colocasia esculenta L.	60	128	3	149	447
2. Manihot esculenta L.	60	418	1	134	134
3. Baguio beans	60	61	6	83	498
4. Zea mays L.	60	114	3	786	2,385
5. Bulb onion	60	60	6	333	1,998
6. Lycopersicon esculenium Mill.	60	59	6	1,137	6,822
7. Habitchuelas	60	112	3	568	1,704
8. Leafy onion	60	102	3	450	1,350
9. Bush beans	60	97	3	1,889	5,667
10. Phaseolus radiatus L.	60	80	4	63	252
11. Cucurbita maxima Duch.	60	64	5	355	1,775
12. Ipomea batatas L.	60	133	2	258	516
13. Peanuts	60	130	2	236	472
14. Okra	60	61	6	57	342
15. Habitchuelas	70	57	6	128	768
16. Zea mays L.	10	105	3	938	2,814

				1985					
1972	1982	1083	1984	Feb.	Mar.	Apr.	May.	Jun.	Jul
Musa textilis Nee	Coffee arabica L.	Coffee arabica L. Capsicum annum L. Theobroma cacao L.	Theobroma cacao L. Bread fruit Ananas comosus L. Nicotiana cabacum L. Capsicum annum L. (2) Colocasia esculenta Scott. Manahot esculenta Schott. Scheum edule	Capsicum annum L. (2) Theobroma cacao L. Ginger	Baguio beans Cucurbita maxima Duch. Habichuelas (7) Zea mays L. (3) Phaseolus radiatus L Allium cepa L. Nicotiana tubacum Capsicum annum L. (2) String beans Sword beans Lycopersicom esculentum Mill. Manihot esculenta Schott. Momordica charantia L. Millet	Baguio beans Zea mays L. (2) Cajanus cajan L. Lycoparsicon esculentum Mill. Habichuelas. Cucurbita maxima Duch. (3) Xantho-soma violaceum Schott. Millet Momordica charantia L. Capsicum annum L. Phaseolus radiatus L.	Habichuelas Baguio beans (2) Xantho soma violaceum Schott. (3) Momordica charantia L. Habichuelas Capsicum annum L. (5) Nicotiana tubacum L.	Habichuelas Zea mays L. (2) Baguio beans	

Figure 1

A Panoramic View of Cropping Style of Cas

1985						1986		
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	Xanthosoma violaceum Schott. (3) Atis Chicos Lanzones Musa paradisiaca L. Lycopersicon esculentum Capsicum L. annum L. Solanum melongena L.	Capsicum annum L. Xantho soma viola ceum Schott. Manihot esculenta Schoot. Lycoper sicon esculen tum Mill. (3) Solanum melongena Momordica charantia L. (2) Zea mays L. (3) Sikwa Baguio beans Alogbati	Pechay (4)	Pechay (3) Ananas comosus L. Capsicum annum L. Baguio beans (2) Cajanus cajan L. Xanthosoma violaceum Schoot. Saccharum offici narum L. Oryza eative L. Zea mays L.	Okra Ananas comosus L. Pechay (2) Ipomea batatas Allium cepa L. Colocasia esculenta Schott. Rambutan Baguio beans Capsicum annum L. Mahinot esculenta Schott. Coffea erabica L.	Pechay (2) Lycoparsicon esculentum Mill.	Zea mayss L. (2) Baguio beans	Manihot esculenta Schott. Momordica charantia L.

of Case Farmer Number 2

1985

Aug	Sept	Oct.	Nov.	Dec.	J
Capsicum annum L.	Capsicum annum L.	Capsicum annum L.	—	Capsicum annum L.	M c
Solanum melongena L.	Lycopersicom esculentum	Baguio beans	—	Petchay	
Lycoper-sicon esculentum Mill.	Solanum melongena L.	Lycopersicom esculentum Mill.	—	Lycopersicom esculentum Mill.	

Fig

A Panoramic View of Cropping

1986

lan	Feb	Mar.	April	May	June
lomordica harentia L.	Solanum melongena L.	—	Baguio beans	—	Zea mays L
	Lycopersicon esculentum Mill.	—	Xanthosoma violaceum Schott.		Lycopersico esculentum Mill.
	Zea mays L. Baguio beans	—			

ure 2
Style of Case Farmer Number 2

Figure 3

Graph Showing Monthly Production Level During A Period of 10 Months (Case # 1)

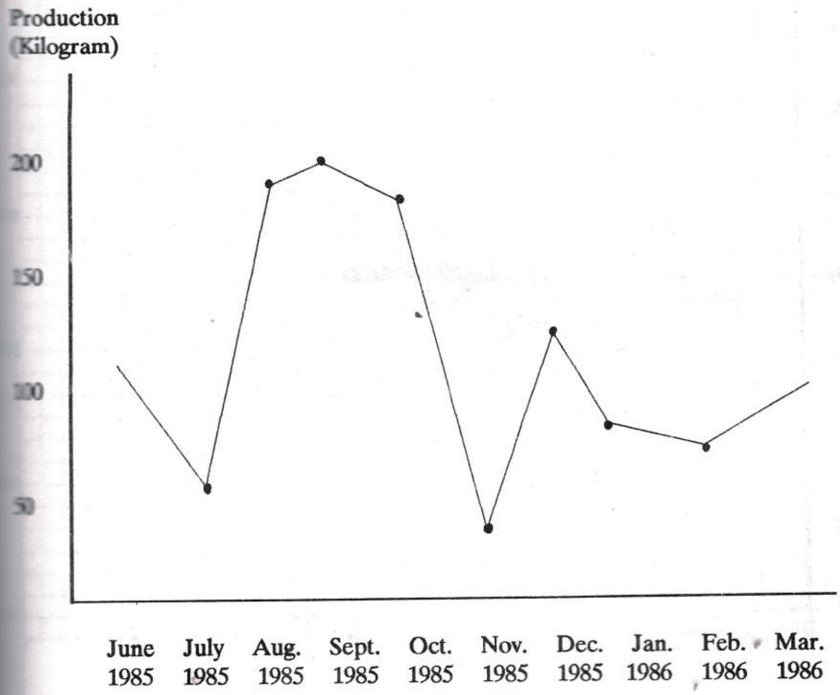
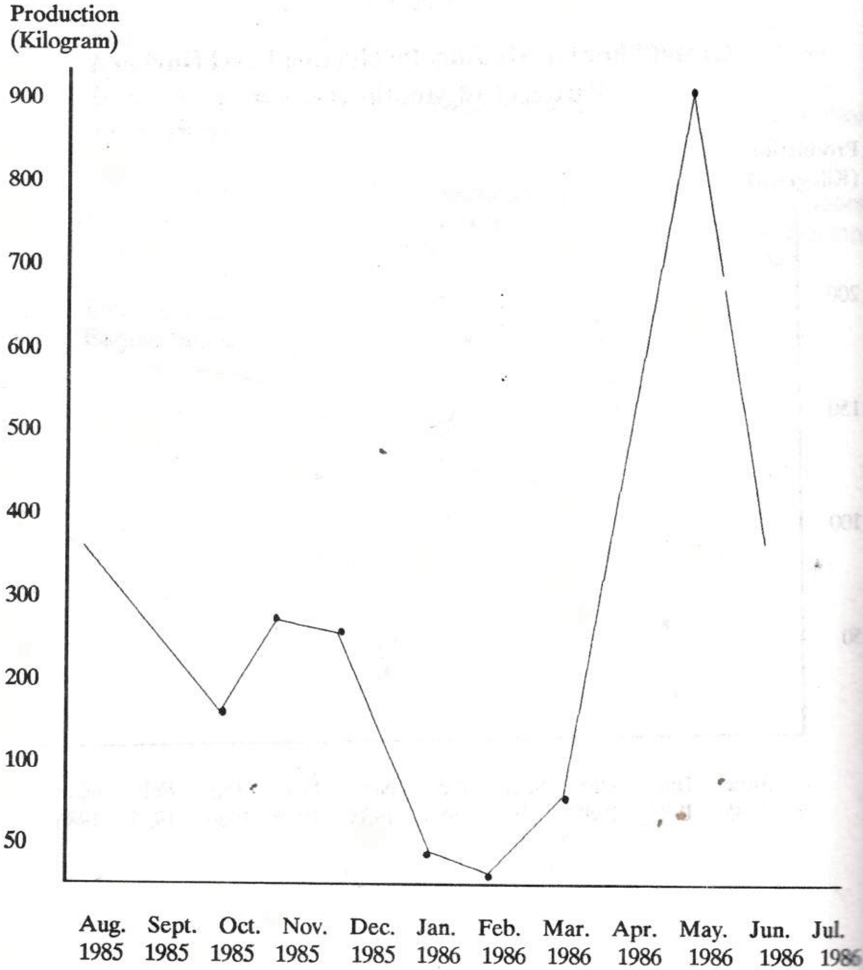


Figure 4

Graph Showing Monthly Production Level During A Period of 11 Months (Case # 2)



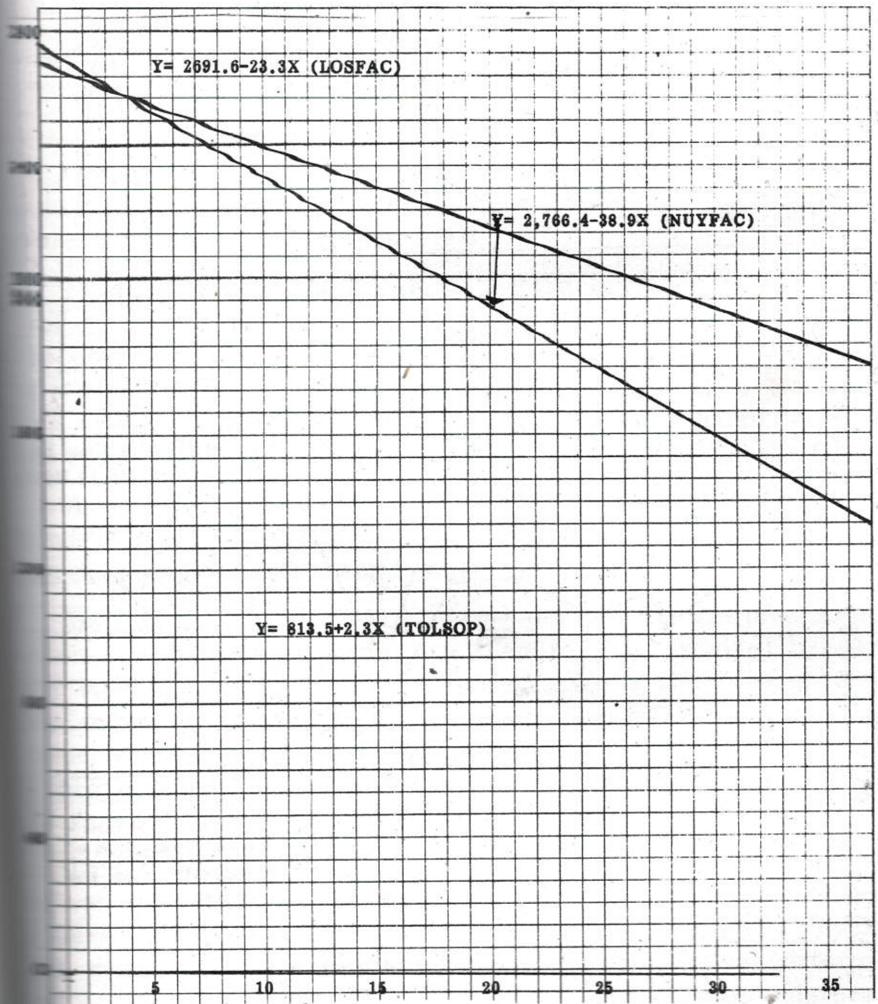


Figure 5

...ession Lines of Three Independent Variables (LOSFAC, TOLSOP, NUYFAC)againt Total Production

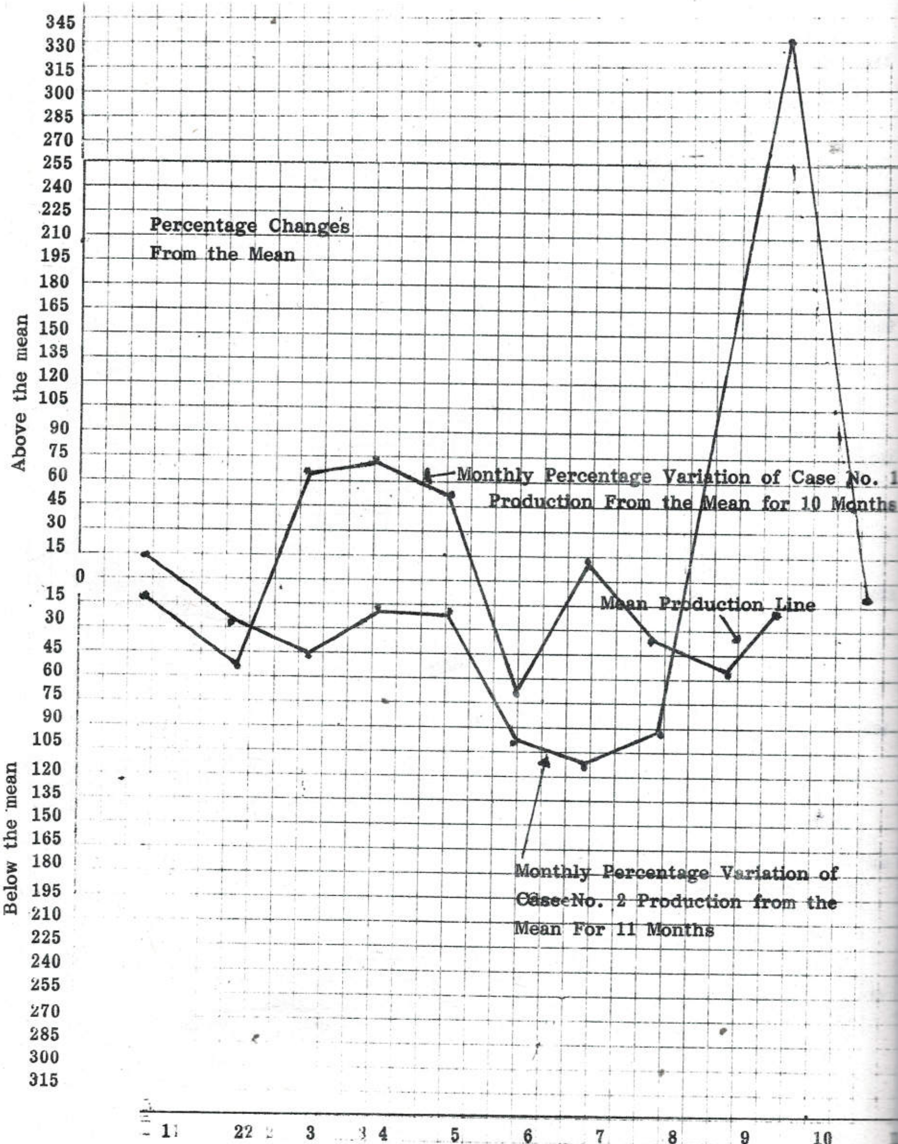


figure 6

Monthly Variation of Production From the Mean of Two Cases of Farmers