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To the Graduate Council:

I am submitting herewith a thesis written by Revanna Ramanna entitled "Some Economic Aspects of Producing Potatoes in Bangalore and Kolar Districts, Mysore State, India." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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SOME ECONOMIC ASPECTS OF PRODUCING POTATOES
IN BANGALORE AND KOLAR DISTRICTS
MYSORE STATE, INDIA

A Thesis
Presented to
the Graduate Council of
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In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
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CHAPTER I

THE PROBLEM AND TECHNIQUES OF ANALYSIS

I. INTRODUCTION

Importance of Potatoes in Bangalore and Kolar Districts

Potatoes is an important nutritive food crop as well as a commercial crop. The preparation of potatoes invariably finds a place in some form or the other in the daily dish of most consumers. The demand for potatoes has been gradually on the increase. Bangalore, the capital city of Mysore State is a rapidly growing city. The population of this city has increased from 170,000 in 1901 to 1,300,000 in 1959, and increase of about 700 per cent during a period of 60 years. This increase has been even more rapid since World War II; it has increased from 3 lakhs to 7.79 lakhs. In addition, there is a large mass of floating population. The growing city of Bangalore provides an excellent market for vegetable crops, especially potatoes.

Potatoes are also produced in Kolar District, especially in Chikkaballapur, Srinivasapur, Chintamani, and Shidlaghatta taluks. The moderate climate in Bangalore and parts of Kolar Districts provides an ideal climate for the production of potatoes (Appendix). Bangalore is the principal market for potatoes although a fair portion of them are exported to other places. The increased demand for potatoes has led to an increase in the acreage of potatoes during recent years. The acreage in Bangalore districts, for example, increased from 2,595 acres in 1952-53 to 4,035 acres in 1957-58 (Appendix). This expansion in acreage of

potatoes resulting from an increase in their demand, has tended to obscure many of the important production problems. In their anxiety to produce and supply more and more to the market, potato farmers have often overlooked the relationship between enterprise costs and returns.

Most potato farmers rarely maintain any cost records. Hence occasion does not arise for them to think in terms of costs and returns. It is the object of this study to analyze the various costs that enter into the production of potatoes and to focus the attention of farmers on some of the production problems and to aid them in making better judgment with regard to adjusting their operations to changing economic conditions.

Objectives of the Study

1. To determine the cost of production and net returns from potatoes.
2. To analyze the efficiency factors contributing to increased yields.
3. To determine the labor requirements of the crop.
4. To direct the attention of researchers to the problems of potato farmers.

II. DIFFERENT METHODS AVAILABLE FOR COLLECTION AND ANALYSIS OF FARM-MANAGEMENT DATA

In the following section a brief survey of the different methods generally used in collecting and analyzing farm management data will be made. Basic facts from which farm-management principles are developed are obtained from four major sources. They are farm accounts, farm surveys,

controlled experiments on individual farms and theoretical approach. The first two are the most important sources from which most of the principles have been developed. The third is often prohibitively costly, and the fourth is of even less importance in establishing management principles for farmers although it affords a useful check on the principles developed from other studies.

Farm Accounts

Farm accounts are more or less detailed records of transaction made by the farm operator during a given year, the details depending upon his particular needs and ability. For this purpose the researcher must prepare in advance the schedules necessary to collect desired information. These records are carefully kept and at the end of the year's operation the results are tabulated, summarized, and organized for purposes of analysis.

"Farm accounts serve a very useful purpose as a farm-management tool which the individual producer can use as a basis for adequately finding out what he is doing and why and for providing ideas as to future improvements."¹ The use of farm accounts is limited, however, as a source for collecting farm management data for use in establishing basic management principles.

From a research standpoint, data obtained from well kept farm accounts is more accurate and reliable than those obtained through survey and other procedures. Also farm accounts provide more complete and detailed

¹Norman J. Efferson, Principles of Farm Management (New York: McGraw-Hill Book Company, Inc., 1953), p. 48.

information on all phases of farm business than is possible to obtain through other sources. Generally, farmers have more confidence in the results that are developed from farm accounts data. The results will be especially significant to extension workers.²

However, farm accounts as a research tool have some serious limitations. First, the cost may be prohibitive. It requires elaborate preparation more than a year before the information is to be collected. This involves the preparation of record books, contacting farmers, and training them in keeping records in a desired manner.

It often happens that many farmers drop out during the year. This naturally increases the cost per record obtained.

Second, it is only the more progressive farmers that keep accounts. The results obtained from such records tend to show what the best farmers are doing rather than the typical or the average picture. This sets a serious limitation to the usefulness of the farm accounts method as a research tool.

The Survey Method

"The word 'survey' refers to a method of study in which an over-all picture of a given universe is obtained by a systematic collection of all available data on the subject."³ It involved preparation of suitable schedules and collection of data from primary sources.

Ordinarily the information collected by the survey method comes from the memory of the individuals interviewed and the accuracy of the information

²Ibid., p. 69.

³Ibid., p. 50.

obtained depends upon the memory of the farmers contacted and the skill of the enumerator in eliciting replies. To minimize estimating errors, farmers should be contacted immediately after the crop year is ended. It often happens that the farmer feels that he does not know the answer to a particular question, but the truth is he does not know that he knows the answer. Here comes the importance of the skill of the enumerator in eliciting answers to his questions.

An important type of error encountered in farm management surveys is of the type called "compensating errors." They are termed compensating because each individual farmer when making estimates to the questions is as likely to underestimate as to overestimate. Thus when estimates from a large number of farmers are taken, the overestimates of some are "compensated" by the underestimates of others, so that the average represents a true picture of the situation. However, there is no possible way to eliminate errors of an individual farmer and this limits the use of survey records for detailed case study analysis.

Non-compensating errors occur when either the enumerator or the farmer is biased. When the farmers are led to believe that the data collected are going to be used for price control programs, taxation and the like, farmers in general are likely to overestimate costs and underestimate yield and incomes. To minimize non-compensating errors, it is, therefore, necessary to begin with, to make clear to the farmers that the survey is in no way connected with these programs, and that the object is to study the actual conditions of his farm. Here again comes the importance of trained enumerators who are also familiar with the agriculture of the

region. The enumerator should gain the confidence of the farmers " and ask questions in such manner that they can be answered with reasonable accuracy and without bias" taking care not to suggest answers to the questions. Adequate care should be taken in the preparation of schedule and pretesting them for their adequacy.

Advantages of survey method. Data by this method could be obtained with much less expense and effort than by the farm accounting method. Also, it is possible to obtain samples more representative of the given area. In the farm accounting method, records are generally obtained from the good farmers, while in the survey method all types and sizes can be included.

Limitations. There is a greater possibility of errors creeping in as the data obtained depends upon the accuracy of farmers' memory. For obtaining fairly reliable and accurate results, the data should be collected immediately after the crop year, and a sufficiently large sample has to be obtained. Another drawback of the survey method is that it cannot be adapted to certain types of studies like input-output variations of enterprises, work simplification, and the like.

Selection of the sample. One of the prerequisites for collecting farm management data by the survey method is the selection of the sample. It is almost an impossibility to study the entire universe. The process of covering the entire universe is expensive of money and effort. What we need to do is to "take a large enough sample by a well designed sampling method to satisfy ourselves to any desired degree of confidence concerning the actual average for all farms. . . ." ⁴ in the universe.

⁴ Mordecai Ezekiel and Karl A. Fox, Method of Correlation and Regression Analysis (third edition; New York: John Wiley and Sons, 1951), p. 14.

Ezekiel and Fox further argue that covering the entire universe adds nothing to the usefulness of the results.⁵

We generalize from the results obtained from the sample to the universe. "Thus, statistical inference is a special case of the logical process of induction, whereby we reason from particular facts about particular objects to general conclusions as to what will be the facts for all objects of a given class."⁶

The following are the more important types of sampling techniques used in farm management research: (1) block sampling, (2) random sampling, (3) stratified random sampling, (4) randomized block sampling, and (5) purposive sampling.

Block sample. The block sample consists in complete enumeration of a representative block or section of the large area and extending the results to the entire area from which the sample was selected. The block sample is a useful method for studying the "variation in returns from farming and the determination of farm management principles causing these differences,"⁷ since the results are based upon a complete coverage of all the farms in the block. But one defect of this type of sample is that it is often difficult to get a block which is truly representative of the area of which it is a part.

The random sample. Random sampling consists in selecting, at random, individual items for study from the entire universe so that each item has

⁵ Ibid., p. 14.

⁶ Ibid., p. 15.

⁷ Efferson, op. cit., p. 55.

an equal chance of being selected. By this procedure, chances of getting a sample truly representative of a given area are great. Different methods are adopted for getting a random sample. A list of all farms in the area may be prepared, and every fifth or tenth farm is chosen, depending upon the number of farms one intends to survey. Sometimes without resorting to listing farms, the enumerator covers every road in the area and selects each fifth or tenth farm along the roads.⁸ Another method followed consists in making a list of all the farms and drawing lots.

Because of its wider coverage, random sample is better adapted to the types of studies designed to estimate the average conditions of the area. But for purposes of analyzing the variations, this method of sampling may not be very accurate because of the difficulty of obtaining a truly random sample.

Stratified random sample. In order to get a more representative sample for the region, it is necessary to stratify or break down the universe according to certain characteristics such as size of farms, type of soil, managerial skill, etc., and select samples at random from each stratum depending upon the number of farms in each stratum. By this procedure each unit of observation is given its due emphasis, and it is possible to obtain from relatively fewer records a more representative picture for the entire region from which the sample is drawn.

Randomized block sample. The entire area intended to be studied is marked on a map into a series of uniform grids, and a certain proportion of the grids is then selected for study at random. The number of

⁸ Ibid., p. 56.

farms in each grid is selected, depending upon the time and money available. This system of sampling combines the advantages of both the block sample and the stratified random sample methods.

The purposive sample. In this method of sampling, certain samples are intentionally selected, eliminating others. Thus, selection of the samples is "intentionally biased." After eliminating some farms which are not needed, samples may be taken from the rest of the farms according to any of the methods described. Forster suggests that purposive sampling is only a "means of selecting representative situations for use as a basis for the development of the models or standards which can be used as guides in the improvement of actual farms which are below standard in physical performance and financial achievement."⁹

III. ANALYSIS OF FARM MANAGEMENT DATA

The following methods of analysis of data are available for the determination of relationships and establishment of management principles: (1) method of direct comparison, (2) method of budget analysis, (3) the case study method, (4) multiple correlation analysis, and (5) the theoretical approach.

The Method of Direct Comparison

In this method of analysis, the data collected from a large number of farms, preferably over 100, are sorted and subsorted according to certain major factors of differences, such as costs, returns and physical

⁹G. W. Forster, Farm Organization and Management (third edition; New York: Prentice Hall, Inc., 1953), p. 84.

inputs and tabulated for each group. The object of sorting data is to introduce multiple controls and to determine more accurately the independent effects of each management factor. "... the object is to find out how and why farmers managed as they did and not to rationalize the researcher's bias as to what they should do."¹⁰

The advantage of this method is that the results are based on the actual experience of farmers on their own farms and are free from bias and hence easily understood and relied upon by farmers.

Forster points out that "a comparison of the organization of a given farm with the best in the area will undoubtedly suggest changes that, if made, will lead to increase in profits."¹¹ He, however, assumes that the size and other factors are the same in such comparison.

One important disadvantage of this approach is that it presents a picture of the past rather than a forecast of the future.

Budget Analysis

A farm budget is a plan for the future used of land, labor, power, equipment and other resources of the farmer. Budget analysis may be used to determine the possible incomes from farming, based on past input-output relations and prices adjusted to changes in each of them. An analysis of the budget indicates the strong and weak points in the present organization and the differences in costs and expected returns between the present and alternative organization.

¹⁰ Efferson, op. cit., p. 61.

¹¹ Forster, op. cit., p. 125.

Case Study Analysis

The essential nature of the case method is "the study rather in its entirety of a limited number of units of observation." It is a thorough, intensive study of a limited number of cases. "At its best, it is the best of all; but in ordinary hands, it is likely to suggest more untrustworthy general conclusions than those obtained by the extensive method of collecting more rapidly very numerous observations, . . . and obtaining broad averages in which inaccuracies and idiosyncrasies may be trusted to counteract one another to some extent."¹² This method of analysis has a very limited application in farm management studies.

Multiple Correlation Analysis

Early research workers in the field of farm management used the regression coefficients as a "method by which the changes in farm returns due to changing one factor could be found while eliminating the effect of all other factors."¹³ Efferson says that multiple correlation analysis in farm management research work has for the most part been discontinued in favor of other methods.¹⁴

In the case of regression type, the values of inputs, i.e., the independent variables, are "selected in advance by the investigator, as is typical in controlled experiments, with no requirements that the

¹² Alfred Marshall, *Principles of Economics*, quoted in L. A. Salter, *Land Economics* (Minneapolis: University of Minnesota Press, 1948), pp. 44-45.

¹³ Efferson, *op. cit.*, p. 65.

¹⁴ *Ibid.*, p. 65.

distribution of the independent variables in the sample will be representative of these in the universe. . . . In this model, measures of correlation have only a verly limited meaning, and estimates of reliability of regression coefficient apply only to a distribution of samples, each drawn or constructed under exactly the same conditions as the given sample. . . ."¹⁵

Theoretical Approach

The theoretical approach to a study of farm management, according to Efferson, lies in the use of relevant economic theory on management problems to determine management principles.¹⁶

The theoretical approach to farm management study has been used in the development of farm models, based on economic theory. This model can be checked with the actual cases. Theories and models thus act as guides to aid in pointing out definite problems. The theoretical approach helps to serve as a check on the results obtained by other methods and to draw conclusions on much sounder basis.

IV. SAMPLING PROCEDURE USED IN THIS STUDY

The Sample of Farms Studied

It was decided to interview 100 potato growers in Bangalore and Kolar Districts to collect data relating to cost, yields, and labor requirements. In addition, production and marketing practices and other factors affecting net returns were studied.

¹⁵ Ezekiel and Fox, op. cit., pp. 280-281.

¹⁶ Efferson, op. cit., p. 66.

Information relating to acreage of potatoes, along with other vegetable crops by taluks in the two districts for the crop year 1956-57, was obtained from the state statistician, government of Mysore (Table I). Based on this information it was decided to obtain data from five taluks in Bangalore and four taluks in Kolar Districts. These were Bangalore North, Bangalore South, Nelamangala, Hosakote, and Devanahalli in Bangalore District and Chikkaballapur, Chintamani, Srinivasapur, and Shidlaghatta in Kolar District. It was decided to visit one to three villages in each of these taluks depending upon the acreage of potatoes grown in each.

During the second quarter of 1959, a list of villages in each of the nine taluks was prepared and sent to the respective agricultural officers or the block development officers, as the case may be, to obtain a list of villages which produced the 1958-59 crop of potatoes.

From this list, villages from each of these taluks were selected at random by drawing lots. A total of 19 villages were selected from the nine taluks.

Preparation of Schedules and Collection of Data

Preliminary schedules for collecting data from potato growers were developed under the guidance of Dr. M. B. Badenhop, Exchange Professor from the University of Tennessee. A few test cases were taken, and after certain revisions of the questions, the final form of the schedules was prepared.

The potato farmers were personally interviewed in June 1959, with the assistance of the local agricultural officers or the block development officers. Since the growers were contacted with the assistance of these officers who had previous intimate contacts with them, it was possible to

TABLE I

ACREAGE OF VEGETABLES BY TALUKS, BANGALORE
AND KOLAR DISTRICTS, 1956-57

District Taluks	Potatoes	Sweet Potatoes	Onions	Other Vegetables
<u>BANGALORE</u>				
1. Bangalore North	293	56	50	4332
2. Bangalore South	610	60	160	540
3. Hoskote	968	305	696	1282
4. Devanahalli	950	210	1056	410
5. Doddballapur	10	158	62	223
6. Nelamangala	400	50	180	445
7. Magadi	35	45	75	216
8. Channapatna	--	--	--	642
9. Ramanagaram	--	--	--	345
10. Kanakapura	--	--	25	1450
11. Anekal	<u>250</u>	<u>--</u>	<u>146</u>	<u>2559</u>
DISTRICT TOTAL	3516	884	2450	12,344
<u>KOLAR</u>				
1. Kolar	205	25	160	313
2. Mulbagal	85	12	140	---
3. Srinivasapur	350	25	50	145
4. Chintamani	750	26	---	3
5. Sidlaghata	300	--	350	945
6. Bagepalli	---	--	32	9
7. Gudibanda	8	5	138	---
8. Gouribidnur	---	250	250	276
9. Chickballapur	490	115	725	400
10. Malur	270	70	240	3270
11. Bangarpet	<u>40</u>	<u>9</u>	<u>17</u>	<u>142</u>
DISTRICT TOTAL	2498	537	2102	5503

to secure the required data with relative ease. To begin with, however, the farmers were assured that the collection of the data had nothing to do with the land revenue or the agricultural tax policy of government. As pointed out earlier, very few potato growers maintained records of their operations; much of the information had to come from their memory. Only farmers who had produced the 1958-59 crop of potatoes were selected for interviewing so that the operations were still fresh in their memory. Every effort was made to get accurate information, although a certain amount of inaccuracy in estimates is inevitable.

Potatoes are grown both as a winter and summer crop. The winter crop is usually planted during December and January and harvested in March and April. However, some winter crops were planted in the latter part of October and harvested in the first week of January. The summer crop was planted during the second half of June and harvested in the last week of August and the first week of September.

The data was collected from 98 potato farmers. Since a few farmers had grown two crops during the year, a total of 104 schedules was obtained. For purposes of this analysis they will be considered as 104 farms. No attempt was made to stratify the sample according to the size of potato enterprise. The distribution of the sample of farms by size of enterprise is shown in Table II.

The data had to be collected in a relatively short period of time. The block sample was not considered as it was difficult to conceive of any block truly representative of the entire region. Stratified sampling method was considered too elaborate and time consuming. Hence the random sampling method was used.

TABLE II
DISTRIBUTION OF FARMS STUDIED BY SIZE GROUPS,
BANGALORE AND KOLAR DISTRICTS

Acres of Potatoes	Number of Farms		Total
	Bangalore	Kolar	
Less than .50	12	16	28
.50 - .99	17	9	26
1.00 - 1.99	23	10	33
2.00 and above	11	6	17
Total	63	41	104

V. REVIEW OF RELATED STUDIES

Few studies pertaining to costs and labor requirements for different crops have been made either in Mysore State or in other states in India. This is particularly true of potatoes. A few studies, however, on cost of producing other crops have been made in some states. Special mention may be made of the pioneering efforts made at Poona, Bombay State (between 1926-28). The Department of Agricultural Economics at Poona Agricultural College made studies on the cost of production of important crops of the three regions of Bombay State; namely, Karnatak, Maharashtra, and Gujarat.

Another cost study undertaken by the ICAR on an all India basis deserves mention. The study mainly pertains to the commercial crops like sugar cane, cotton, and others.

Cost studies on some crops have also been made by the first series of six Farm Management Research Centers and are now being made in the second series of the three centers, one of which is located at Bangalore in Mysore State. At the Bangalore Farm Management Research Centre, studies are being made on the cost of production of some of the important crops of the region like ragi, paddy, potatoes and a few other crops.

A few studies were made by some individuals on the cost of producing potatoes in Mysore State. In the 1929 issue of the Mysore Agricultural Calendar,¹⁷ mention was made of the variety called "British Queen" which was tried on 13 guntas (roughly 0.33 acres) in Sabbanahalli (near Bangalore). The crop was sown in July and harvested in September. The yield was 150 maunds on this one-third acre plot and was sold for rupees 150.00. The cost of cultivation was Rs 86.00 with a net profit of Rs 64.00 or Rs 192 per per acre. It is, however, not clear how the different costs were computed.

Another cost study was made in Chikkaballapur of Kolar District¹⁸ by Mr. K. Ranganatha Rao. He computed the cost per acre of potatoes at Rs 1,200.00. This cost is exclusive of a land assessment, interest on capital, and depreciation on machinery. He points out that if cultivation is taken up by lift-irrigation by means of whote (i.e., using bullock power), the cost of cultivation will be increased by Rs 100.00. He places the average yield at 600 maunds and at Rs 3.00 per maund the net profit

¹⁷ Mysore State Department of Agriculture, The Mysore Agricultural Calendar, 1929, p. 29.

¹⁸ Mysore Agricultural and Experimental Union, Mysore Agricultural Journal, 1954.

would be Rs 600 per acre. He estimated the labor requirement to be 219 man days and 25 woman days. Considering one woman day as equivalent to two-thirds man day and one man day equivalent to eight man hours, the total labor requirement for the crop would be about 1880 man hours. Different items of cost were charged on a flat rate basis; for example, for each irrigation the charge was Rs 3. The land was irrigated by an electric pump.

VI. LIMITATIONS OF THIS STUDY

The yield of the 1958-59 crop of potatoes in some taluks of Bangalore and Kolar was very low. This low yield was probably due either to defective seed or crop damaged by insect pests and diseases. But the potato farmers were unable to give any valid reason for this low yield. In some areas in Kolar, rains before harvesting of the crop and poor drainage of soil, especially in one village in Chintamani taluks, resulted in the decay of potatoes in storage for a few days after harvest. This factor decreased greatly the marketable yields from the crop and lowered the average price per maund.

Generally, low yields are associated with poor quality of tubers; the cost of production per maund would be high and the prices received relatively low.

CHAPTER II

COST OF PRODUCTION OF POTATOES

The computation of cost of producing potatoes in this study included all costs regardless of whether the items represented cash outlay, fixed cost, or non-cash costs. These items included costs of labor, seed and seed treatment, manures and fertilizers, poison and rent of sprayer, depreciation, interest and repairs, land rent and taxes, marketing, and others. For purposes of comparison, the costs were computed for the two districts, Bangalore and Kolar.

I. METHOD OF COST COMPUTATION IN THIS STUDY

Labor

Hired labor was charged at the prevalent rates of wages per day actually paid by the farmers for various operations in the locality for men, women, and children. Family labor was also charged at the prevalent daily rates in the locality. When the family worked for less than four hours a day on the crop, half the daily rate was charged.

Depreciation

Depreciation for each item of equipment was calculated using the straight line method based on the farmers' estimate of the life of each item of equipment. The charge to potatoes was based on the estimated proportion of time each item of equipment was used on the crop.

Repairs

Repair charges were computed on the basis of the farmers' estimate of normal annual repairs for each item of equipment used. The charge to

potato enterprise was based on the proportion of the total time the equipment was used on the potato crop.

Interest

Interest charges were calculated on 50 per cent of the estimated value of the equipment. The charge was at four per cent rate on investments in equipment whose estimated life was six years or more, and for items whose estimated life was less than six years, a six per cent rate was used. The potato crop was charged its due proportion. No interest, however, was calculated on the working capital such as wages paid, seed cost, and others.

Land Rent

Only a very few potato growers had rented-in land, and in those cases, the rental was charged at the amount actually paid by the tenant farmers. In the case of owned land, the charge was based on the farmer's estimate of the annual rental he would pay if he had rented-in the same land.

Land Revenue

Land revenue was charged at the local rates. This is the tax on land collected by the government.

Seed

Very few farmers used their own seed, and in these cases the farmers' estimate of the cost they would pay if they had bought the seed was used. When the seed was bought, the cost of transportation, to farm

from place of purchase, was also included in the actual cost of seed. Cost of seed treatment was grouped with seed cost for purposes of this analysis.

Manures and Fertilizers

When the farmyard manure and city waste were bought, the actual rates paid were used. When the farmer used his own manure, local rates reported by them were used. Fertilizers and oil cakes were charged at purchase rates. Transportation costs, if any, were also included in the manure and fertilizer costs. Since there was no basis for determining the residual effect of manures, the entire cost was charged to potatoes.

Bullocks (oxen)

Depreciation was charged on the bullocks (working life assumed to be 10 years). Feed for bullocks was charged at Rs 1.50 per day for the number of days they were used for work on the potato crop.

Bullock costing included the depreciation charges and feed. No grower hired bullock services.

Marketing

Marketing cost included the cost of transportation to the market, toll charges, commission, brokerage, and other charges actually paid by the farmers.

Others

All other items were charged at the actual rates paid.

II. ANALYSIS OF COST OF PRODUCING POTATOES

IN BANGALORE AND KOLAR DISTRICTS

There was much variation in the cost of producing potatoes between the two districts. To provide a uniform basis for comparison, all items of costs were computed on an acre basis. The total cost per acre of producing potatoes in Bangalore was Rs 1187.38 and in Kolar it was Rs 1281.17, and the average for both the districts was Rs 1224.33. The various items of costs were comparatively higher in Kolar than in Bangalore District. The total cost of production per acre of potatoes was higher in Kolar than in Bangalore by Rs 93.79 (Table III). A test of significance was made for the difference between the two means and a "t" of 1.69 was obtained. The difference between the mean costs between the two areas was significant at 90 per cent level of confidence. The range in the costs for Bangalore was from Rs 593.12 to Rs 1866.63 and the same for Kolar was Rs 734.51 to Rs 2039.47. The standard deviation of the mean total cost for the two areas was Rs 305.74 and Rs 281.08 respectively.

Labor Costs

Labor costs included costs of both hired and family labor for all operations in producing potatoes. The average labor cost for Kolar of Rs 358.97 was higher than that for Bangalore by Rs 80.68. The average labor cost for both the areas was Rs 310.10 or 25.33 per cent of the total cost. Labor costs were lower in both areas for the summer crop than for the winter crop, the averages for both districts being Rs 285.21 and Rs 319.72 respectively (Table IV). The higher proportion of labor

TABLE III

AVERAGE COST PER ACRE OF PRODUCING POTATOES,
BANGALORE AND KOLAR DISTRICTS

Items of cost	Bangalore (Rupees)	Kolar (Rupees)	Average for the two districts (Rupees)
Labor	278.29	358.97	310.10
Seed and seed treatment	380.62	407.66	391.28
Poison and rent of sprayer	3.46	2.72	3.17
Manures and fertilizers	242.36	247.27	244.29
Depreciation, repairs, and interest	112.42	145.95	125.63
Land rent and revenue	90.50	81.04	86.78
Marketing	48.56	16.47	35.90
Others	31.17	21.05	27.18
Total	1187.38	1281.13	1224.33

TABLE IV

COST PER ACRE OF PRODUCING POTATOES IN BANGALORE
AND KOLAR DISTRICTS, WINTER AND SUMMER CROPS

Items of costs	Winter		Average for two districts (Rupees)	Summer		Average for two districts (Rupees)
	Bangalore (Rupees)	Kolar (Rupees)		Bangalore (Rupees)	Kolar (Rupees)	
Labor	293.93	363.01	319.72	232.35	350.27	285.21
Seed and seed treatment	401.78	469.95	427.23	288.87	308.30	297.58
Poison and rent of sprayer	3.29	2.30	2.92	3.95	3.62	3.80
Manures and fertilizers	261.47	257.60	260.02	186.22	225.01	203.61
Depreciation, interest and repairs	120.93	127.30	123.31	87.43	186.13	131.67
Land rent and revenue	87.90	89.17	88.38	98.15	63.52	82.63
Marketing	49.94	16.55	37.48	44.52	16.31	31.87
Others	35.99	28.00	33.01	17.01	6.07	12.11
Total	1242.97	1374.46	1292.07	1024.10	1079.56	1048.48

used for preparatory cultivation and irrigation in winter than in summer accounted for most of the differences in labor costs between the two crops.

Seed and Seed Treatment Costs

The average seed and seed treatment cost was also higher for Kolar than for Bangalore by Rs 27.04. The average for the two districts was 391.28 or 31.96 per cent of the total cost. In both the districts winter growers had higher cost than summer growers and Kolar growers had more costs than those in Bangalore. Table V indicates how differences in seeding cost by areas and by summer and winter crop were influenced by seeding rates and prices paid for seed. There was a wide range in the purchase price of the seed. When seed was purchased from growers, the cost averaged around Rs 9 per maund. When seed was obtained direct from Simla City, the cost was about Rs 10.50, but growers who bought seeding material from the merchants paid a relatively higher price. This price ranged from Rs 10 to 19.20 and the average was around Rs 14. When the farmer does not get the seed from other sources in the late season, he has to inevitably buy them from merchants and the merchants often exploit the situation and charge a higher price. Table VI shows that although a large majority of growers obtained seeding potatoes from other growers, over 37 per cent obtained them from merchants.

There was a tendency for farmers to use more seeding material of the simla variety than of rickets. The farmers' explanation for this was that even though the tubers of simla were larger than those of rickets, the number of buds were about the same, which meant that each portion of

TABLE V
AVERAGE SEEDING RATE FOR WINTER AND SUMMER CROP
IN BANGALORE AND KOLAR*

District	Winter (Maunds)	Summer (Maunds)
Bangalore	37.61 (Rs 10.68)	34.36 (Rs 8.41)
Kolar	40.62 (Rs 11.57)	39.11 (Rs 7.88)

*Figures in the parentheses indicate the average price in rupees paid per maund of seed.

TABLE VI
NUMBER OF POTATO GROWERS OBTAINING SEEDING
MATERIAL FROM DIFFERENT SOURCES*

Source of seed supply	Bangalore		Kolar		Total for both Districts
	Winter	Summer	Winter	Summer	
Other growers	22 (46.80)	11 (68.75)	13 (46.43)	10 (76.92)	56 (53.85)
Merchants	21 (44.68)	5 (31.25)	11 (39.29)	2 (15.39)	39 (37.50)
Own	1 (2.13)	-	2 (7.14)	1 (7.69)	4 (3.85)
Cooperatives	2 (4.26)	-	1 (3.57)	-	3 (2.88)
Simla City	1 (2.13)	-	1 (3.57)	-	2 (1.92)

*Figures in the parentheses indicate the percentages for the crop season.

the bud cut was larger and heavier in simla seed than in rickets. Hence, more seeding material by weight was necessary for simla than for rickets. The average seeding rate for both areas was 40.03 maunds per acre for simla and 35.34 maunds per acre for rickets. For simla variety the seeding rate was 37.79 maunds in Bangalore and 45.49 maunds in Kolar. The average seeding rate for rickets was 34.81 maunds in Bangalore and 35.82 maunds in Kolar. The high seeding rate in Kolar partially accounted for the higher seed cost in that area than in Bangalore.

In Kolar 18 farmers out of a total of 41, or 43.90 per cent treated their seed before planting, while in Bangalore only 11 out of 63, or 17.46 per cent, treated their seed.

Other Costs

The Kolar farmers on an average had less cost for poison and rent of sprayer than had Bangalore farmers. The average for both the areas was Rs 3.17, or 0.26 per cent, of the total cost.

The cost on manures and fertilizers was about the same for the two areas. The average for the two districts was Rs 244.29, which was approximately 20 per cent of the total cost. Growers of the winter crop, on an average, made more expenditure for manures and fertilizers than growers of the summer crop. The common manures used in Bangalore district were the farmyard manure and city waste. The growers nearer to Bangalore, especially those Bangalore South, Bangalore North, and Hoskote, used city waste extensively. The more common manure in Kolar was farmyard manure. A few farmers used inorganic fertilizers and several used oil cakes.

Equipment cost averaged Rs 145.95 per acre in Kolar and Rs 112.42 in Bangalore. The average for the two areas was Rs 125.63, or 10.26 per cent of total cost. The average equipment investment per acre was Rs 4683.80 in Kolar, but in Bangalore it was only Rs 2302.81, or approximately 50 per cent, as high as in Kolar. Logically this might be expected to result in equipment cost for Kolar of twice that in Bangalore, but actually it was only 1.29 times higher. This indicated that potato growers in Kolar made a better utilization of their equipment than did growers in Bangalore. But Kolar farmers in summer had high investment and made lesser use of their equipment and so had higher cost than had Bangalore farmers.

Irrigation equipment in the form of wells and devices for lifting water, like the pickota, mhote, the pumping equipment, etc., accounted for over 80 per cent of the total investment in equipment. If the irrigation equipment was used for a number of acres over a greater part of the year, then the proportion of the total cost on equipment chargeable to any one acre of crop would be less. Thus, if a farmer produced only one crop of potatoes during the year, the land was idle for eight to nine months of the year. The entire cost on equipment would then be charged to potatoes, thus increasing the cost per acre. This points to the importance of efficient use of resources.

There was little difference in the land rent and revenue between Bangalore and Kolar and the average for the two districts being Rs 86.78.

Marketing costs were higher in Bangalore than in Kolar. This was because most farmers in Bangalore sold their potatoes at the wholesale market, while in Kolar most of the potatoes were sold at the farms. This accounted for a higher marketing cost in Bangalore as compared to Kolar.

Other costs included the value of bullock feed, electricity charges, and temporary storage for potatoes. Bullocks were used by some for preparing the land, for planting potatoes, and for irrigation. Electricity was used by some farmers for lifting water through pumps for irrigating potatoes. These costs were higher in Bangalore than in Kolar for both crops, and in both districts they were higher in winter than in summer.

Total cost per acre of potatoes in Bangalore for the winter crop was Rs 1242.97, while in Kolar it was Rs 1374.46, and in summer they were Rs 1024.10 and Rs 1079.56 respectively. The average cost for both areas for the winter crop was Rs 1292.07, and for the summer crop it was Rs 1043.48. Winter costs were generally higher than summer costs, but in both seasons, costs in Kolar were higher than in Bangalore. A large part of this difference was accounted for by the differences in cost of labor and seeding material.

It is thus clear from the above analysis that labor and seed formed the two most important items of costs in producing potatoes and together they accounted for 57.29 per cent of the total cost. Labor accounted for approximately 25 per cent of the total cost (Figure 1). Next in importance were manures and fertilizers and equipment cost, accounting for 19.95 per cent and 10.26 per cent respectively. Land rent and revenue constituted 7.09 per cent of total cost. The other miscellaneous items, including marketing, poison, bullock feed, electricity charge, and temporary storage cost of potatoes before sale together, represented 5.41 per cent of the total cost.

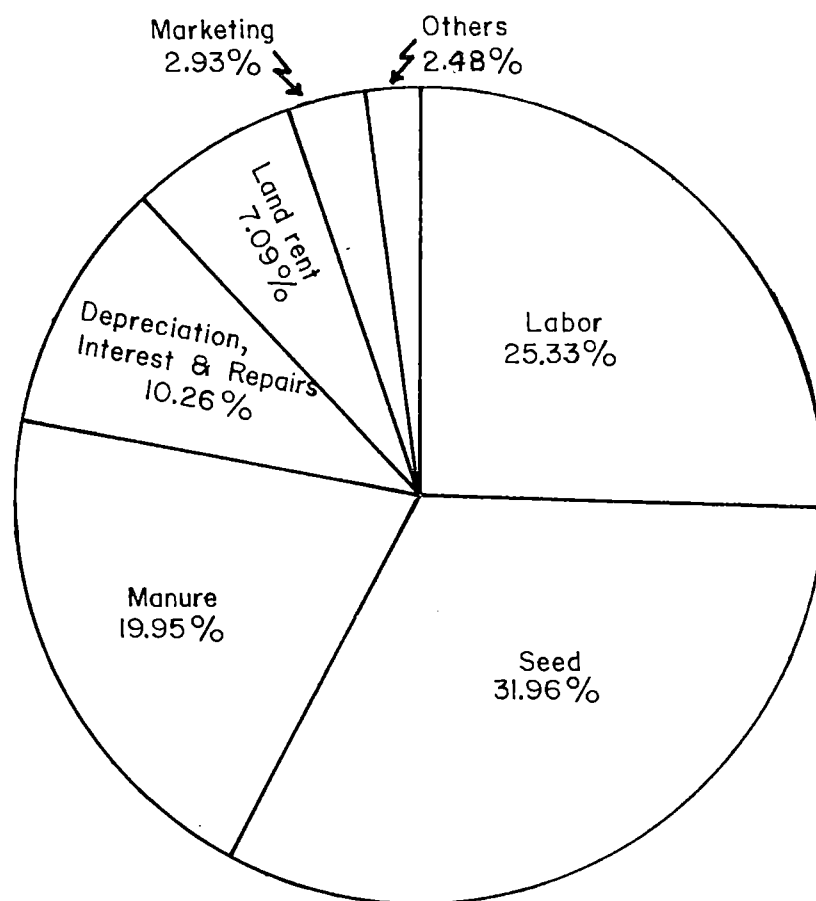


FIGURE 1

PROPORTION OF TOTAL COST USED FOR OBTAINING
IN THE PRODUCTION OF POTATOES

III. ANALYSIS OF COST OF PRODUCING POTATOES BY SIZE GROUPS

Labor costs tended to decrease slightly with the size of enterprise from Rs 318.03 in the first group to Rs 296.27 in the third, but it then increased by Rs 32.07 in the fourth (Table VII). The average cost for all the four size groups was Rs 310.10. This phenomena testified to the fact that there are no large cost economics of size where hand labor predominates.

There was a tendency for the seed cost per acre to increase with increase in size, although there was no apparent increase from second to the third group. The seeding rate generally increased with an increase in the size of potato enterprise, increasing from 35.35 maunds per acre in the first size group to 40.11 maunds in the fourth size group. There was a tendency for the average seed cost per maund also to increase with the size of enterprise (Table VIII). Thus, the higher seeding rate and higher price of seed accounted for the higher costs on the larger farms. It was possible that operators of the larger farms tried to obtain better seed material from distances, and hence the additional transportation cost increased the cost per maund of seed.

Twenty-nine growers, or 27.89 per cent of the total number of growers, treated their seed before planting, of which 11, or 18.46 per cent, were in Bangalore and 18, or 43.90 per cent, in Kolar. By size group the numbers treating seed were 3, 5, 14, and 7 respectively. The average cost of seed treatment for those adopting this practice was Rs 3.61 per acre and the average cost for all the 104 farms was approximately one rupee per acre.

TABLE VII

TOTAL COST PER ACRE OF PRODUCING AN ACRE OF POTATOES
FOR DIFFERENT SIZE GROUPS

Items of Cost	Less than 0.50 A Rs	0.5 to 99 A Rs	1 to 1.99 A Rs	2 A and over Rs	Av. of all farms Rs
Labor Cost	318.03	307.17	296.27	328.34	310.10
Seed and Seed Treatment	322.29	404.86	405.97	459.02	391.28
Poison and Rent of Sprayer	2.24	2.92	4.26	2.95	3.17
Manures and Fertilizers	199.89	259.62	253.49	276.13	244.29
Depreciation, Interest and Repairs	196.42	104.33	93.70	103.14	125.63
Land Rent and Tax	72.83	84.09	97.91	92.22	86.78
Marketing	20.66	33.51	44.77	42.28	35.90
Others	20.27	39.11	25.98	29.28	27.18
Total	1152.63	1235.61	1222.35	1333.36	1224.33
Av. Cost/Md.	4.37	4.75	3.91	3.98	4.26

TABLE VIII

AVERAGE SEED RATE PER ACRE AND COST PER MAUND
FOR DIFFERENT SIZE GROUPS

Size Group	Seed Rate/Ac. (Maunds)	Seed Cost/Maund (Rupees)
Less than 0.50 Acres	35.35	8.09
0.50 to 0.99 Acres	38.32	10.55
1.00 to 1.99 Acres	39.07	10.36
2 Acres and Above	40.11	11.45

There was a tendency for the cost on manures and fertilizers to increase with the size of enterprise, although it dropped somewhat from second to third group. The average for all the four size groups was Rs 244.29.

The equipment cost decreased with the increase in size of enterprise up to the third group and then it increased. The largest drop was Rs 92.09 from first to the second size group, and again it dropped from second to the third group by Rs 10.63, but it increased from Rs 93.70 for the third group to Rs 103.14 for the fourth size group. This decrease in the equipment cost with size points to the fact that size economics result largely from spreading of fixed costs on machinery and equipment. The decrease in the equipment cost up to the third size group indicates that the growers in the larger size groups were making a better utilization of their equipment. Their cost was spread over a number of crops, and the proportion debitable to potatoes per acre was smaller.

This fact becomes more evident when the equipment costs for each size group are compared with the corresponding average investment in equipment made by the different size groups. The average equipment investment for the four size groups was Rs 4958.75, 2609.37, 2802.30, and 2232.29 respectively. For the smallest size group, investment was high, and cost chargeable to the crop was also high.

Land rent and revenue tended to increase with the size but for the fourth group it dropped. Marketing costs also increased up to the third size group from Rs 20.66 for the smallest size to Rs 44.77 for the third, and then fell to 42.28 for the fourth group. Miscellaneous costs varied differently with size groups. They were the lowest for the first size group, being Rs 20.27, and the highest for the second size group, being Rs 39.11. The average for all farms was Rs 27.18.

There was a general tendency for the total costs to increase with increase in the size. This increase was more marked from first to second group, and increase of Rs 82.98. There was a slight decrease from second to third group by Rs 13.26 and again it increased by Rs 111.01 to the fourth size group. The average cost for all the 104 farms was Rs 1224.33.

It could further be observed from Table VII that the average cost per maund of potatoes varied differently with the size groups, the average for all farms being Rs 4.26. The lowest cost per maund was in the third size group, being Rs 3.91 and the highest being Rs 4.75 in the second size group.

IV. FIXED COSTS AND VARIABLE COSTS OF PRODUCTION

The total cost of producing a commodity could be broken down into two broad categories, namely fixed costs and variable costs. The average fixed cost in producing an acre of potatoes for both the areas was Rs 324.81 and was composed of family labor, Rs 132.21, depreciation and interest on equipment, Rs 105.82, and land rental and revenue Rs 86.78 (Table IX). Fixed costs accounted for 26.57 per cent of the total cost of potato production.

The most important variable cost was for seed and seed treatment, accounting for Rs 391.26, or 44.88 per cent of the total variable cost. Next in importance came manures and fertilizers, Rs 244.29, or 28.02 per cent, and the hired labor accounting for Rs 177.89, or 20.41 per cent of the variable cost. The rest of the variable costs constituted only 6.69 per cent. Variable costs accounted for 71.21 per cent of the total cost.

Miscellaneous costs, of which some were fixed and some variable, accounted for 2.22 per cent of the total cost.

V. NON-CASH COST OF PRODUCTION

Size of Enterprise and Non-Cash Cost

The total non-cash costs generally tended to decrease with an increase in the size of potato enterprise (Table X). While the total costs were increasing with size, the total non-cash costs were decreasing; the total non-cash costs were 41.95, 31.58, 27.08, and 24.11 per cent of the respective total costs for the four size groups. The average total non-cash cost for all the 104 farms was Rs 385.05, which constituted 31.44 per cent of the total cost.

TABLE IX

AVERAGE FIXED AND VARIABLE COSTS
IN PRODUCING AN ACRE OF POTATOES

<u>Fixed Costs</u>			
Family labor	Rs 132.21		
Depreciation and interest	Rs 105.82		
Land rent and revenue	Rs 86.78		
Total fixed costs		Rs 324.81	26.57%
<u>Variable Costs</u>			
Hired labor	Rs 177.89		
Seed and seed treatment	Rs 391.28		
Poison and rent of sprayer	Rs 3.17		
Manures and fertilizers	Rs 244.29		
Repairs on equipment	Rs 19.81		
Marketing	Rs 35.90		
Total variable costs		Rs 872.34	71.21%
Miscellaneous costs		Rs 27.18	2.22%
Total		Rs 1224.33	100.00%

TABLE X

NON-CASH COSTS IN PRODUCING AN ACRE OF POTATOES
FOR DIFFERENT SIZE GROUPS

Items of Cost	Less than .50 Ac.	.50 to .99 Ac.	1 Ac. to 1.99 Ac.	2 Ac. and over	Av. of all farms
Family labor	187.92	130.51	105.01	95.88	132.21
Seed	6.86	20.38	0.00	12.35	8.96
Manure	37.83	42.60	50.73	29.12	41.69
Depreciation and interest	168.06	88.37	79.51	82.84	105.82
Land rent	67.55	74.38	81.77	91.35	77.66
Other	15.33	34.00	14.01	10.03	18.71
Total non- cash costs	483.55	390.24	331.03	321.57	385.05

Family Labor Cost

The most important item which contributed to a greater share of the total non-cash costs was the family labor. Family labor cost decreased from a high of Rs 187.92 for the very small size group to a low of Rs 95.88 in the two acres and above size group. In terms of percentages of the respective total labor costs, the family labor costs for different size groups were 59.09, 42.49, 35.44, and 29.20. It is thus clear that, as the size of potato enterprise increased, the family labor contributed relatively a smaller proportion of the total labor used.

Equipment Cost

The next non-cash cost of importance was depreciation and interest, the average for all farms being Rs 105.82 and representing 27.48 per cent

of the total non-cash costs. It was pointed out earlier that the cost on equipment decreased as the size increased except in the fourth size group. The non-cash costs on equipment also behaved in the same manner.

Land Rent

Third in importance among the non-cash cost items was land rent. The average land rental for all farms was Rs 77.66, or 20.17 per cent of the total non-cash cost. The land rental increased gradually as the size of enterprise increased from Rs 67.55 for the first size group to 91.35 in the fourth.

Others

A few growers used their own farmyard manures. All oil cakes, fertilizers, and city waste, and most of the farmyard manure were purchased. Farm produced manure used for potatoes accounted for Rs 41.69 per acre on an average, or 10.83 per cent of the total non-cash cost. There was a general tendency for this cost to increase slightly with increase in the size of enterprise. Miscellaneous non-cash cost items accounted for 7.19 per cent of the total non-cash cost.

It is apparent from the above analysis that family labor cost constituted a rather large proportion of the total non-cash costs in producing potatoes. It is possible that on some farms an even greater proportion of the labor for the potato enterprise could be handled with family labor, thus further reducing cash costs of production. There are a number of operations in potato production, like the preparatory cultivation, and weeding, etc., which need not be performed within a very narrow range of time. In performing these operations, it is possible in many cases for the

family to contribute most of its labor and hire that proportion of labor which is inevitable. Thus the cash costs on labor could be reduced appreciably. It may, however, be mentioned that a large majority of growers used their family labor for irrigation, although a few hired some labor to supplement their own. The family labor used for irrigation accounted for over 75 per cent of the total family labor used for potatoes.

Non-Cash Cost for Winter and Summer Crop

Another interesting feature in the use of family labor in potato production was that there was a tendency for the growers to use more family labor for the winter crop than for the summer crop. A comparison of costs of family labor in Table XI under the respective size columns reveals this fact. In the two acres and above size group, family labor was not used for the summer crop. In the other size groups, especially in the second and the third, there was considerable difference in the family labor cost between the winter and summer crops. One explanation for this feature is that potatoes were not produced as an independent enterprise; it was only one part of the entire diversified farm organization. During the period from June to October when the summer crop was being produced the family labor of the potato grower was also required to be engaged in other farm operations, especially on paddy, ragi, and other rain-fed crops. The farmer family, therefore, was not free to spare much labor for potatoes during the rainy season.

Generally, it was the larger farms that had a large potato enterprise. Hence, these farms had less family labor to spare to potatoes, especially for the summer crop and hence the family labor contribution

TABLE XI

**NON-CASH COSTS IN PRODUCING AN ACRE OF POTATOES FOR DIFFERENT
SIZE GROUPS, WINTER AND SUMMER CROPS**

Items of Cost	Less than 0.50 acres	.50-.99 acres	1.00-1.99 acres	2 acres and above	Average all farms
Winter Crop					
	(Rupees)				
Family labor	189.89	140.92	118.04	116.42	140.47
Seed	10.67	29.44	-	15.00	12.43
Manure	46.61	47.20	49.36	35.35	45.57
Depreciation and interest	152.58	91.78	86.85	91.16	104.61
Land rental	66.89	75.21	78.33	87.71	76.59
Other	16.90	46.77	15.03	12.18	22.56
Total winter non-cash costs	481.54	431.32	347.61	357.82	402.64
Summer Crop					
	(Rupees)				
Family labor	184.37	107.10	64.29	-	110.85
Seed	-	-	-	-	-
Manure	22.03	34.75	55.00	-	31.67
Depreciation and interest	195.92	80.69	56.57	44.00	109.98
Land rental	68.72	72.50	92.50	108.33	80.44
Other	12.50	5.25	10.83	-	8.75
Total summer non-cash costs	483.54	300.29	279.19	152.33	341.69

to potatoes declined more sharply with size for the summer crop than for the winter crop. Another factor which was partially responsible for the decline in the family labor costs associated with increase in size was the social prestige. Operators of large farms, from prestige point of view, did not work much at arduous types of work as was required in the production of potatoes.

The total non-cash costs decreased fairly sharply with increase in size except in the fourth size group for the winter crop where it increased by Rs 10.21. These costs decreased much more sharply for the summer crop than for the winter. This decline in cost with size was largely due to the decline in the family labor costs and depreciation and interest, which accounted for a large proportion of the total non-cash costs.

Relative Importance of Cash and Non-Cash Costs

It has been pointed out earlier that the labor cost formed 25.33 per cent of the total cost of producing potatoes (Figure 1). Of this, 42.63 per cent formed the non-cash costs and 57.37 per cent was cash cost.

Next in order of importance of the non-cash items came the depreciation and interest, land rent, and manures. The total depreciation costs accounted for 10.26 per cent of the total costs, of which 84.23 per cent was non-cash and 15.77 were cash. Purchased manures and fertilizers accounted for a major proportion (82.93 per cent) of the total manures and fertilizers cost, and the rest of 17.07 per cent accounted for the non-cash costs.

Land rent and taxes formed relatively a smaller proportion, 7.10 per cent, of the total cost, but non-cash costs formed 89.49 per cent

while cash cost formed only 10.51 per cent of the cost on rent and land revenue. This was because most of the farmers produced potatoes on their own land. Only four growers in Kolar had rented-in land.

Seed cost accounted for nearly one-third of the total cost in producing potatoes, of which cash cost formed 97.42 per cent, and 2.58 per cent was non-cash costs. Only four growers used their own seed. Figure 2 gives a comparison of cash and non-cash costs for both districts in winter and summer. (See also Table XII.) Of the total cost of Rs 1224.33 in producing an acre of potatoes, cash costs were Rs 839.28, or 68.55 per cent, and non-cash costs were Rs 385.05, or 31.45 per cent, of the total cost.

In winter both cash and non-cash costs were relatively higher in Kolar District than in Bangalore. For the summer crop cash costs were higher in Bangalore than in Kolar. Both cash and non-cash costs for Bangalore and Kolar were higher in winter than in summer.

Legend

C - Cash Cost
 NC - Non-Cash Cost
 B - Bangalore
 K - Kolar
 Av. - Average

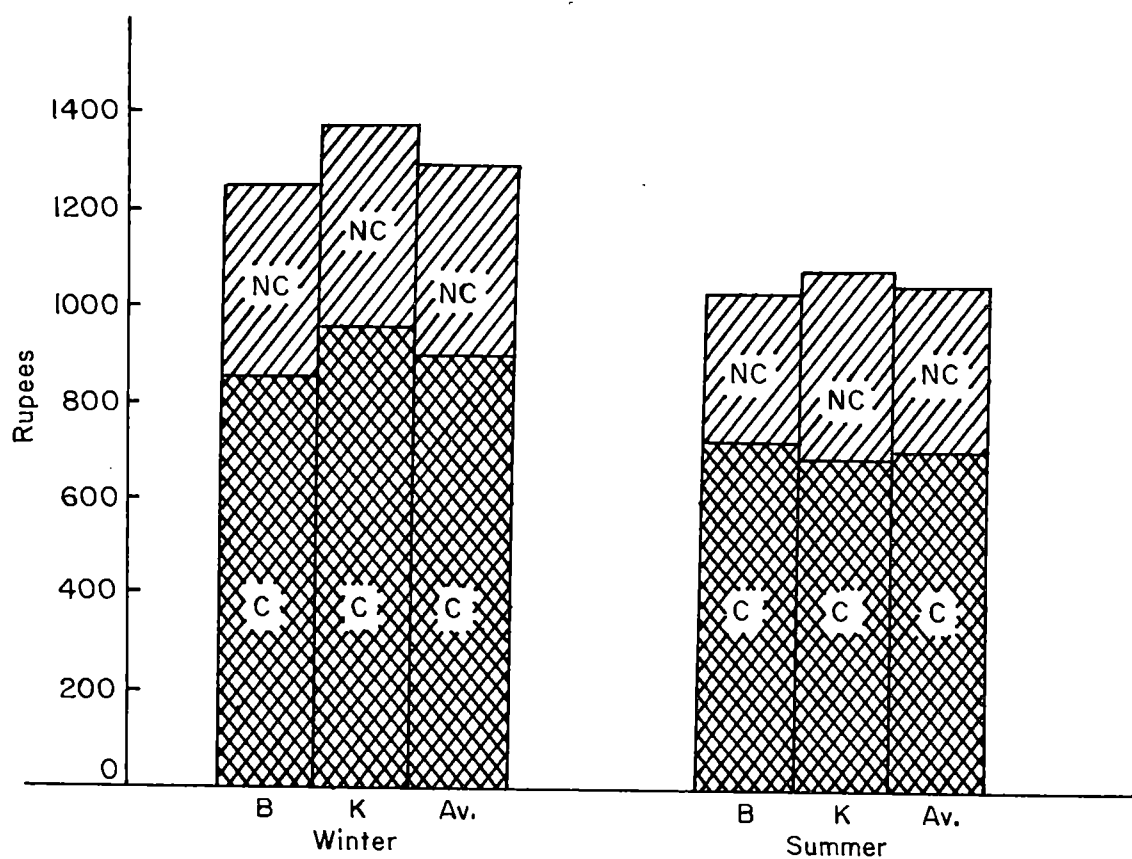


FIGURE 2

AVERAGE CASH AND NON-CASH COSTS IN PRODUCING 100 KG OF POTATOES
 IN BANGALORE AND KOLAR DISTRICTS, WINTER AND SUMMER 1962.

TABLE XII

CASH AND NON-CASH COSTS IN PRODUCING AN ACRE OF POTATOES
WINTER AND SUMMER CROP, BANGALORE AND KOLAR DISTRICTS*

District	Winter			Summer		
	Cash	Non-Cash	Total	Cash	Non-Cash	Total
Bangalore	847.44 (68.18)	395.53 (31.82)	1242.97	720.64 (70.37)	303.46 (29.63)	1024.10
Kolar	959.89 (69.84)	414.57 (30.16)	1374.46	691.42 (64.05)	388.14 (35.95)	1079.56
Average for the two districts	899.84 (68.87)	402.23 (31.13)	1292.07	706.79 (67.41)	341.69 (32.59)	1048.48

*Figures in the parenthesis indicate per cent of total cost.

CHAPTER III

RETURNS FROM POTATOES

This chapter deals with the returns from an acre of potatoes. Returns from potatoes were computed for production areas for the winter and summer crops. For the winter crop the returns were calculated for various size groups, but it was not possible to study variation in returns by size group for the summer crop because of the small number of observations. Table XIII gives the average net returns per acre of potatoes for the winter and summer crops in Bangalore and Kolar Districts. The value of potatoes consumed in the home was also included in the net returns calculations.

I. RETURNS OVER ALL COSTS

Returns From Winter Crop

Mention has already been made in Chapter I, under "Limitations of the Study," that 1958-59 was an unusually poor year for potatoes, especially in Bangalore District. Most of the potato growers in Bangalore sustained heavy losses, and even in Kolar a good many incurred losses. However, the position was better in Kolar than in Bangalore. Out of 47 farmers in Bangalore, 29, or 61.70 per cent, sustained loss, and only 18, or 38.30 per cent, had some returns over all costs. In Kolar, out of 28 growers, only 12, or 42.86 per cent, sustained losses, while 16, or 57.14 per cent, gained (Figure 3). The loss sustained in Bangalore was much higher than the loss in Kolar. Among those who made gains, Kolar growers had relatively higher returns than Bangalore growers.

TABLE XIII

AVERAGE NET RETURNS FROM POTATOES PER ACRE OF WINTER CROP
BY SIZE GROUPS AND SUMMER CROP, BANGALORE
AND KOLAR DISTRICTS

Size Group Winter Crop	Bangalore (Rupees)	Kolar (Rupees)	Average for all farms (Rupees)
Less than .5 acres	- 230.27	3.56	- 116.92
.50 - .99 acres	- 372.08	1,265.46	- 8.18
1.00 - 1.99 acres	77.42	525.55	256.67
2 acres and over	- 42.40	269.67	123.57
Average for winter farms	- 138.34	417.78	69.27
Average for summer farms	347.32	- 12.09	151.73

It could be seen from Table XIII that except in the third size group in Bangalore, all the other size groups on the average sustained losses, while in Kolar all the size groups made profits on the average. The average loss per acre in Bangalore increased from the first to the second size group and then it dropped. The average loss per acre for the winter crop in Bangalore was Rs 138.34, while the average gain in Kolar for the same crop was Rs 417.78. If the average returns for the two areas is considered, the first two size groups incurred loss on an average of Rs 116.92 and Rs 8.18 respectively. The growers in the third size group gained on the average Rs 256.67 and the returns for the fourth size group dropped to Rs 123.57. The average return in winter for both areas was Rs 69.27.

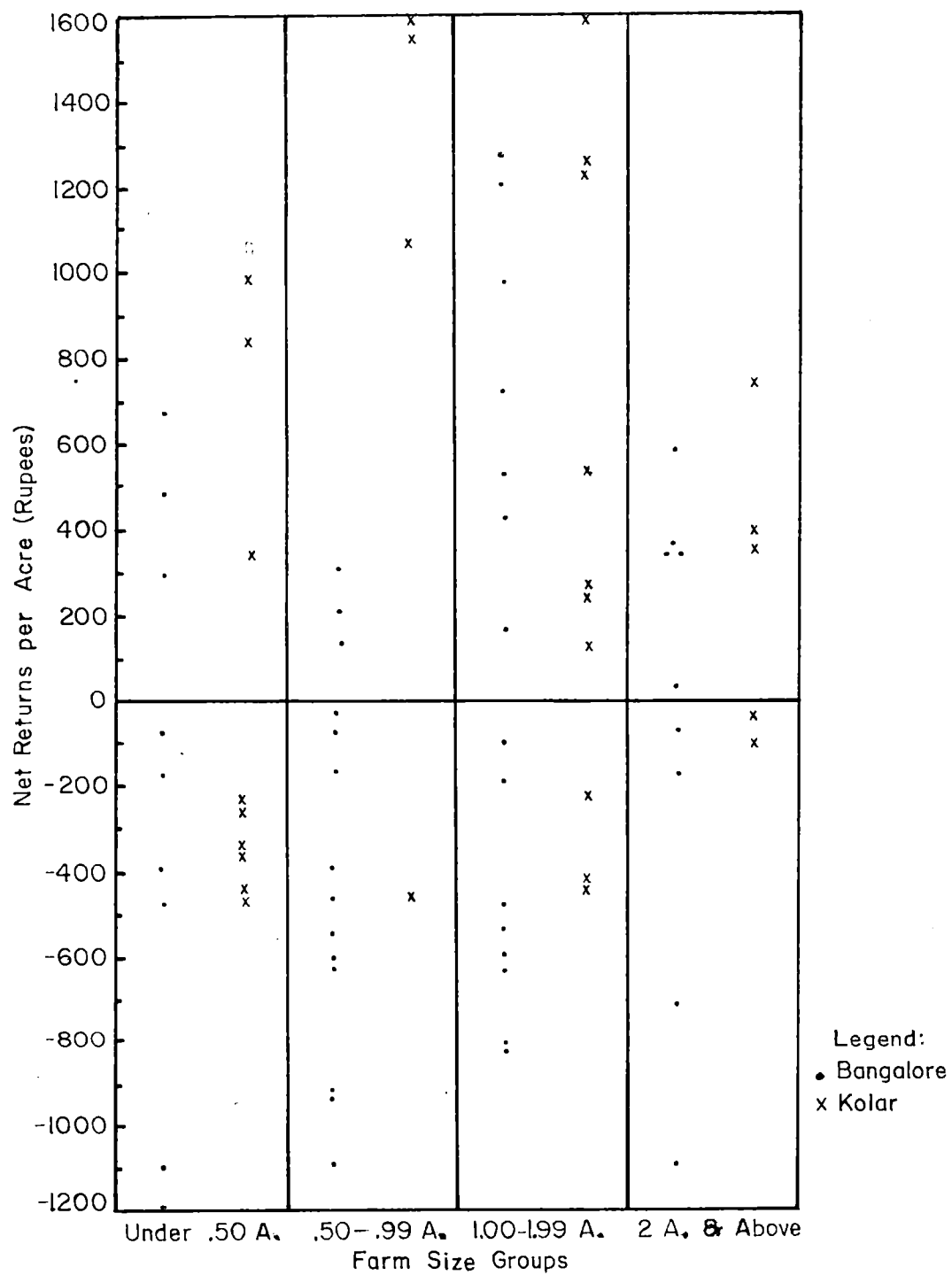


FIGURE 2

ANALYSIS OF NET RETURNS BY DISTRICT AND FARM SIZE GROUPS
 (BASED ON 1950-51 DATA, TOTAL 100)

Returns from Summer Crop

The average gain per acre for the summer crop in Bangalore was Rs 347.32, while the average loss in Kolar was Rs -12.09, but the average gain for all farms for the summer crop was Rs 151.73. Very low yields of a few farmers resulted in the average negative returns to Kolar growers in summer. For the summer crop, returns were higher in Bangalore than in Kolar (Figure 4).

Returns for Winter and Summer Crops

The position appears to be slightly better for Bangalore if the summer and winter returns are combined under the respective size groups. The negative returns in the first and second size groups for the winter crop decreased from Rs 230.27 to Rs 187.33 and from Rs 372.08 to Rs 163.91 respectively (Tables XIII and XIV). The returns for the third size group increased from Rs 77.42 to Rs 153.20. In the fourth size group, the negative return of Rs 42.40 for the winter crop was changed to a gain of Rs 51.49. On an average, the position improved from a net loss of Rs 138.34 to a net loss of Rs. 14.99.

While the average returns position improved in Bangalore after combining the returns for both winter and summer crops, returns in Kolar decreased. The average net returns for all farms decreased from Rs 417.78 in winter to Rs 281.47 for both crops. This decrease in returns was largely the result of a decrease in returns in the second size group.

It is clear from the above analysis that summer crops were more profitable for the Bangalore growers than the winter crops. A review of Table XIV indicates that the average net income per acre increased in

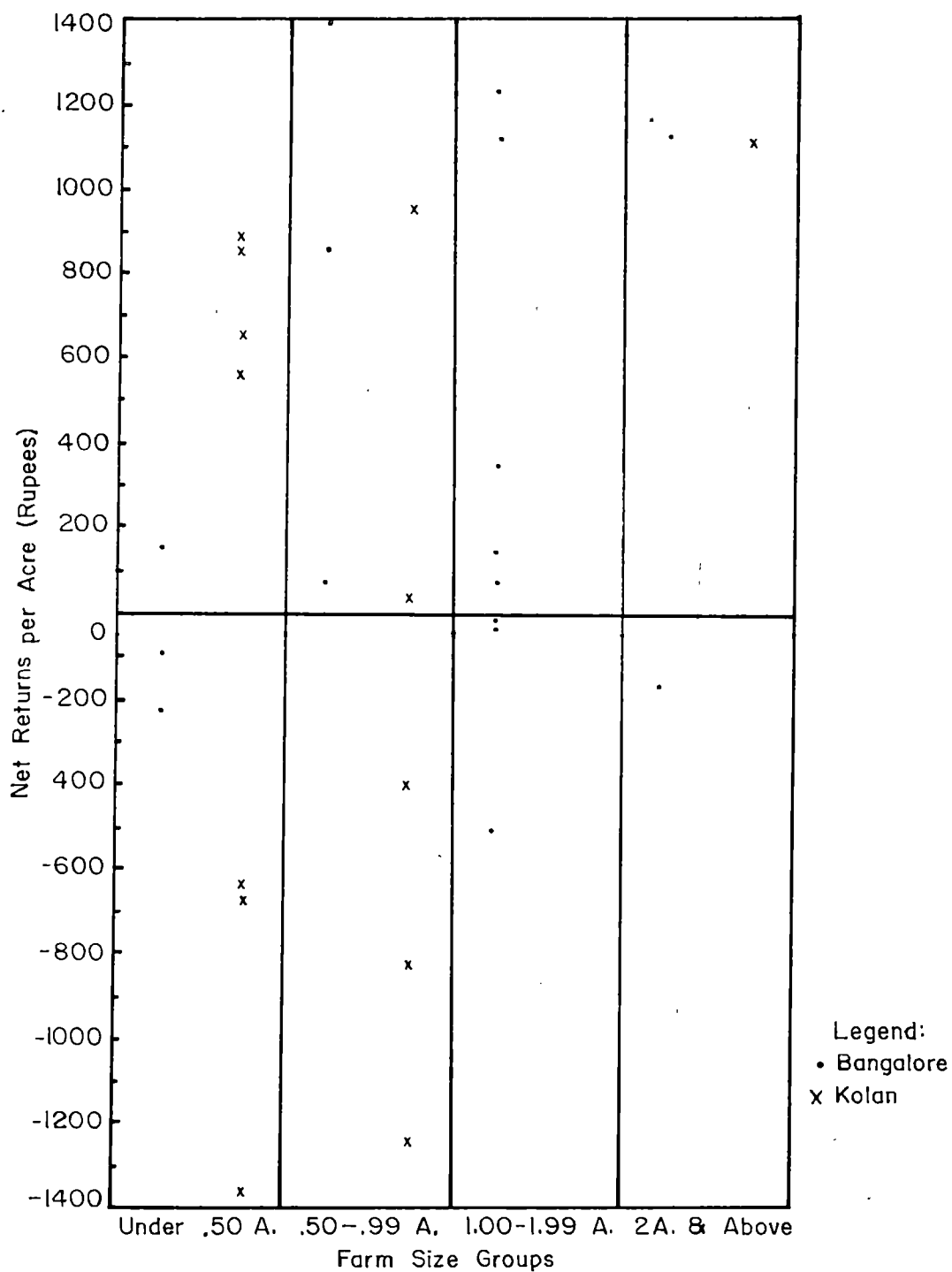


TABLE 1

NET RETURNS PER ACRE BY FARM SIZE GROUPS
 BANGALORE AND KOLAR DISTRICTS, 1950-51

TABLE XIV

AVERAGE NET INCOME FROM POTATOES PER ACRE FOR WINTER AND SUMMER CROPS,
BY SIZE GROUPS, BANGALORE AND KOLAR DISTRICTS

Size Group	Bangalore (Rupees)	Kolar (Rupees)	All Farms (Rupees)
Less than .50 acres	- 187.33	18.20	- 69.88
.50 - .99 acres	- 163.91	393.15	28.91
1.00 - 1.99 acres	153.20	525.55	266.03
2 acres and over	51.49	409.22	177.75
All farms average	- 14.99	281.47	101.88

both the districts as the size of potato enterprise increased up to the third and then it dropped in the fourth size group. The average net income per acre for all farms increased from Rs -69.98 for the first size group to Rs 266.03 in the third and then it dropped to Rs 177.75 in the fourth size group. It might also be pointed out at this stage that the cost per maund of potatoes was the lowest in the third size group.

II. RETURNS OVER CASH COSTS

From the point of view of farmers, returns over cash costs are more meaningful than returns over all costs. The farmers generally feel satisfied if they can cover all their cash costs out of the sale proceeds from potatoes. They do not generally count wages for the family labor, costs of farm-produced manures and, especially, they do not consider as costs depreciation charges on wells and other equipment and the rental value of land. If they realize some returns over their cash expenses, there is a tendency for them to feel that all the excess is profit.

It is this feeling that has tended to keep them in potato production. Further, they rarely keep any account of expenses to enable them to review their potato enterprise in terms of costs and returns.

The average returns per acre from the winter crop of potatoes over cash costs for the less than .50 acre size group was Rs 242.53 in Bangalore, while in Kolar it was Rs 503.94, and the average for both the areas was Rs 373.24. In Bangalore for this size group, three growers sustained a loss over cash costs and six made gains, while in Kolar only one had a loss and eight made gains.

For the size group .50 to .99 acres, the net return over cash costs was Rs 32.54 in Bangalore, while in Kolar it was Rs 1807.83 (Table XV). In this size group six Bangalore growers had some losses over cash costs and eight made gains, while in Kolar one sustained some loss and three made very good incomes. The average returns over cash costs for both districts for this size group was Rs 427.71.

The average returns over cash costs increased in the third size group in Bangalore to Rs 415.58 and in Kolar the average return was Rs 838.79. In Bangalore seven growers had losses and eight made fairly good profits, while in Kolar only one incurred a loss and nine growers made fairly good incomes. The average return for both the districts was Rs 584.86 in the third size group.

The average returns over cash costs in the fourth size group was less than in the third size group in both the districts. Returns over cash cost in the fourth size group was Rs 295.64 in Bangalore and Rs 676.42 in Kolar, the average for the two districts being Rs 431.63. In this

TABLE XV

AVERAGE RETURNS ABOVE CASH COSTS FROM POTATOES PER ACRE
OF WINTER CROP BY SIZE GROUPS AND SUMMER CROP,
BANGALORE AND KOLAR DISTRICTS

Size Group Winter Crop	Bangalore (Rupees)	Kolar (Rupees)	All Farms (Rupees)
Less than .5 acres	242.53	503.94	373.24
.50 - .99 acres	32.54	1,807.83	427.71
1.00 - 1.99 acres	415.58	838.79	584.86
2 acres and over	295.64	676.42	431.63
Average of winter farms	257.19	832.35	471.50
Average of summer farms	650.78	376.05	493.44

size group, two growers in Bangalore sustained some loss and seven made fairly good incomes, while in Kolar all the five growers made good incomes.

The average returns over cash costs for the winter crop was Rs 257.19 in Bangalore and Rs 832.35 for Kolar; the average for the two districts being Rs 471.50.

In summer only one Bangalore farmer had negative returns over cash costs, while fifteen had, on an average, fairly good returns. The position was a little different in Kolar. Out of the thirteen farmers who produced the summer crop, five had negative returns and eight made fairly good returns on an average.

The yield of five farmers for the summer crop in Kolar was unusually low. This had an adverse effect on the average returns in Kolar for the summer crop. Again in Bangalore the winter crop was a poor crop, while the summer crop was better. The farmers who produced the summer crop made better incomes than the winter growers.

CHAPTER IV

LABOR REQUIRED FOR PRODUCING POTATOES

Total labor required to produce an acre of potatoes includes all labor, men, women, and children, used in producing the crop, beginning with preparatory tillage and planting of the crop until the time the crop was harvested and marketed. Before marketing the potatoes, the harvested crop was generally stored for a few days. The labor involved in such work was also included.

I. METHOD ADOPTED FOR COMPUTATION OF LABOR

For purposes of obtaining uniformity in the labor requirement and rendering the figures more comparable, all labor was computed in terms of man hours per acre. Normally, the hired labor was paid on daily basis, not on the basis of the number of hours worked. Often on small potato acreages, certain operations like spraying could be finished in less than a day. Also, when family labor worked on the crop it was possible that they worked longer hours than the hired labor. To obviate these difficulties, all labor used was computed on an hourly basis. Estimates made by farmers regarding the labor used for each operation and the number of hours worked each day on the operations were used in computing the men, women, and children labor used for different operations. All labor was then converted to man-hour equivalent. In computing man equivalents, one and one-half hours of female labor or two hours of child labor were considered as equivalent to one man-hour; thus, the labor used for each operation could be expressed in man-hour equivalents.

II. LABOR USED FOR DIFFERENT OPERATIONS BY AREAS

Preparatory cultivation for planting potatoes included a number of operations. The seed bed was prepared with scrupulous care, either by plowing or digging land, or sometimes both. Normally, if the land was prepared by plowing only, it was plowed six to eight times with the plow at intervals of about a week. Some cultivators used the wooden plow and some used both the wooden and the mould board plow. Each plowing was generally followed by breaking of clods. Eleven of the 104 growers plowed the land with no digging. The average labor used for plowing for these eleven growers was 96.9 hours of bullock pairs and 130.0 hours of man labor. Twelve growers did both digging and plowing. For these twelve growers the average labor hours used was 52.8 hours of bullock pairs and 52.8 hours of man labor for plowing. For digging the land, the average labor used by them was 228.8 man hours. However, plowing was not a very common practice in potato production.

Generally the land was dug twice. Ordinarily, the first digging was given one to one and a half months and sometimes two months before the potatoes were planted. The digging was a very elaborate operation, making heavy demands on labor. Potato growers considered that elaborate digging was necessary because generally the garden lands were heavily infested with deep-rooted weeds.

In the first digging, the land was dug one to one and a half feet deep. After the first digging, the land was left in clods for weathering for about a month or so. During the second digging operation, the clods

were broken, the land given a light digging, and leveled. The weeds were also removed during the second digging.

Labor Used for Irrigation

Irrigation was the most important item of labor used, accounting for over one-third of the total labor used. The average labor used for irrigation was 709.2 man hours per acre. The average number of hours of labor used for irrigation per acre was 828.5 in Kolar and 631.6 in Bangalore (Table XVI). Five Kolar farmers, who irrigated their crop by drawing water from the well, using manual labor, used an average of 1552.6 man hours of labor per acre. This high labor used by five growers greatly influenced the average labor used for irrigation in Kolar.

Growers in Bangalore, on an average, used less labor for irrigation for the summer crop than for the winter crop (Table XVII) because the summer crop was grown during the monsoon period and the number of irrigations was less. The average number of irrigations in Bangalore for the winter and the summer crops was 27.8 and 17.9 respectively. But in Kolar the average labor used for irrigating the summer crop was over 100 hours more than for the winter crop, although the number of irrigations for the summer crop were fewer. This was because four growers in Kolar irrigated their summer potatoes by drawing water by manual labor from the well. As a consequence, they had to use large amounts of labor; the average for these four growers was 1365.1 man hours, which increased the average very much. Even the labor for irrigating the winter crop in Kolar was much higher than in Bangalore, because of the high labor, 2304.0 hours, used by one grower in Kolar who irrigated by drawing water by manual labor from the well.

TABLE XVI

AVERAGE MAN HOURS OF LABOR USED PER ACRE OF POTATOES
FOR DIFFERENT OPERATIONS - BANGALORE AND KOLAR DISTRICTS

Operations	Bangalore	Kolar	Average of all farms	Per cent of total labor
Plowing	17.9	22.8	19.9	0.98
Digging	554.7	566.1	559.2	27.51
Manuring	108.3	113.8	110.5	5.44
Sprinkling water	51.9	38.6	46.6	2.29
Planting	199.4	206.4	202.2	9.95
Weeding	79.9	96.6	86.5	4.25
Earthing	90.4	122.7	103.2	5.08
Irrigation	631.6	828.5	709.2	34.89
Spraying	5.9	4.9	5.5	0.26
Harvesting and cleaning	180.5	204.4	189.9	9.35
Total	1920.5	2204.8	2032.7	100.00

TABLE XVII

AVERAGE MAN HOURS PER ACRE OF POTATOES FOR DIFFERENT OPERATIONS,
WINTER AND SUMMER CROPS, BANGALORE AND KOLAR DISTRICTS

	Bangalore		Kolar		All Farms	
	Winter	Summer	Winter	Summer	Winter	Summer
Plowing	9.7	42.1	21.7	25.1	14.2	34.5
Digging	595.4	464.9	590.3	514.0	593.5	486.9
Manuring	119.7	88.9	114.8	111.8	117.9	99.2
Sprinkling water	51.5	54.5	47.3	19.8	49.9	38.9
Planting	207.9	174.6	216.8	183.9	211.2	178.9
Weeding	72.7	101.1	88.7	113.5	78.7	106.6
Earthing	89.3	93.8	117.3	134.4	99.7	112.0
Irrigation	681.5	485.1	796.9	896.3	724.6	669.5
Spraying	5.4	7.4	3.8	7.1	4.8	7.2
Harvesting and cleaning	179.8	182.7	211.3	189.5	191.6	185.7
Total	2012.9	1695.1	2208.9	2195.4	2086.1	1919.4

Table XVIII shows the number of potato growers who used the different devices for irrigation and the average labor used by each device to produce an acre of potatoes in the two seasons in Bangalore and Kolar Districts. It is clear from this table that the average labor requirement for irrigating the winter crop by different devices was generally higher than for the summer crop in both the districts.

Labor Used for Digging

Next in importance, the item of operation which made heavy demands on labor used was digging the land. The average amount of labor used for digging an acre of land was 559.2 man hours, comprising 27.5 per cent of the total labor used on an acre of potatoes. There was very little difference in the amount of labor used for digging between Bangalore and Kolar. But there was some large difference in the labor used for digging between the winter and summer crops (Table XVII).

Labor Used for Planting and Harvesting

Planting and harvesting potatoes were the next two important items of operation, accounting for 202.2 and 189.9 hours of labor respectively. There was not much difference in the labor used for planting between the two districts. However, relatively more labor was used for winter planting than summer planting in both districts. Planting labor included labor for final preparation of the land, making of the beds for planting, cutting the seed, planting and covering of the seed with soil. The average labor used per acre for harvesting and cleaning in the two areas was 180.5 and 204.4 man hours respectively.

TABLE XVIII

NUMBER OF FARMS USING DIFFERENT DEVICES FOR IRRIGATION
AND THE AVERAGE LABOR USED BY EACH
IN BANGALORE AND KOLAR DISTRICTS*

Area	Season	Devices used for irrigation											
		Pump		Pickota		Mhote		Hand Watering					
		No. of irriga- tions	MH	No. of irriga- tions	MH	No. of irriga- tions	MH	No. of irriga- tions	BPH	No. of irriga- tions	MH		
Bangalore	Winter	16	28.4	413.7 (14.6)	12	27.8	1069.31 (38.5)	19	27.7	662.0 (23.9)	253.8 (9.2)	-	-
Kolar	Winter	11	26.6	527.8 (19.8)	9	25.7	962.8 (37.5)	7	25.1	791.4 (31.5)	235.14 (9.4)	1	24
													2304.0 (96.0)
Bangalore	Summer	6	14.7	282.8 (19.2)	8	17.9	591.9 (33.1)	2	20.0	650.0 (32.5)	218.3 (10.9)	-	-
Kolar	Summer	3	15.7	288.0 (18.3)	3	25.3	1122.67 (44.4)	3	20.0	653.3 (32.7)	195.6 (9.8)	4	26.3
													1365.1 (51.9)
Total		36		416.8	32	-	(925.0)	31	-	689.9	(244.9)	5	-
													1552.6

*Figures in the parenthesis indicate the average hours of labor used per irrigation.

MH - Man hours

BPH - Bullock pair hours

Manuring included the labor involved in transporting manure to the field, spreading, and mixing with the soil. Also included was the labor used for spreading oil cake and fertilizers. Both districts used approximately the same amount of labor for manuring, the average being 110.5 man hours. However, more labor was used in Bangalore for manuring the winter crop than for the summer crop, but in Kolar there was very little difference.

Weeding and Earthing

Weeding of potato fields is generally done a month after planting, and a few days later "earthing" is done. The operation of earthing involves moving of soil from the rows to the trunk of potato plants, so that the trunk and any exposed roots are covered. This is claimed to be beneficial in tuber formations. The average labor used for weeding was 86.5 hours, and for Bangalore and Kolar it was 79.9 and 96.6 man hours respectively. Earthing used a little more labor than weeding, the average being 103.2 man hours, and for the two districts the labor hours used were 90.4 and 122.7 hours respectively. In both districts, the summer crop utilized more labor than the winter crop for both weeding and earthing.

Others

Other items of minor importance were sprinkling water a day before the crop is planted, plowing, and spraying the poison. These together used an average of 72.00 hours of labor per acre, or 3.5 per cent of the total labor. More labor was used in both districts for plowing and spraying in summer than in winter.

It is clear from the above that potatoes was a heavy labor consuming crop. The average labor used per acre of potatoes for both the districts was 2032.7 man hours, irrigation alone accounting for 34.39 per cent of the total. Then came the digging and plowing of the land, accounting for 23.49 per cent of the total labor used (Figure 5). Planting and sprinkling water together accounted for 12.24 per cent. Harvesting potatoes used 9.35 per cent of the labor, and weeding and earthing together represented 9.33 per cent of the total labor. Manuring accounted for 5.44 per cent and the rest, or .26 per cent, was used for spraying.

The average labor used in Kolar for different operations was generally higher than for the same operations in Bangalore, except in case of sprinkling water and spraying. The total labor used per acre was 2204.8 man hours in Kolar and 1920.5 man hours in Bangalore, a difference of 284.3 man hours. Over 70 per cent of this difference came from the difference in the labor used for irrigation. Even within any given area, there was a large variation in the labor used per acre in producing potatoes. This could be seen from the high standard deviation in both areas. The standard deviation for the labor used was 691.14 man hours in Bangalore and 863.36 man hours in Kolar. A test of significance for the difference between the labor requirement per acre for the two areas gave a "t" of 1.72. The difference between these two labor means was statistically significant at the 90 per cent level of confidence.

There were some large differences in the total labor used in the two districts as between the winter and summer crops. This was more true of Bangalore than Kolar. The average labor used in Bangalore for the winter crop was 2012.83 man hours for an acre of potatoes while for

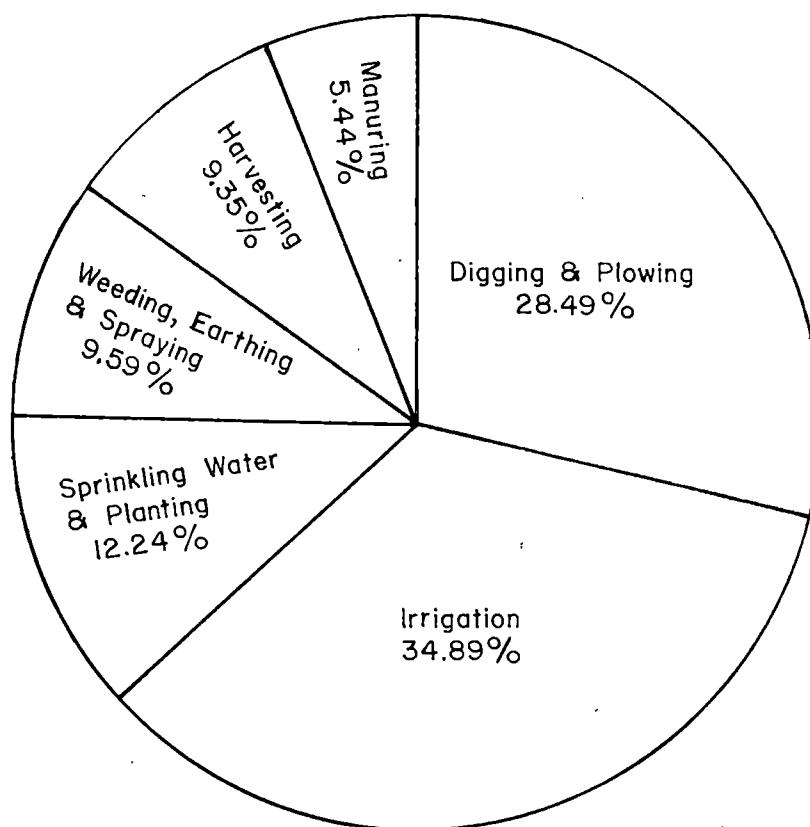


FIGURE 5

PROPORTION OF TOTAL LABOR USED FOR DIFFERENT OPERATIONS
IN THE PRODUCTION OF PIMENTO

the summer crop it was 1687.49 man hours. Similar figures for Kolar were 2209.0 and 2195.45 respectively, a difference of only 13.58 man hours. A test of significance was made for the difference between the summer and winter labor hours used in Bangalore and a "t" of 1.605 was obtained, which was not significant at the 90 per cent level

III. LABOR USED PER ACRE OF POTATOES BY SIZE OF ENTERPRISE

The total labor used per acre declined from a high of 2194.8 man hours for the less than half acre size group to a low of 1917.0 man hours in the one to 1.99 acre size group, and then slightly increased to 1924.5 man hours in the two acres and above size group (Table XIX). The total labor hours used for the second size group was 2087.2. It is thus clear that as the size of enterprise increased the average man hours of labor used per acre tended to decrease. It could be observed from Table XIX that a very large part of this decrease in labor used was accounted by labor used for irrigation. From the first size group to the fourth, the average labor used for irrigation decreased from 958.3 to 470.1 man hours, a total decrease of 488.2 man hours. The labor requirement for irrigation decreased sharply with an increase in the size of potato enterprise, the man hours used for the largest size group being only 49.06 per cent of the labor used for the smallest size group.

The differences in the amount of labor used for irrigation between the various size groups was a result of differences in irrigation devices used rather than in the number of irrigations given to the crop. The average number of irrigations given for the four size groups were respectively 24.6, 24.5, 24.3, and 26.6. When the pump was used for lifting

TABLE XIX

AVERAGE MAN HOURS USED FOR DIFFERENT OPERATIONS BY SIZE GROUPS

Operations	Less than 0.50 acres	.50-.99 Ac.	1.00-1.99 Ac.	2 Ac. and above
Plowing	35.2	6.7	17.3	2.0
Digging	460.8	609.9	509.7	766.9
Manuring	100.2	113.3	119.5	117.4
Sprinkling water	36.4	47.1	55.9	44.5
Planting	204.3	207.9	205.9	182.5
Weeding	101.1	82.6	91.6	58.4
Earthing	112.6	109.3	100.1	82.7
Irrigation	958.3	717.4	614.5	470.1
Spraying	3.8	4.6	7.0	5.7
Harvesting	182.1	188.4	195.5	194.3
Total	2194.8	2087.2	1917.0	1924.5

the water from the well, the average labor used on an acre was less. When the "mhote" was used, bullock labor also was involved in irrigating the crop, and hence the human labor requirement was relatively less. When the pickota was used, heavy labor was involved as the entire operation is done by manual labor only. A few growers irrigated their crop by drawing water from the well by manual labor, and the labor used was very high.

It could be seen from Table XX that as the size of potato enterprise increased a larger proportion of growers used the labor saving device for irrigation; i.e., pump, and hence the average number of hours of human labor used decreased. In working with the mhote the average bullock pair labor used was 244.9 hours.

The next important item of operation which was a heavy labor user was digging. There was a tendency for the average labor used for digging land to increase with the increase in size of potato enterprise, although it decreased from second to third size group. The labor requirement increased from 460.8 hours for the first size group to 766.9 hours for the fourth, an increase of 306.1. The general practices used in preparing land for planting varied with the size groups. The smallest size group used more man hours for plowing land than did the other size groups, the largest size group using only two man hours for plowing. This may partially explain the increase in the labor used for digging with the size group. Another important factor affecting the labor used for preparatory tillage was the infestation of land by weeds.

TABLE XX

NUMBER OF FARMS USING DIFFERENT DEVICES FOR IRRIGATION
IN THE DIFFERENT SIZE GROUPS AND THE
AVERAGE LABOR USED PER ACRE*

Size Group	Pump		Mhote		Pickota		Hand watering	
	No.	Av. Labor Hours	No.	Av. labor Hours	No.	Av. labor Hours	No.	Av. labor Hours
Less than 0.50 Ac.	5 (17.9)	293.3	7 (25.0)	715.1	11 (39.3)	1147.6	5 (17.8)	1552.6
0.50 - .99 Ac.	4 (15.4)	404.4	12 (46.2)	711.7	10 (38.4)	847.0	-	-
1.00 - 1.99 Ac.	17 (51.6)	435.4	8 (24.2)	710.9	8 (24.2)	898.4	-	-
2 Ac. and Above	10 (58.8)	451.9	4 (23.6)	538.50	3 (17.6)	439.8	-	-
All Farms	36 (34.6)	416.8	31 (29.8)	689.9	32 (30.8)	925.0	5 (4.8)	1552.6

*Figures in the parenthesis indicate the percentages in each size group.

There was little difference in the average labor used per acre for the different size groups for some of the operations, like manuring, sprinkling water, spraying, and harvesting the crop. Even for planting the average labor used for different size groups was almost the same for the first three size groups, about 205 hours. For the largest size group it was 182.50 hours.

There appeared to be some relation between labor used for digging and for weeding. For the smallest size group, labor used for digging was the lowest, but for weeding it was the highest, being 101.1 man hours. On the other hand, labor used was the highest for digging in the two acres and above size group, but it was the lowest for weeding, 58.4 man hours. Also from the second size to the third, labor hours for digging decreased but weeding labor increased from 82.6 to 91.6 man hours.

Labor used for "earthing" gradually decreased from 112.6 hours for the smallest size group to 82.7 man hours for the largest size group.

CHAPTER V

FACTORS AFFECTING NET RETURNS

It may be recalled here from Chapters II and III that there was a large variability in the costs and net incomes per acre among the different size groups and also between the two districts. Costs and returns varied a great deal even within the same size group. In Bangalore, excepting the one to 1.99 acre size group, all the other three groups had negative returns on the average. Even in Kolar, where on an average, all size groups had returns over all costs, there was large variability in incomes.

Variability in the net returns per acre could be explained by (1) yields per acre, (2) prices received per maund of produce, and (3) cost of production per acre. Net returns per acre could be increased by one or all of the following three methods, (1) increasing yield per acre, (2) reduction of cost per acre, and (3) a higher price received per maund of potatoes. However, yields were one of the most important factors influencing cost per maund and returns from potatoes. Cost per maund of potatoes for each of the 104 farms was plotted against the corresponding yields and a free hand curve was fitted. It could be observed from Figure 6 that the cost per maund decreased appreciably with increase in the yields per acre.

It was seen earlier in Chapter II, Figure 1, that labor and seed cost together accounted for 57.39 per cent of the total cost, constituting 25.35 and 32.04 per cent of total cost respectively. Scatter

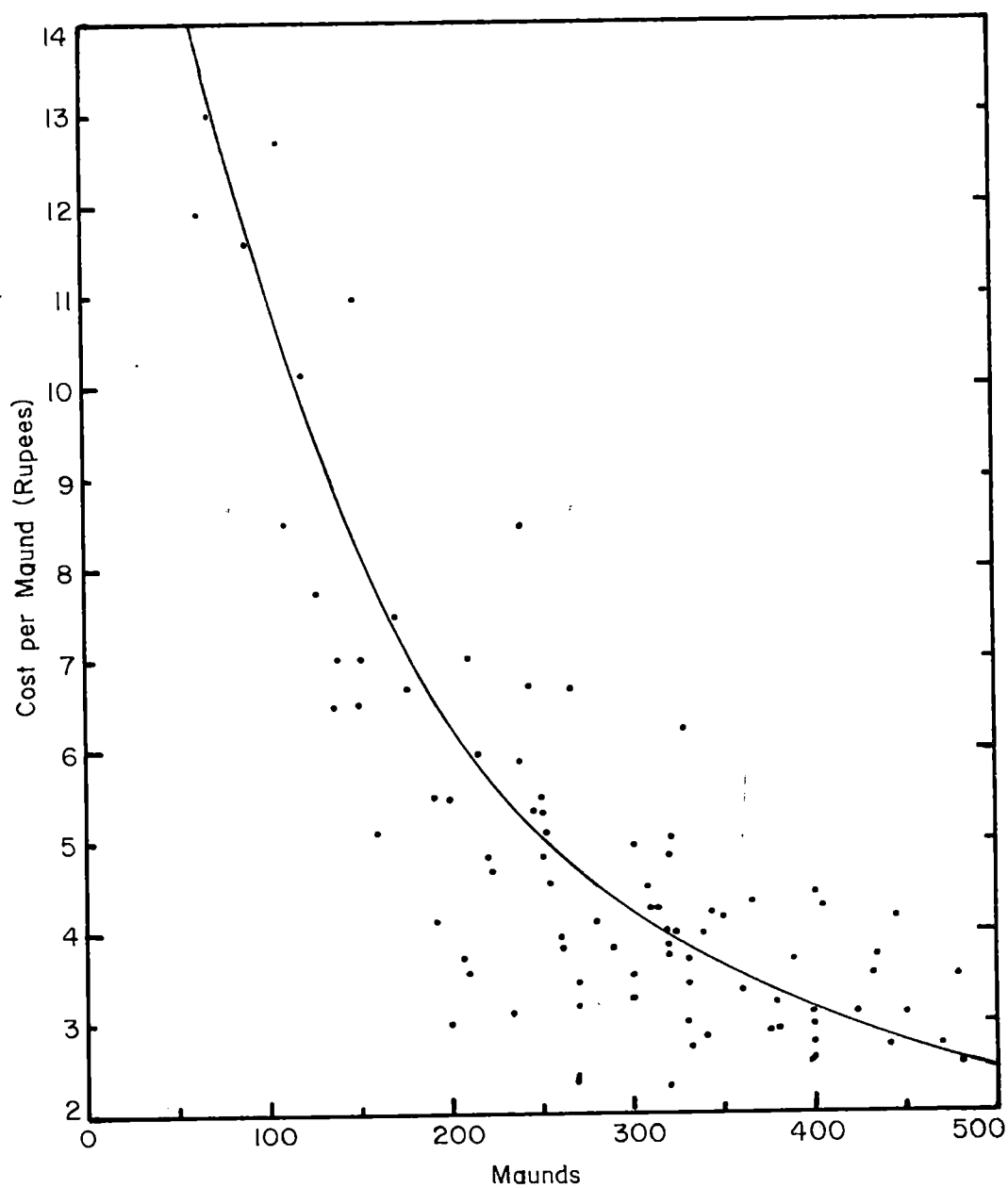


FIGURE 6

RELATIONSHIP BETWEEN THE COST PER MAUND
AND YIELD PER ACRE OF PORE TOLLS

diagrams relating cost per maund of potatoes to the labor cost and seed cost per acre were plotted but no apparent relation was observable; the points were highly scattered.

Again, net returns per acre for all the 104 farms were plotted against the yield per acre and a free-hand curve was fitted. (See Figure 7.) There appeared to be a linear relation between yield and net returns. Figures 6 and 7 indicate that higher yields would lead to a reduction in the cost per unit of the product and a higher net return received per acre of the crop produced. Hence, increasing yield per acre of potatoes appears to be a good way to increase net returns.

I. YIELD PER ACRE OF POTATOES

Yield per acre of potatoes was probably one of the most important factors affecting the net returns per acre. Yields varied greatly as between the two districts and between seasons in the same district. The variety of seeding material used influenced the yields. Table XXI gives the average yields per acre in Bangalore and Kolar for the summer and winter crops and for the two varieties, simla and rickets.

It could be observed from Table XXI that yields for the winter crop were higher in Kolar than in Bangalore, for both the varieties, while the yields for the summer crop in Kolar were less than in Bangalore. Farmers in Kolar did not use simla seed in summer. In Bangalore, out of 47 growers who produced the winter crop, twenty growers, or 42.55 per cent, had yields of less than 250 maunds, the average being 152.10 maunds, while in Kolar out of 28 growers only five, or 17.86 per cent, had yields of less than 250 maunds, and the average yield was 183.40 maunds. The

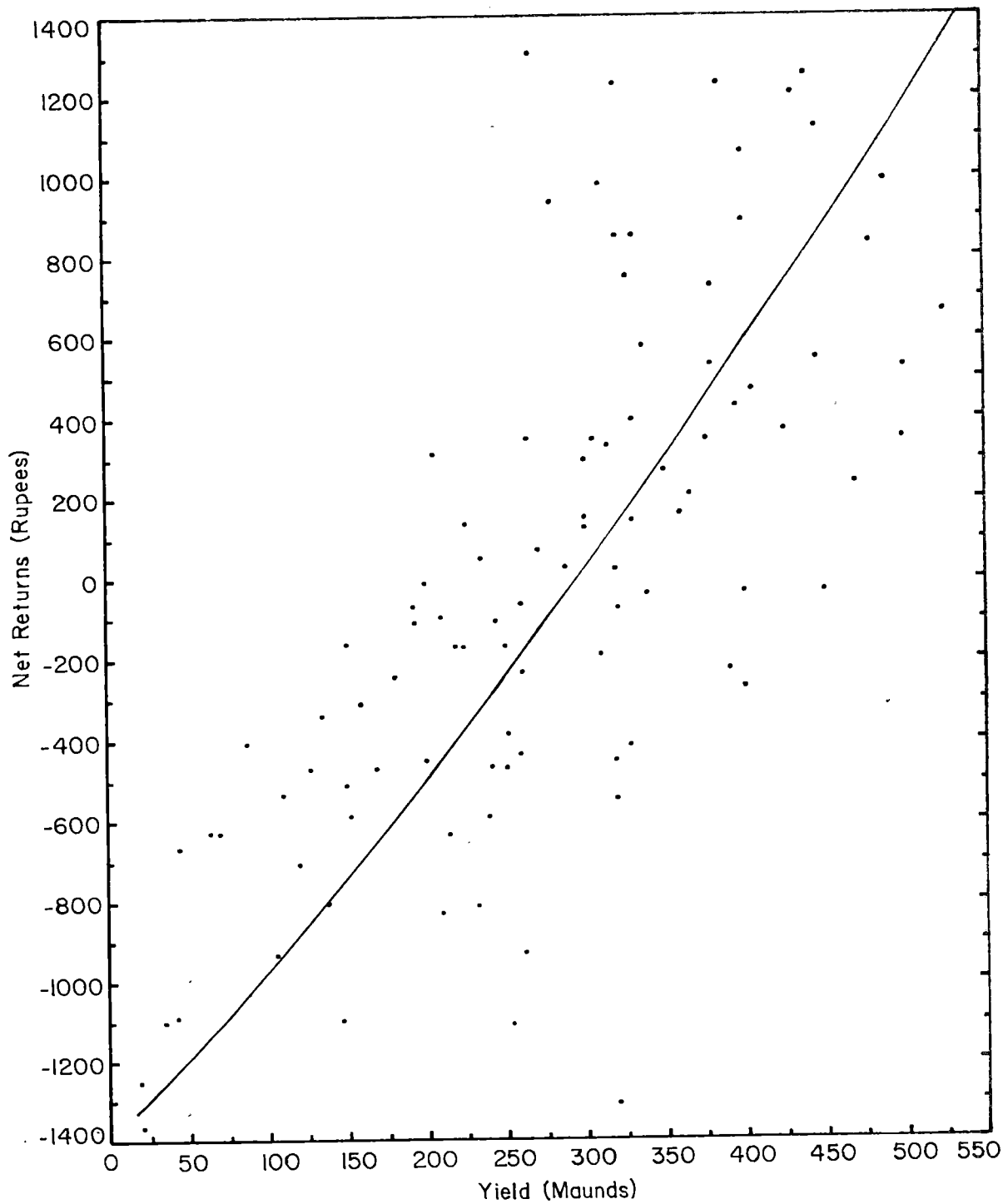


FIGURE 7

RELATIONSHIP BETWEEN YIELD AND NET RETURNS
 (YIELD IN MAUNDS, NET RETURNS IN RUPEES)

TABLE XXI

AREA DIFFERENCES IN YIELD PER ACRE OF POTATOES
BY VARIETIES AND SEASONS (IN MAUNDS)*

Variety ¹	Bangalore		Kolar	
	Summer	Winter	Summer	Winter
Rickets	(2) 280.50	(15) 200.76	(12) 213.25	(10) 267.90
Simla	(14) 298.85	(32) 313.88	-	(18) 396.00
Average for two varieties	(16) 296.56 ($\sigma=117.49$)	(47) 277.78 ($\sigma=139.04$)	(12) 213.25	(28) 350.96 ($\sigma=119.30$)

¹One grower in Kolar produced a summer crop of potatoes using Holland variety of seed and got 800 maunds of yield per acre on his 4.50 acre plot. If this yield is included, the average yields for summer in Kolar would be 258.38 maunds ($\sigma=213.78$ maunds).

*Figures in the parenthesis indicate number of growers.

position was different in summer when yields in Kolar were less than the yields in Bangalore. Excluding one farmer in Kolar who produced the Holland variety, of the remaining twelve growers, seven, or 58.33 per cent, had yields of less than 250 maunds. Their average was only 118.14 maunds. But in Bangalore only three growers, or 18.75 per cent, obtained yields of less than 250 maunds, the average yield being 170.00 maunds.

In Bangalore, since only two growers produced the rickets variety in summer, the number of observations was too small to compare the average yield for this variety between the two districts.

The average yield for summer crop was 296.56 maunds in Bangalore. A test of significance for the difference between the mean yields between the two districts for summer crop was made and "t" of 0.671 was obtained. The difference was not significant even at 50 per cent level of confidence.

The average yield for the winter crop was 277.78 maunds in Bangalore and 350.96 maunds in Kolar. A test of significance was also made for the difference between the mean yields in the two districts for the winter crop and a "t" of 2.391 was obtained which was significant at the 98 per cent level of confidence.

Tests of significance for the difference between the mean yields for winter and summer crops for Bangalore gave a "t" of 0.702 ($n = 63$) which is significant at the 50 per cent level and for Kolar it gave a "t" of 1.68 ($n = 41$) which is significant at 90 per cent level of confidence.

Tests of significance were also made for the difference between the average yields of rickets and simla varieties for the winter crop in

Bangalore and Kolar districts. The respective "t's" for Bangalore and Kolar were 2.774 ($n = 47$) and 3.040 ($n = 28$). Both "t's" were significant at the 99 per cent level of significance. This indicates that there was a highly significant difference between the mean yields of rickets and simla varieties and simla variety was a relatively higher yielder than rickets.

Variation of Actual Yields from Normal Yields

It was pointed out under "the limitations of the study" that the yields were very poor during the year under consideration. Table XXII gives a comparison of the actual yields with the normal yields for both districts for winter and summer crops. The normal yield figures were the averages of the normal yields given by the growers at the time of collecting the schedules.

There was a great variability in the actual yields, and in Bangalore the range was 36 to 642.50 maunds, the standard deviation being 139.04 maunds. In Kolar for the winter crop there was not much difference between the actual and the normal yields, the difference being only 9.42 maunds.

The position appeared to be better in Bangalore than Kolar for the summer crop, although the difference between the actual and normal yield in Bangalore was 59.69 maunds and in Kolar it was 96.08 maunds. On an average for both crops the difference was more in Bangalore (91.94 maunds) than in Kolar (37.37 maunds). The standard deviation for the actual yields in each case was very high, indicating a wide variability in the yields obtained. But for normal yield the variability was not

TABLE XXII
COMPARISON OF ACTUAL YIELDS WITH NORMAL YIELDS,
WINTER AND SUMMER CROPS, BANGALORE
AND KOLAR DISTRICTS
(in maunds)

Crop Season		Bangalore		Kolar	
		Actual	Normal	Actual	Normal
Winter	Average	277.78	363.68	350.96	360.38
	Standard Deviation	139.04	82.15	119.30	79.56
Summer	Average	296.56	356.25	258.38	354.46
	Standard Deviation	117.49	98.90	213.78	65.18
Average for both crops	Average	269.85	361.79	321.12	358.49
	Standard Deviation	157.42	85.93	157.36	74.17

so high as in the case of actual yields, and the standard deviation was not as high. There was apparently no difference in the normal yields between the two districts for the two crops.

II. RELATIONSHIP BETWEEN YIELDS AND ASSOCIATED FACTORS

With a view to determining the extent of relationship between the yield per acre of potatoes and the various factors associated with yields chi-square tests were made for the frequencies relating yields to these factors.

Yield and Seeding Rate Per Acre

Table XXIII shows the relationship between yields and seeding rate. Yields per acre were broken down into three levels, (1) low - less than 250 maunds per acre, (2) medium - 250 to 399 maunds per acre, and (3) high - 400 and over maunds per acre. The seeding rate was also broken down to three levels, less than 35 maunds per acre, between 35 and 44 maunds, and 45 maunds and over. Since there were too few observations in some cells to make chi-square test, the seeding rate was then broken down to two levels, at less than 40 maunds and 40 maunds and over per acre. However, the table with three breakdowns in yield and seeding rate has been presented to indicate the amount of variability in yield. A chi-square test, using three yield categories and two seeding rate categories, gave a chi-square value of 14.39. Chi-square table value for two degrees of freedom at 99.9 per cent level of confidence was 13.815. Hence the relationship between yield and seeding rate was highly significant.

TABLE XXIII
YIELDS AT DIFFERENT LEVELS OF SEEDING RATE*

Seeding Rate Per Acre	Less than 250 Mounds	250-399 Mounds	400 and above Mounds
Less than 35 maunds	137.30 (13)	283.27 (11)	575.00 (3)
35-44 maunds	158.87 (22)	322.78 (26)	466.04 (12)
45 and above maunds	216.00 (1)	322.37 (8)	509.00 (8)

*Figures in the parenthesis indicate the frequencies in each cell.

Yield Per Acre and Size Group

A test of significance was made for frequencies relating yields to size group and a chi-square of 4.75 was obtained. (See Table XXIV for yield and size categories used.) Critical value of chi-square for 6 degrees of freedom at 30 per cent confidence level was 3.828 and at 50 per cent it was 5.348. By linear interpolation, the chi-square value to be significant at 40 per cent level should be 4.568. Hence the relation between yields and size groups was not significant even at 40 per cent level of confidence.

Yield and Number of Irrigations Given

Another factor which was assumed to have an important effect upon yields was the number of irrigations. It was seen earlier that the number of irrigations given to the crop varied substantially for the winter and summer crop. For the summer crop irrigations were given to supplement rains, and hence the number of irrigations varied with the intensity of rain and number of rainy days during the crop period. Since it was difficult to arrive at any valid conclusions relating yield to the number of irrigations applied, the relation was studied only for the winter crop, when the crop did not receive any substantial quantity of rain water. (See Table XXV.)

The chi-square value obtained by relating yield to number of irrigations on the winter crop was only .80, which is non-significant at any acceptable level. The test, therefore, revealed, contrary to expectation, that there was no relation between yield and the number of irrigations applied. One possible explanation for this lack of relationship was that

TABLE XXIV
THE RELATIONSHIP BETWEEN YIELDS AND SIZE GROUPS*

Size Group	Yield per Acre			Average Maunds
	Less than 250 Maunds	250-399 Maunds	400 and Above Maunds	
Less than .50 acres	154.93 (13)	302.44 (9)	442.33 (6)	263.93 (28)
.50 - 0.99 acres	143.07 (10)	284.08 (12)	480.75 (4)	260.10 (26)
1.00 - 1.99 acres	165.95 (9)	335.87 (16)	530.44 (8)	336.70 (33)
2 acres and above	139.50 (4)	322.02 (8)	513.80 (5)	335.48 (17)

*Figures in the parenthesis indicate frequencies in each cell.

TABLE XXV
RELATIONSHIP BETWEEN YIELDS AND NUMBER
OF IRRIGATIONS APPLIED - WINTER CROP*

Number of Irrigations	Yield in Maunds			Average
	Less than 250	250-399	400 and above	
Less than 25	177.85 (6)	333.37 (8)	513.10 (5)	331.56 (19)
25-30	134.79 (9)	313.36 (14)	494.50 (6)	295.42 (29)
30 and above	167.90 (10)	318.42 (10)	447.57 (7)	296.12 (27)

*Figures in the parenthesis indicate the frequencies in each cell.

potato growers over-irrigated the crop. It is also possible that some interrelation between irrigation and other factors involved obscured this relationship.

Yield Per Acre and Labor Hours Used

It was possible that more labor used on the crop resulted in better and more thorough cultivation leading to higher yields. Table XXVI shows the yields per acre of potatoes at different levels of labor inputs with the respective frequencies.

A test of significance was made for the frequencies and a chi-square value of 2.159 was obtained. Chi-square table value for four degrees of freedom at 20 per cent level of confidence was 1.649, and at 30 per cent level it was 2.195. By linear interpolation, it could be inferred that the chi-square value obtained was significant at the 25 per cent level of confidence. It could thus be seen that there was no significant relationship between labor input and yield.

Fertilizers Used and Yield Per Acre

Another important factor affecting yields was the application of manures and fertilizers. In physical terms, the farmers were applying fairly large doses of organic manures, and to some extent inorganic fertilizers also. Organic manures used were barnyard manure, city waste, and ground nut (peanut) oil cake. Inorganic fertilizers used included ammonium sulfate, super phosphate, urea, and potato mixture.

A regression equation linear in logarithms was fitted to input and output data to determine the relationship between fertilizer used and

TABLE XXVI
RELATIONSHIP BETWEEN THE YIELD PER ACRE
AND THE MAN HOURS USED*

Labor Hours Per Acre	Yield Per Acre (maunds)			Average yields
	Less than 250	250-399	400 and above	
Less than 1,000	151.62 (12)	305.17 (12)	518.44 (8)	300.91 (32)
1,000 - 2,499	128.19 (14)	316.05 (24)	489.11 (9)	293.23 (47)
2,500 and above	188.20 (10)	314.89 (9)	473.33 (6)	302.24 (25)

*Figures in parenthesis indicate the number of growers in each cell.

yields of potatoes. Since the soils were comparatively rich in potash, it was not considered as a variable and omitted from the analysis, and only nitrogen and phosphorus were taken for study to determine the production function.

The nitrogen and phosphorus content of the various manures and fertilizers was estimated by the Division of Agricultural Chemistry, Department of Agriculture, Bangalore. Since there were fewer samples in the summer crop, it was omitted, and only the production function for N and P on yield was worked out for the winter crop for both simla and rickets varieties. Since there were some observations with unusual yields, either very low or very high, these were also omitted from the analysis.

Variation in yield from farm to farm may be attributed to such factors as number and intensity of irrigation, seed varieties, amounts of fertilizers used, cultural and management practices, and such other natural factors as soil types, climatic variations, pests and diseases, and a host of factors other than those under consideration having an effect upon yields. This limits to some extent the usefulness of the production function derived, in which only fertilization is treated as a variable. Further, during the year under consideration (1958-59), the yields were unusually low in certain areas, which further limits the practical utility of the function.

Linear relationships are much easier to handle from the standpoint of computational procedures than curvilinear functions. Exponential and power functions become linear when transformed to logarithms. For example, the Cobb-Douglas function $\hat{Y} = a N^{b_1} P^{b_2}$ when transformed to

logs would be $\log Y = \log a + b_1 \log N + b_2 \log P$. In the latter form, the fitting can be accomplished by least square regression procedures. Thus, the advantage of such a transformation to exponential form is that the curvilinear function is reduced to a linear form.

The function $\hat{Y} = \log a + b_1 \log N + b_2 \log P$ contains:

1. Y - the dependent variable; i.e., the yield or output of potatoes which is to be estimated (in maunds).
2. a - the intercept; i.e., the amount of Y that would be produced when the inputs of both N and P are zero.
3. b_1 and b_2 - the parameters or constants, the values of which are determined from observations, but whose relationship to variables is specified by the expression.
4. N and P - the independent variables which are the inputs of nitrogen and phosphorus elements (in pounds).

The production function was fitted for both the varieties by the regression analysis and the results of this analysis are given by the following expressions:

For simla variety - $\log \hat{Y} = 1.59410 + .15197 \log N + .24867 \log P$

For rickets variety - $\log \hat{Y} = .71536 + .44655 \log N + .25128 \log P$

From these two equations, Tables XXVII and XXVIII, showing the expected yields in maunds per acre at different levels of N and P , were constructed by substituting the relevant values of N and P and converting the figures back to antilogs. The coefficient of multiple determination (R^2) was .2842 for simla potato and .4459 for rickets. This meant that only 28 per cent of the variation in yield of simla potato and 44 per cent

TABLE XXVII

ESTIMATED YIELDS OF POTATOES (SRILA VARIETY) AT SEVERAL RATES OF NITROGEN
AND PHOSPHORUS IN BANGALORE AND KOLAR DISTRICTS, MYSORE STATE, INDIA

	Nitrogen Levels							
	50	100	150	200	250	300	350	400
50	188.2	209.2	222.5	232.4	239.9	247.2	253.0	258.2
100	223.7	248.5	264.3	276.15	285.8	293.7	300.6	306.8
150	247.4	274.9	292.4	305.4	316.0	324.9	332.5	339.5
200	265.1	294.6	313.3	327.3	338.6	348.1	356.4	363.7
250	280.9	312.1	332.0	346.8	358.8	368.8	377.6	385.3
300	293.9	326.6	347.4	362.9	375.4	385.9	395.1	403.2
350	305.4	339.4	360.9	377.5	390.1	401.0	410.5	418.9
400	315.7	350.8	373.1	399.8	403.2	414.6	424.4	433.1

Phosphorus Levels

TABLE XXVIII

ESTIMATED YIELDS OF POTATOES (RICKETS VARIETY) AT SEVERAL RATES OF NITROGEN
AND PHOSPHORUS IN BANGALORE AND KOLAR DISTRICTS, MYSORE STATE, INDIA

	Nitrogen Levels					
	50	100	150	200	250	300
50	79.6	108.5	130.0	147.8	163.3	177.2
100	94.7	129.1	154.7	175.9	194.4	210.9
150	104.9	143.0	171.3	194.8	215.2	233.5
200	112.8	153.7	184.2	209.4	231.4	251.0
250	119.3	162.5	194.8	221.5	244.7	265.5
300	124.9	170.2	203.9	231.9	256.2	277.9
350	129.8	176.9	212.0	241.1	266.3	288.9
400	134.2	182.9	219.2	249.3	275.4	298.8

Phosphorus Levels

in Rickets could be explained by variations in inputs of N and P. This was expected because of the large number of variables not included in the analysis. However, the coefficient of multiple correlation R was found to be significant at 99 per cent level for both simla and rickets potato. The results were further tested for F ratio and the level of significance was the same as for the R's. (Table XXIX).

The regression coefficient (b's) were tested for significance, using the t-test and both the coefficients in case of simla potato were found to be highly significant. For rickets the regression coefficient for N was found to be significant at the 99 per cent, and the regression coefficient for P was significant at the 95 per cent level. Thus, it could be concluded that both nitrogen and phosphorous had a significant effect upon yields of both varieties. The effect of N and P upon the yield of rickets, for example, could be more clearly understood by a comparative study of the yield curves for rickets in Figures 8 and 9, 10 and 11. The fitted yield curves rose more steeply with increasing doses of nitrogen than with phosphorus. In the case of simla variety, quite the reverse was true. The curves rose more steeply with increasing doses of phosphorus than with nitrogen. It is interesting to make a comparative study of the Figures 8 through 11. The yields of simla potato are greater at all levels of fertilization than those of rickets. Further, the curves narrow down as the inputs of nitrogen are increased at different levels of P, while the gap between the yield curves widens with increased phosphorus application at different levels of nitrogen. This points to the same fact mentioned earlier that phosphorus, as compared to nitrogen, has relatively more significant effect upon yields on simla variety than on rickets. On

TABLE XXIX

RESULTS OF TESTS OF SIGNIFICANCE

Seed Variety Obs.	No. of	R ²	R	Critical R	F	Critical F	st. error		S _{b1}	S _{b2}	t ₁	t ₂	Critical t
							of	Estimate					
Simla 39		.28424	.53314	.373 (95/)	7.1506	3.25 (95/)	.01389	.02714	.02512	5.5995	9.898	2.704 (99/)	
				.454 (9/)		5.21 (99/)						3.551 (99.9/)	
Rickets 20		.4459	.6678	.520 (95/)	6.849	3.59 (95/)	.02825	.11552	.10654	3.8654	2.3585	2.10 (95/)	
				(99/)		6.11 (99/)							

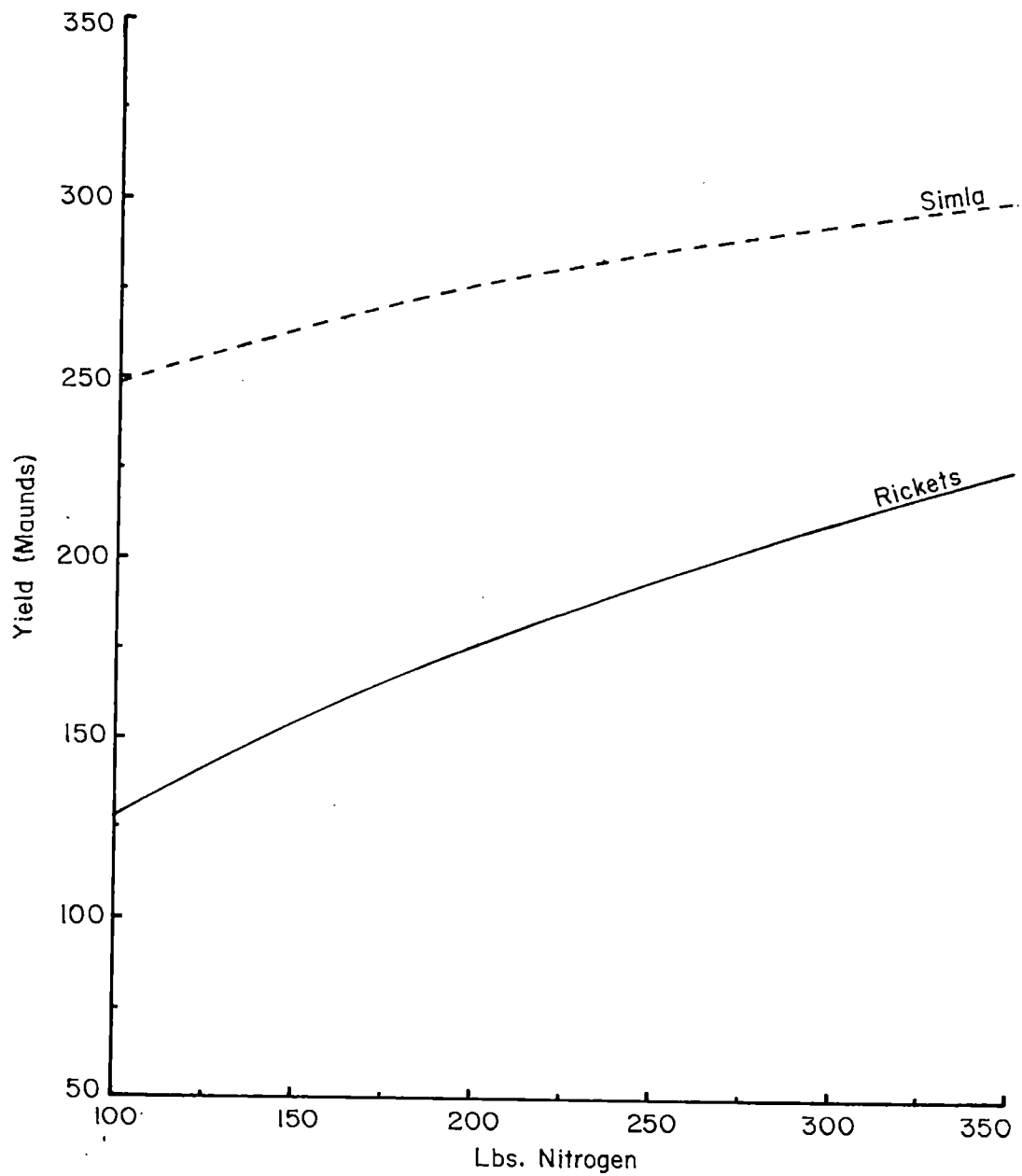


FIGURE 2
YIELD RESPONSE OF SIMLA AND RICKETS TO NITROGEN
IN RESPONSE TO 100 POUNDS PHOSPHORIC ACID

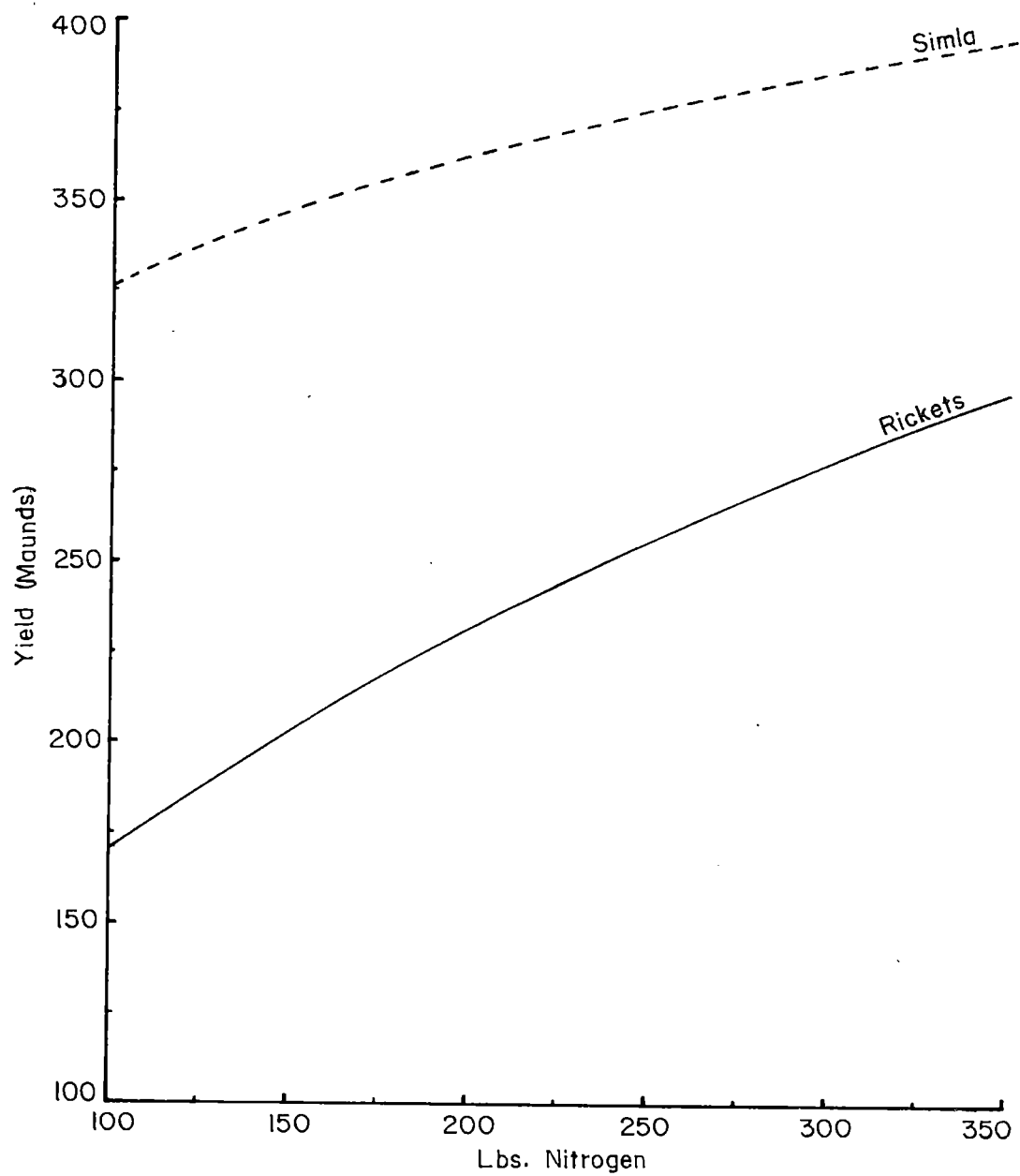


FIGURE 5

YIELD RESPONSE OF SIMLA AND RICKETS TO NITROGEN
OVER A RANGE OF TWO HUNDRED POUNDS PER ACRE

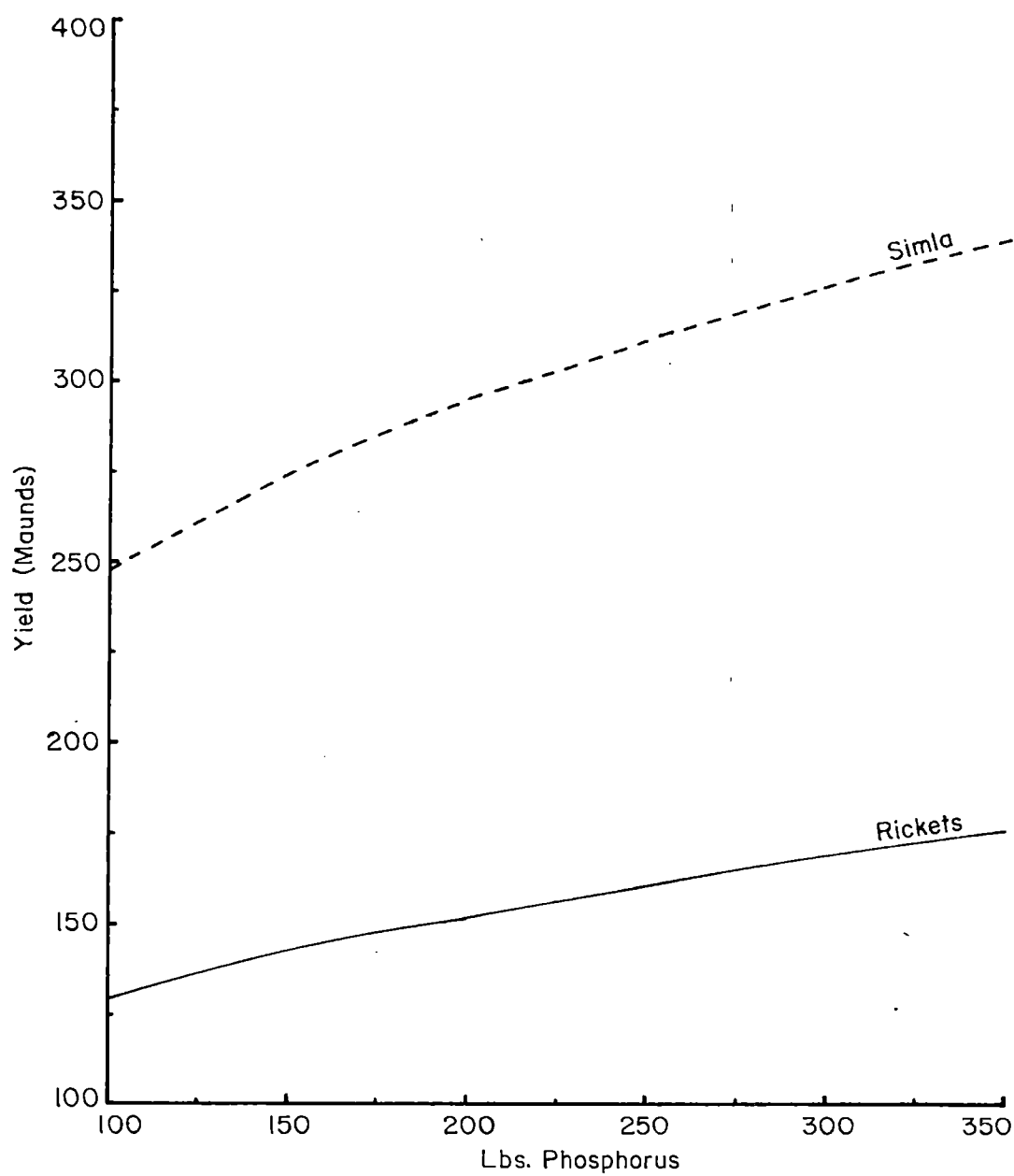


FIGURE 1.

YIELD RESPONSE OF SIMLA AND RICKETS TO PHOSPHORUS AT 100 POUNDS PER ACRE.

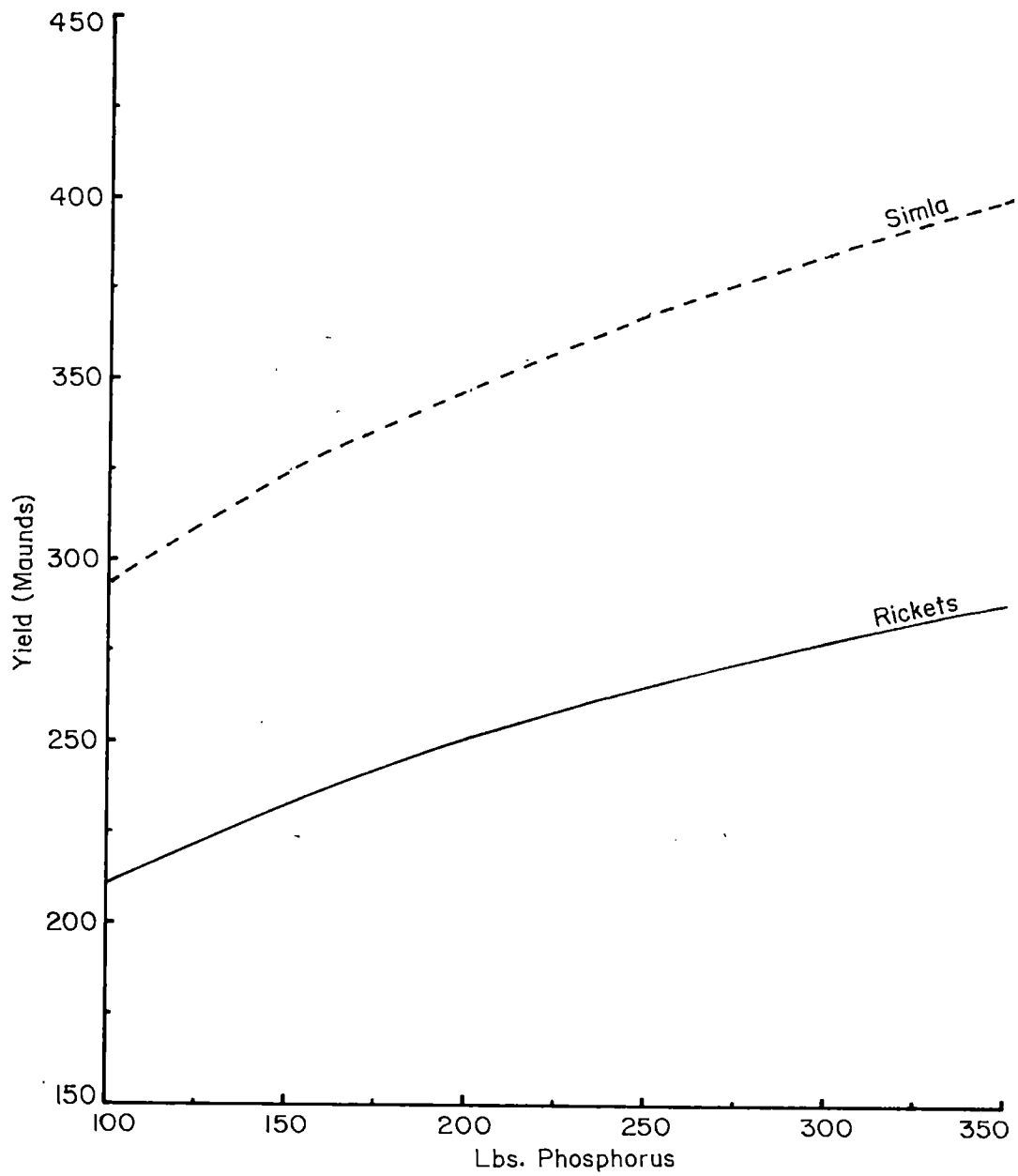


FIG. 11

YIELD OF STALKS AND STRAW PER ACRE
IN RESPONSE TO 100 POUNDS PER ACRE

the other hand, nitrogen has relatively more significant effect upon yields of rickets than has phosphorus.

It is evident from the foregoing discussion that the yield of potatoes was influenced to a great extent by the seeding rate, seed variety, the application of manures and fertilizers, and to a very limited extent by the size of potato enterprise. The yield, in turn, determined to a great extent the net returns from potatoes.

II. COST PER ACRE OF PRODUCING POTATOES

Another important factor affecting the net returns from an acre of potatoes was the cost of production. The cost per acre of production varied to a certain extent between size groups, but there was much variability in costs within the same groups.

It could be seen from Table XXX that there was not much variation in costs within the same cost group. A test of significance for frequencies was made. Since there were too few observations in the less than Rs 1,000 cost category in the two acre and above size group, the third and the fourth size groups were combined for purposes of working out the test for frequencies. The test gave a chi-square value of 3.193. The chi-square table value for four degrees of freedom at 30 per cent level of confidence was 2.195 and at 50 per cent level it was 3.357. By linear interpolation the chi-square table value at the 45 per cent level was 3.067. Hence it was inferred that the relation between the size of the potato enterprise and the cost of production was not a function of the size of the enterprise.

TABLE XXX

THE RELATION BETWEEN THE TOTAL COST AND SIZE
OF POTATO ENTERPRISE*

Size of Enterprise	Average Total Cost Per Acre			Average Rs
	Less than Rs 1,000	Rs 1,000 - 1,299	Rs 1,300 and above	
Less than 0.50 acres	868.84 (8)	1162.14 (14)	1552.88 (6)	1152.92 (28)
0.50 - 0.99 acres	806.86 (5)	1140.44 (11)	1557.61 (10)	1236.74 (26)
1.00 - 1.99 acres	850.60 (9)	1168.86 (12)	1555.46 (12)	1222.64 (33)
2 acres and above	945.46 (2)	1222.31 (6)	1500.32 (9)	1341.40 (17)

*Figures in parenthesis indicate the number of observations in each cell in the table.

It was also seen in Table VII that the average cost per maund varied with the size groups. There was no general tendency for the average cost per maund either to increase or decrease with the size of enterprise. This partially explains that the cost per maund was largely dependent upon the production methods and practices adopted by the individual growers. The cost of production per acre or per maund of potatoes was within certain limits; therefore, within the control of the individual growers. This points to the importance of adopting efficient methods and practices in production and, thereby, reducing the total per acre costs as well as the cost per maund. Other things being equal, high yields and lower cost per maund would lead to a greater net return per acre to the growers.

III. PRICE PER MAUND OF POTATOES

A third important factor over which the growers had relatively less control was the price received per maund of potatoes. Given a definite quantity of yield and cost, the net returns per acre to the growers are determined by the prices they receive for their crop. Figure 12 indicates the relation between the average price received by farmers and the net returns per acre. Net return for each observation was plotted against price per maund and a freehand curve was fitted. The general trend, that farmers who received a higher price had greater net returns, could be observed from the figure. It could be observed from Table XXXI that there was a large variation in the prices received by potato growers as between the two districts.

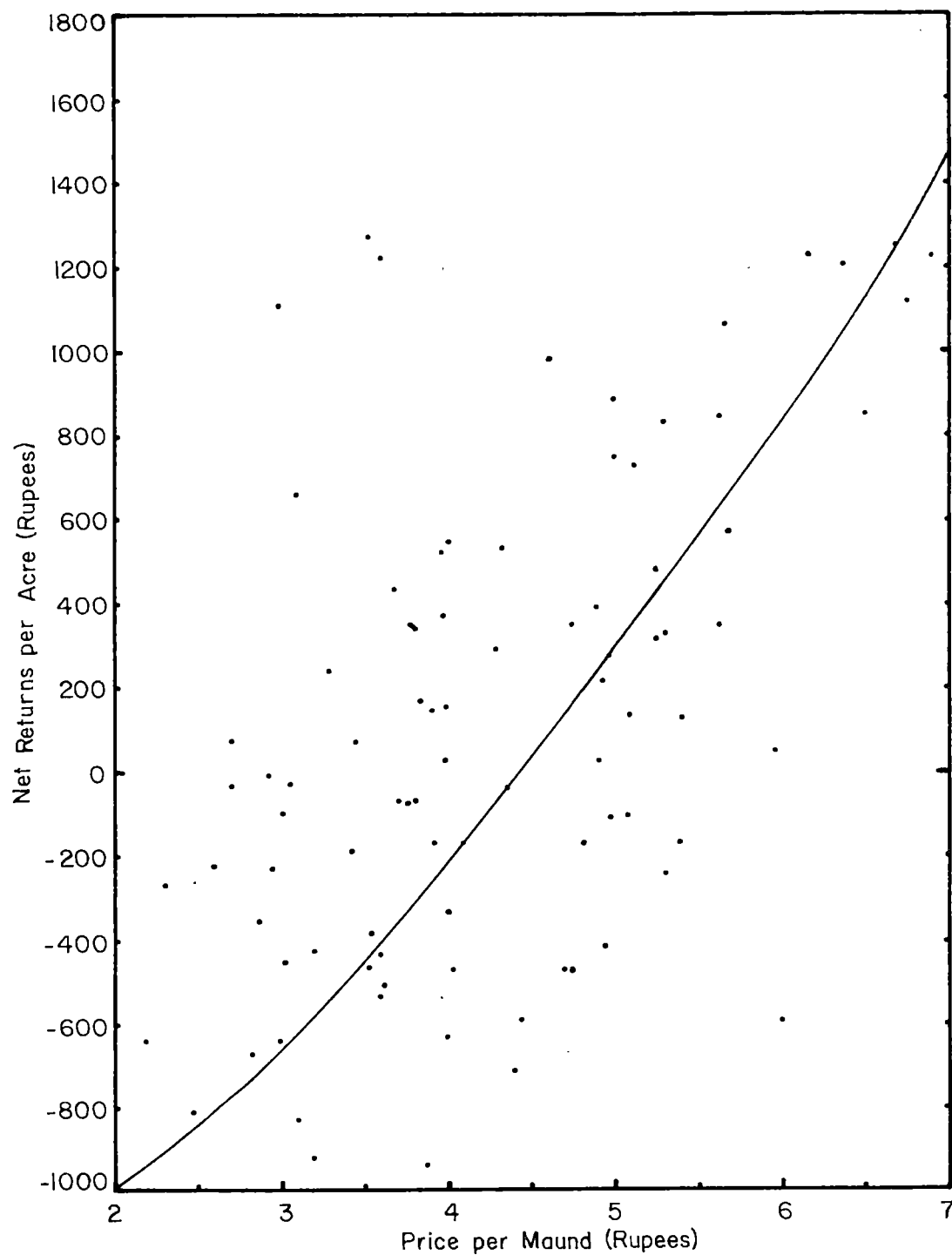


FIGURE 10

RELATIONSHIP BETWEEN PRICE PER MAUND AND NET RETURNS PER ACRE

TABLE XXXI

NUMBER OF GROWERS RECEIVING DIFFERENT PRICES FOR THEIR WINTER
AND SUMMER CROP OF POTATOES IN BANGALORE
AND KILAR DISTRICTS

Prices Received Per Maund	Winter		Summer	
	Bangalore	Kolar	Bangalore	Kolar
Less than Rs 2.50	7	1	--	1
Rs 2.50 - 3.49	4	5	6	5
Rs 3.50 - 4.49	22	5	4	2
Rs 4.50 and above	14	17	6	5

In winter Kolar farmers received a better price than Bangalore farmers. The prices per maund received varied with the quality of the potato tubers. Generally, potatoes were sold under two grade lots, the good quality (Hasan) and the inferior quality (Kalapu), although a few sold them without grading (Sagatu). The average price per maund received for the "Hasan" quality was about Rs 4.50, while for the "Kalapu" it was about Rs 3.00. Growers who sold their potatoes for seeding material received an average price of about Rs 7.50. The higher prices were obtained for better quality potatoes, indicating the importance of producing quality tubers. Poor quality of tubers is generally associated with lower yields. There is, therefore, the need for improving management practices in order to produce higher yields of better quality tubers. That is probably the best means of obtaining higher net returns. Data from this study is not adequate to suggest the fixation of a minimum price for potatoes. However, an organized market is needed for potato growers. An attempt in this direction has been made in Bangalore to regulate the market practices for certain commodities and potatoes is one of them.

IV. COST AND PRICE PER MAUND OF POTATOES

Table XXXII shows the average cost and price per maund of potatoes in the two districts by size groups. In Bangalore for the winter crop the average cost per maund tended to decrease as the size of enterprise increased, from Rs 7.52 to 5.25 in the third size group, and it increased to 7.43 in the fourth size group. In Kolar the cost per maund decreased from first to second size group and then gradually increased up to the

TABLE XXXII

AVERAGE COST PER MAUND OF POTATOES AND PRICES RECEIVED PER MAUND
IN BANGALORE AND KOLAR DISTRICTS FOR WINTER CROP BY SIZE
GROUPS AND FOR THE SUMMER CROP

Size Groups	Bangalore		Kolar	
	Cost/md	Price/md	Cost/md	Price/md
	Rs	Rs	Rs	Rs
Less than .50 acres	7.52	3.14	4.73	4.29
.50 to .99 acres	6.59	3.90	3.97	5.79
1.00 to 1.99 acres	5.25	4.00	3.99	4.97
2 acres and above	7.43	4.34	4.16	4.97
Av. for winter farms	6.50	3.87	4.19	4.87
Av. for summer farms	3.53	4.35	15.51	4.31
Av. for both winter and summer farms	5.74	3.99	7.78	4.69

fourth size group. But in Kolar the average prices received increased from Rs 4.29 per maund in the first to Rs 5.79 in the second and then dropped to Rs 4.97 in the third and fourth size groups. The average cost per maund in winter was lower for all size groups in Kolar than in Bangalore, while the prices received per maund by Kolar farmers in different size groups were higher than the corresponding prices received by Bangalore growers.

Cost and Price Per Maund by Size Groups in Winter

In the first size group, one grower in Bangalore with a yield of only 36 maunds per acre had a cost per maund of Rs 32.76. This one observation influenced the average cost per maund for this size group. If this farmer is excluded from the analysis the average cost per maund for Bangalore growers in this size group would be only 4.37. In Kolar, although the average price received was fairly good, the cost per maund was fairly high.

In the second size group, three growers in Bangalore had costs of over Rs 10 per maund. Excluding these three, the cost per maund for the other 11 growers would be Rs 5.12. These three growers received comparatively low prices for their crop. In Kolar, out of four growers, only one had cost per maund greater than the price received per maund. The other three had fairly low costs per maund and received good prices for their crop.

Eight growers in Bangalore in the third size group sustained loss, while seven made profits. These eight growers had comparatively a high average cost of Rs 7.63 per maund and a low price of Rs 3.40. The other

seven growers had relatively low costs of Rs 3.17 and received better prices, Rs 4.53. In Kolar, three sustained loss and seven made profits.

In the fourth size group, four growers in Bangalore sustained loss mainly because of higher cost per maund. The average cost and prices received by these four growers was Rs 12.25 and Rs 4.23 respectively. Average cost per maund for the other five growers was Rs 3.57 and the price per maund was Rs 4.43. Even though the average price received by these two groups of growers was about the same, the first group of four growers sustained loss because of high cost per maund of potatoes. This points to the importance of reducing cost per maund.

In Kolar, out of five growers in the fourth size group, two sustained some loss and three had some returns. Both the cost per maund and prices received per maund were moderate.

Cost and Prices Per Maund in Summer

In summer the average cost per maund for Bangalore growers was Rs 3.53 and the average price received was Rs 4.35. But in Kolar the average cost was Rs 15.51 and the price received was Rs 4.31. The high cost per maund in Kolar was influenced by four growers who had more than Rs 10 cost per maund, of which two had Rs 71.36 and 69.04 per maund, and these two received low prices for their crop (Rs 3.00 and Rs 1.25 respectively per maund). If the four growers were omitted from the analysis, the average cost for the other nine growers would be Rs 3.92. In Bangalore six growers sustained some loss; the other ten growers made profits.

Although total costs per acre were higher in Kolar than in Bangalore for the different size groups in winter, the cost per maund in Kolar was lower as the average yield was higher than in Bangalore. But in summer, as the average yield was relatively low in the Kolar District, the cost per maund was high. Kolar growers generally received a higher average price for their crop as some of them sold their potatoes for seeding material. From the above analysis, it is apparent that improving management practices and producing larger output per acre, thus reducing the cost per maund, is necessary if greater net returns from potatoes are to be achieved.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Potatoes were an important vegetable crop in Bangalore and Kolar Districts, occupying over 18 per cent and 23 per cent respectively of the total vegetable area in the two districts. Practices adopted in producing potatoes varied rather greatly from area to area and within the same area from farm to farm. Potatoes were usually produced in conjunction with other farm enterprises, thus the particular practices and inputs used in potato production were likely to be dependent on the degree of resource competition between potatoes and the other farm enterprises.

The average total cost of producing an acre of potatoes was Rs 1224.33. Kolar farmers had higher costs on an average than Bangalore farmers. Generally, the cost of production of the winter crop was higher than for the summer crop. Nearly one-third of the total cost was accounted for by seed and seed treatment and one-fourth by labor. Manures and fertilizers was the third important item of cost and accounted for nearly 20 per cent of the total. Equipment cost constituted 10 per cent of total cost and miscellaneous costs, such as land rent and marketing charges, accounted for the remaining 12 per cent of total costs. Approximately one-fourth of the total cost of producing an acre of potatoes was fixed cost and nearly three-fourths was variable. The total non-cash cost per acre was Rs 385.05, or about 31 per cent. Family labor, depreciation and interest, and land rent were the most important non-cash cost items.

Family labor made up a larger proportion of the labor for the winter crop than for the summer crop.

Potatoes are a heavy labor consuming crop. The average labor used to produce an acre of potatoes was 2032.7 man hours. Kolar farmers generally used more labor per acre than Bangalore farmers. A large part of the total labor used, nearly 35 per cent, was accounted for by irrigation. Next in importance came the preparatory cultivations including digging, manuring, leveling, and sprinkling water (36.22 per cent). Third in importance was planting, using nearly 10 per cent of the total labor. There were some large differences in labor requirements between winter and summer crops. A large part of this difference came from differences in the labor utilized for irrigation and preparatory cultivation, especially digging operations.

The average net returns from potatoes tended to increase with the size of enterprise up to the third size group. The returns over all costs for the first size group was Rs 69.88, for the second Rs 23.19, third Rs 266.03, and for the fourth Rs 177.75; the average for all farms was Rs 101.88. Even within the same size group, there was a large variation in the net returns. The most important factor which affected the net returns was the yield which, in turn, influenced cost per acre. Differences in returns among the farmers could also partially be attributed to differences in the price received for the potatoes. Price differences were largely due to differences in quality of the potatoes and to some extent to the market outlet used in selling the potatoes. Yields were related to the seeding rate, amount of fertilizer and manure applied and to the variety of seed used. No significant relationship was found

between yields and size of enterprise, number of irrigations used, or amount of labor input per acre.

I. IMPLICATIONS OF THE STUDY

One of the prerequisites for increasing the efficiency of potato production in Bangalore and Kolar Districts is the creation of attitudes among the farmers which will result in a greater awareness of the business and profit aspects of production. Several possibilities for reducing costs and increasing the net returns from the potato crop seem apparent. If the total amount of labor necessary to produce an acre of potatoes could be reduced, family labor could contribute a higher proportion of the total labor, thus reducing the cost of hired labor. Labor use was particularly high for preparatory tillage, due to the extensive hand digging of the land that is usually involved. This elaborate digging is considered to be necessary because much of the potato lands are heavily infested with deep-rooted weeds.

Labor use could be reduced if alternative methods of weed control could be developed. Some research on the possibilities of chemical weed control has been undertaken by Agricultural Research Stations in India. However, further research is necessary before specific recommendations to farmers can be made. If effective and economical means of chemical weed control can be developed, the elaborate preparatory tillage may become unnecessary and thus labor costs could be reduced.

Potato growers, particularly those nearby Bangalore, are using city wastes extensively as manures, usually without previously allowing it to decompose in a compost. City waste is composed largely of cloth,

paper pieces, wood ash, and other carbon materials, all of which are low in organic matter. This undecomposed material is applied to the potato fields about a fortnight before the planting date. It is possible that this may result in an unfavorable carbon-nitrogen ratio in the soil, which in some cases, may result in an adverse effect on yields. This may be one of the reasons for the relatively low level of returns to the potato enterprise in the Bangalore District. In Hosakote, where growers use city waste extensively, some of the farmers observed that potato production was not a paying crop for them. They commented that the irrigated Ragi crop, grown immediately following the potato crop, gave them much higher returns. The Ragi crop was not manured but the residual effect of the city waste applied to the preceding potato crop was taken advantage of in producing the Ragi crop. Further research is needed to determine the effect of various types of fertilizing materials on crop yields. At present, recommended levels of fertilization seem too low as many farmers are now using manures and fertilizers at higher levels than those recommended by the Department of Agriculture. Hence, the need for intensified research on the economic aspects of fertilization is keenly felt.

This study reveals that simla variety of seed was a better yielder than rickets variety (Table XXI). Simla seed is considered to be better suited to the winter climate than summer. Even so, about 50 per cent of the winter growers in both districts used simla seed in winter, and the average yield of simla in both districts was more than 100 maunds more than that of rickets. In fact, it was mostly these growers who used the rickets seed who sustained losses in both districts and reduced the

district average yield and net returns. Also a large majority of Bangalore growers used simla seed in summer and obtained a higher average yield than those who used the rickets variety. Use of a better variety of seed combined with better production methods is one of the best ways to increase yields. High yielding varieties must be popularized and their adaptability to the seasons determined.

Most potato growers buy seed either from other growers or from the local merchants. In many cases, it is possible to obtain seed at a lower cost from Simla City or from cooperatives.

Generally, potato growers have a tendency to over-irrigate the crop. This was probably one of the reasons for the lack of observed relationship between the number of irrigations given and the yield. Irrigation combined with other factors, like fertilization and others, may result in higher yield per acre. Research and education in this area is needed so that decisions, regarding both the quantity of water and frequency of application, can be made with due regard to the economic aspects.

Efficient production methods, using better seed, right kinds and amounts of manures and fertilizers, protecting their crop from damage by insect pests and diseases and the like, and adopting cost cutting practices consistent with efficiency, and efficient marketing practices are the means to insure a higher net return from an acre of potatoes.

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APPENDIX

APPENDIX

CLIMATIC CONDITIONS IN BANGALORE AND KOLAR DISTRICTS

		Mean Maximum and Minimum Temperatures in Bangalore District (in degrees centigrade)											
		1958											
		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Maximum		33	31	30	26	27	28	27	27	25	27	30	32
Minimum		22	21	20	20	19	19	19	18	16	16	16	18
Average Rainfall in the Taluks Studied in Bangalore and Kolar Districts (in millimeters)													
Bangalore (North and South)		102.6	225.9	39.4	80.7	287.9	227.4	167.4	81.9	6.2	00	71.5	00
Hosakote		7.1	111.6	35.4	38.3	145.5	190.8	129.6	58.5	00	00	30.2	00
Nelamangola		66.8	190.1	49.5	37.2	234.7	145.8	148.3	51.7	00	00	00	00
Devanahalli		8.6	76.6	49.6	39.8	131.2	117.8	93.6	63.2	00	00	00	00
Chintamani		51.6	70.9	68.4	31.0	245.9	199.1	172.2	67.6	00	00	00	00
Shidlaghatta		50.9	152.4	140.9	29.7	121.6	172.6	163.8	61.7	00	00	7.1	00
Chikkaballapur		58.6	83.0	90.3	69.3	131.1	146.0	222.6	74.9	00	00	00	00
Srinirasepur		34.3	141.5	183.7	24.0	306.6	221.2	159.3	99.0	3.8	00	67.3	00

APPENDIX :

INCREASE IN ACREAGE IN POTATOES
IN BANGALORE DISTRICT
1952-53 - 1957-58

<u>Year</u>	<u>Acreage</u>
1952-53	2595
1953-54	2725
1954-55	2902
1955-56	3336
1956-57	3516
1957-58	4035

APPENDIX

NITROGEN AND PHOSPHORUS CONTENT OF DIFFERENT
MANURES AND FERTILIZERS USED

<u>Manures and Fertilizers</u>	Per Cent of	
	<u>N</u>	<u>P</u>
Ammonium Sulfate	20.50	----
Superphosphate	----	16.00
Barnyard Manure	0.50	0.50
City Waste	0.30	0.30
Ground Nut Oil Cake	7.50	1.50
Honge Oil Cake	4.05	0.90
Potato Mixture	4.60	13.00
Urea	45.00	----