

**FARM SIZE, INPUT USE, PRODUCTIVITY AND  
INCOME LEVELS: A COMPARATIVE STUDY OF  
IRRIGATED AND UNIRRIGATED FARMS IN  
ANDHRA PRADESH**

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**MASTER OF PHILOSOPHY**

**JWALA BEERA**



**CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT  
SCHOOL OF SOCIAL SCIENCES  
JAWAHARLAL NEHRU UNIVERSITY  
NEW DELHI-110067  
2003**



जवाहरलाल नेहरू विश्वावद्यालय  
JAWAHARLAL NEHRU UNIVERSITY  
Centre for the Study of Regional Development  
School of Social Sciences  
New Delhi-110067

CERTIFICATE

I, JWALA BEERA, certify that the dissertation entitled "FARM SIZE, INPUT USE, PRODUCTIVITY AND INCOME LEVELS: A COMPARATIVE STUDY OF IRRIGATED AND UNIRRIGATED FARMS IN ANDHRA PRADESH" for the degree of MASTER OF PHILOSOPHY is my bonafide work and may be placed before the examiners for evaluation.

*Jwala*

JWALA BEERA

Forwarded by

*S.K. Thorat*

(PROF. S.K.THORAT)  
SUPERVISOR

*Aslam Mahmood*

(PROF. ASLAM MAHMOOD)  
CHAIRPERSON

Chairperson  
Centre for the Study of Fed. Dev.  
School of Social Sciences,  
Jawaharlal Nehru University  
New Delhi-110 067

# **CONTENTS**

ACKNOWLEDGEMENT

INTRODUCTION 1-11

Chapter I 12-21

IRRIGATION LEVEL AND CROPPING PATTERN

Chapter II 22-58

USE OF FARM INPUTS

Chapter III 59-82

YIELD RATES, PRODUCTIVITY AND INCOME  
LEVELS

SUMMARY CONCLUSION 83-101

BIBLIOGRAPHY 102-107

APPENDIX 108-132

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**JWALA BEERA**

*DEDICATED TO  
My GRAND PARENTS*

# INTRODUCTION

The agricultural sector contribute about 28% of the Gross Domestic Product (1999 agricultural year) and employs about 65% of its work force in India. The most important feature of the agrarian structure which influences production conditions is the size composition of the land holding. The size distribution of land holding affects not only input uses and productivity but also the nature of technology and distribution of gains from adoption of technology. The pattern of holding also influences the access to credits and control over market and other institutions. The most striking feature of the landholding structure in India is the overwhelming presence of small farms.

## **Review of literature**

Given the significance of land holding structure for input use, technology adoption and yield rates and productivity, a number of scholars have studied the linkage of land holding structure, input use and productivity relation. Before laying down the objectives of this study, we take a look at the earlier literature and capture its main issues.

Studies based on the Farm Management Survey data for the mid-fifties and sixties brought out some economic relation between farm size, productivity level. An important observation of the studies was that there was an inverse relationship between farm-size and output per acre of gross cropped area, thus indicating a higher productivity on small farms as compared with large farms (Khusro: 1964; Mazumdar: 1965; Palgan: 1965 and Hanumantha Rao: 1967). However some argue that the inverse relationship could be generalized in all Indian situations.

Based on the disaggregated farm level data, Rudra (1968) contended that although the inverse relationship did operate in some areas it could not be

accepted as a rule for Indian agriculture. Rao (1967), observed that contrary to the findings of the FMS, productivity remained constant over all holding sizes in all the villages, indicating that holding size has no effect on productivity. Saini (1969, 1971) and Usha Rani (1971) worked with farm-level disaggregated data. Saini found that an inverse relationship between farm size and productivity held strongly in 18 out of 25 cases. Usha Rani (ibid.) found that, for Andhra Pradesh, Orissa, Rajasthan and Tamil Nadu, “the regression coefficient in 14 out of 15 cases were negative”, and hence concluded that yield per acre had a tendency to decrease along with the increase in the size of farm output. Another group of studies, which used disaggregated data observed that, an inverse relation between farm size and output per acre of net sown area was found in most cases although it was not always significant. On the whole, the weight of evidence suggests that the inverse size-productivity relationship existed independently of the form of production relations. Bardhan (1973a) looked at the experience of Andhra Pradesh, Orissa, Madhya Pradesh, Tamil Nadu, Punjab and U.P. The coefficients were negative and significant for paddy in A.P. and U.P., in other cases the coefficient was negative but statistically insignificant. Bardhan argued that the observed negative relation between output per acre and farm-size was likely to be the result more of an inverse correlation between size and other inputs rather than scale diseconomies. Some researchers have expressed the view that technological progress, involving the introduction of chemical fertilisers and labour serving machinery and modern irrigation equipment, was likely to erode the basis of superiority of small-scale agriculture and some of the studies cited earlier corroborated this view. Evidence of a change in relationship, particularly for Punjab and for some other regions, was given by some researchers (Kahlon and Kapur: 1968, Chadha: 1978, Bhalla and Chadha: 1982, Thorat: 1993). In a comparative study of regions of Punjab based on 1970 data, Chadha (1978), observed that the inverse relationship between farm size and productivity was

tending to disappear areas in which a shift to higher capital intensity had occurred on large farms. In areas where capital expansion in relation to labour input was still at a comparatively low level an inverse relationship still held. For a later year (1974-75), and for an advanced region of Punjab, Bhalla and Chadha (1982) made similar observations, noting that large farmers had gained an edge due to the introduction of new rice technology, with which the smaller farmers were not at par. Outside Punjab, Thorat (1993), in a comparative study of technologically advanced and less advanced regions of Maharashtra, arrived at an identical conclusion for technologically advanced irrigated regions and some crops. The inverse relationship between farm size and output per acre was found to be operating at aggregate level and at the level of some traditional crops, though not all coefficients were significant. But in the case of capital intensive HYV crops, the relationship turned positive. However, Chattopadhyay and Sengupta (1997) found that in West Bengal, in a more recent year (1989-90), the inverse relationship between farm size and productivity for paddy continued to hold both in agriculturally developed and less developed regions.

A number of scholars have given various explanations for the relationship between farm size and productivity. Explanations, which link input use to the inverse relationship, can be grouped into "quality based explanations" and "intensity based explanations". The quality based explanations imply that small farms use better quality human labour (more of family labour than hired labour), cultivate superior quality of agricultural land, have better quality of management and higher impact of indivisible factors (such as bullock labour). Among the intensity-based explanations, the higher use of human and bullock labour, current inputs (such as manure and chemical fertiliser), irrigation, intensity of cultivation, greater allocation of cropped area to high value or cash crops have figured quite prominently. However, studies also show that some of these features have undergone a change after the onset



of the green revolution, especially with respect to some of the modern inputs in technically progressive agriculture. It has been observed that labour input is the key, and that high output per acre on small farms in traditional agriculture is really a function of higher input of human labour with other factors varying more or less in the same proportion as human labour (Mazumdar: 1965). Studies based on FMS data for the 1950s and 1960s found statistically significantly inverse relationship between farm size and labour use per acre (Bharadwaj: 1974 and Hanumantha Rao: 1967) and this was found to be true in less developed as well as more developed regions (Chadha: 1978 and Thorat: 1993). The high cropping intensity of cultivation has been attributed to high level of irrigation, (beside the intensive use of human labour on the small farms) which has been statistically confirmed by a number of studies for the fifties and sixties (Ghose: 1979, Sanyal: 1969 and Usha Rani: 1971), and for the seventies (Thorat: 1993). In the high irrigated regions, particularly those served by the perennial canal irrigation system, the relations tended to be neutral (Chadha: 1978 and Thorat: 1993). However, in the case of privately-owned well irrigation, some analysts have observed a bias in favour of large farms (Chadha: 1978 and Thorat: 1993). In the case of cropping pattern, some studies reported significant differences in the cropping pattern between small and the large farms for the mid-fifties, the former devoting a larger percentage of cropped area to high value of output per acre. Those crops also happened to be labour intensive crops, which suited the small farms. The larger percentage of cropped area under high value cash crops was given as one of the explanations for higher output per acre on small farms (Bharadwaj: 1974). However, since the mid-sixties the production condition and cropping pattern have changed a great deal. The evidence on the cropping pattern by farm-size group in seventies and eighties, particularly for developed regions indicate no significant differences and the small farms were not found to allocate a higher area to cash crops. There are, in fact, some indications that in technologically

advanced agriculture, large farmers have gained some edge in the allocation of area to high value cash crops (Chadha: 1974, Bhalla and Chadha: 1982 and Thorat: 1993).

A number of studies have also analyzed the difference in the use of material inputs such as manure, fertilizer, capital services from traditional as well as modern implements and machinery, including bullocks, for the years covered by FMS in the sixties and later for the seventies and eighties. For the sixties, Ghose (1979) found an inverse relationship of manure and fertilizer per acre with farm size for the districts of West Bengal and Punjab, but in the case of Punjab, for 1968-69 a significant positive relationship was observed for all farms as well as labour-based farms. Similarly Thorat (1993) observed higher expenditure and use of manure and chemical fertiliser on the small farms in less developed dry land agriculture in the early eighties. A few studies also found an inverse relationship between farm size and total input cost (including imputed costs) for the sixties (Rao: 1967 and Usha Rani: 1971). Similar results were obtained for less developed dry agriculture during the late seventies (Thorat: 1993). In the seventies and the eighties, changes were observed in the relationship between farm size and level of material input use for inputs such as fertiliser, and capital services of modern implements, and consequently also total input use due to technological change. Since the new technology requires more capital (working and fixed), and the large farmers have better commended over financial resources, owned and borrowed, they are likely to be better placed as compared to the small farms with respect to the use of these new inputs. Some of the studies for the seventies and eighties bring out the change in the inverse relationship between farm size and input use and productivity in regions, which came under the influence of new agricultural technology. The evidence showed the small farmers lost their edge in as much as the inverse relationship observed in the sixties turns in to positive for new inputs such as chemical fertiliser, pesticide and capital services of modern

implements (Chadha: 1978, Bhalla and Chadha: 1982 and Thorat: 1993). Large farms spent more on bio-chemical inputs (like chemical fertiliser and pesticides) as well as on modern Capital services of tractors, tube well, harvesting implements on per acre basis. This explains the weakening of inverse relationship between farm size and productivity. The new technology requires more working and fixed capital. The small farmers' own resources being poor, and their capacity to borrow, as well as their access to formal credit institutions being less, they are placed in a relatively weak position in use of new technology (Thorat: 1990 and 1994).

Some studies re-examine the relationship based on Cost of Cultivation data (Sen and Bhatia (2003), for a few states (Andhra, Maharashtra, Punjab, Rajasthan and Tamil Nadu). The study finds that paddy cultivation in Andhra for 1995-96 shows an inverse relationship between use of family and total labour and chemical fertiliser per hectare and farm size. However, there was no consistent pattern in the use of machine labour while irrigation costs per hectare increased with farm size. Yield per hectare showed little variation in the size classes up to 6 hectares but was higher in the highest size class (6 hectares and above). In the case of sugarcane, while the input pattern was found to be similar, output per hectare was found to be higher on small farms. Data for jowar cultivation for the same year (1995-96 in Maharashtra, also showed an inverse relationship with farm size in the use of total labour and fertilizer (machine labour and irrigation costs were negligible) and yield per hectare did not show any systematic relationship with farm size. In the case of sugarcane, which is irrigated, total human labour was highest in the small and medium-size holdings. The use of machine labour was lowest in the smallest size category (upto 1 hectare) followed by the largest category (6 hectares or more), while fertiliser use per hectare was also the lowest in the highest category. Yield per hectare did not show a systematic relationship with size although it was lowest in the largest size category. In the case of wheat

cultivation in Rajasthan (1992-93) use of all inputs was higher on small farms compared to medium and large farms but there was no significant trend in the yield per hectare. As regards crop diversification and cropping intensity, data for Punjab for 1995-96 and Rajasthan for 1992-93, showed higher cropping intensity on smaller holdings. In Punjab, the cropping pattern on smaller holdings showed a supplementation of crop enterprise with livestock enterprise and a higher area under vegetables. Medium and large holdings had a higher area under certain high

Value crops like sugarcane, paddy, rapeseed and mustard. Since large farms enjoy some advantages due to higher volume of resources and some scale advantages in ownership of assets, the study has also examined the total farm economy for Punjab (1995-96), Rajasthan (1992-93) and Tamil Nadu (1995-96). Their main results are summarised in Table 8. In the case of Punjab, the study found that the use of inputs like seeds, fertilisers and machine labour increased with farm size but total and family labour showed an inverse relationship. However, gross returns per hectare as well as gross margins did not vary systematically with the size of the holding. Thus, the Punjab data did not provide any evidence of significant relationship of overall productivity per hectare with size of holdings. In the case of Rajasthan, it was observed that overall input use was higher for all major inputs on small farms (paid out costs per hectare were also higher) and this resulted in higher per hectare gross output (80 percent higher in the smallest category compared to the largest). In the case of Tamil Nadu, while total human and animal labour showed an inverse relationship with size of holding, the use of machine labour did not vary systematically with size, and the some of the major inputs like fertilizers and hired human labour increased with size of holding. The gross income per cropped hectare did not show a systematic relationship with size.

On the whole, therefore, with the increasing importance of non-labour inputs in production, the earlier observed inverse relationship was not evident in some of the states. However, in Rajasthan the inverse relationship was found to hold at the farm level, although small farms were found to be making losses over comprehensive costs (Cost  $C_2$ ). In most of the states, with the spread of irrigation through bore wells, which made irrigation less human labour intense had also weakened the inverse relationship between use of irrigation and farm size. However, the use of the other divisible modern input (fertiliser) often still continues to show an inverse relationship with size for many crops and for the crop economy as a whole. Thus, the small farmers do not appear to be facing significant scale disadvantages in the use of modern inputs, although because of resource constraints, large farmers in Punjab and Tamil Nadu devote a larger area to resource intensive crops. The study also provides evidence that small farmers do not also face significant price disadvantage, although they do face higher costs on indivisible fixed inputs.

Overall, the study concludes that “ the earlier negative relationship between farm size and productivity is much less evident, and so are “losses” on small farms. On the other hand, some economies of scale are more obvious today, but with custom hiring increasing and price disadvantages facing smaller farmers much reduced, the hypothesis of scale neutrality cannot be rejected” (ibid., p.142, emphasis added).

Few studies have examined the probation behaviour by farm size. The study on paddy by V. Ratna Reddy observed that in Andhra Pradesh the land productivity farm size relationships weekend after the introduction of new technology.

The study observed that use of family labour declines while the use of hired labour increases along with farm size. The use of mechanical inputs

increased with farm size and finally, net returns per unit of land increase as farm size goes up.

The inverse relationship is moreover observed mainly due to the higher labour intensity of material inputs by the small farms. The higher labour extensity on small farms is due to the availability of cheap family labour, the higher productivity on large farms is mainly due to the higher usage of mechanical inputs.

The expenditures of small farmers are generally high as they cannot reduce their expenditure by adopting mechanical inputs which is a one-time investment. Between the irrigated and unirrigated farms the study found that there is the existence of a positive relationship on irrigated farms and a negative relation on the unirrigated farms (Nagaraja and Bataiah: 1985-86).

Another study of Chittoor 'district of Andhra Pradesh' (1985-86) observed that the proportion of irrigated land was higher for small farms than large. small and medium farms have a greater potential to adopt new technology and reap benefits.

The increase in yield in the small farmers is not as high as large farmers. It can be said that technological innovation has led to a higher increase in yields in large holdings.

### **Objectives of the Study**

In the present study our main focus is to study the relation between farm size and irrigation level and cropping pattern, input use, productivity and income level in irrigated and unirrigated farms in Andhra Pradesh. The aim is also to see the changes in this relationship between 1981-82 to 1996-97, the specific focus being:

1. To study the variation in cropping pattern and irrigation levels across farm-size groups for major crops in irrigated and unirrigated farms.
2. To study the input use across farm-size holdings for major crops on irrigated and unirrigated farms.
3. To study the variations in physical yield across farms of various sizes for major crops on irrigated and unirrigated farms.
4. Finally to study the inter-farm size variations in gross incomes and net incomes in irrigated & unirrigated farms for major crops.

The changes are brought out by calculating simple growth rates between 1981-82 to 1996-97.

### **Data Base**

The study is based on the data drawn from the comprehensive scheme of cost of cultivation of principal crops in Andhra Pradesh. This is a project under Agricultural University in Hyderabad sponsored by the ministry of Agriculture under which the data base is build up into volumes for two single agricultural years i.e., 1981-82 and 1996-97. The data is given for all farms, irrigated farms and unirrigated farms separately for five farm size holdings for major crops. The data on input use, cost and income for major crops is given for following farm size categories:

- (i) Marginal farms which are up to 50 hectares,
- (ii) Small farms ranging between one to two hectares,
- (iii) Semi-medium farms between two to four hectares,
- (iv) Medium farms ranging between four to six hectares, and
- (v) Large farms above six hectares.

The major crops include paddy, ragi, jowar, bajra, maize, redgram, greengram, black gram, groundnut, cotton and sugarcane. The variables taken here are basically the farm inputs in physical units like human labour hour per hectare including both family and casual labour, bullock labour paired hours both hired and owned labour, fertilisers in kilogram nutrients, HYV seeds in kilograms and machine labour. The output is taken in both physical and values terms.

There are also other variables, which are derived from the given variables and include irrigation levels, cropping pattern and net incomes. Cropping patterns are worked out by adding the total cultivated area of the given crops within each size holdings and percentage of cropped is calculated for each crop. Net income is calculated by subtracting the costs from the gross income given in rupees per hectare.



## CHAPTER 1

### IRRIGATION LEVEL AND CROPPING PATTERN

Irrigation is the basic input upon which agricultural productivity is dependent to a large extent. Irrigation helps to increased productivity, and higher agricultural output, mainly by inducing multiple cropping, irrigation intensity, and facilitating more use of inputs. In this chapter our main purpose is to study the level of irrigation and the cropping patterns during the agricultural year in 1981-82 & 1996-97 in Andhra Pradesh , on the sample holdings, and also study the changes during this period. (Reference tables are given at the end of the chapter).

First section studies the irrigation level for principal crops at aggregate level and across farm-size categories. We also study the changes in irrigational level among different size holdings. The table below shows the percentage of irrigated area under different crops for 1996-97. In the year 1996-97, at aggregate level, about 24% of area were irrigated. But the ratio varies across the farm-size holdings, with medium size holdings taking the lead in having a highest percentage of irrigated area. 44.14% large, small, marginal and semi-medium holdings follow medium holdings, with 36.17%, 35.3%, 31.91% and 18.18% respectively. Thus the irrigation level was the lowest among the smallest holding.

Across crops the percentage of irrigated area was relatively high for sugarcane (50%), paddy (49.28%), and ragi (49.10%) and lower for blackgram (4.43%). The irrigation level thus varied from a high of 50% to a low of 4.43%.

At the farm size level, the irrigation level was relatively high for sugarcane (50%) and bajra (50%) on the marginal holding and lower for paddy, blackgram and maize. Under the small holdings, the irrigated area was

relatively high under sugarcane (50%), followed by paddy (47.13), ragi (44.16) irrigated area was also higher under sugarcane (50%), followed by paddy (47.4%) and ragi (42.83%) among the medium size holding. Jowar received less irrigation with 10.69%.

In medium holdings also, sugarcane, paddy and ragi enjoy a higher irrigation level, at about 50% of area, which is under irrigation. The next position is occupied by blackgram (49.05%) and greengram (45.11%). The least irrigated crop was under bajra at 35.05%. Finally in the case of large holdings, the irrigated area was found to be higher under ragi (50.81%), and sugarcane (50%) followed by paddy and maize. Jowar and maize had a lower irrigated area. (REFER TABLE NO. 1)

After having examined the crop wise and farm-size variations in 1996-97 we now study the changes between 1981-82 to 1996-97. The percentage of irrigated area increased by 2.18% per annum at overall level. The increase was found to be high under medium size holdings by 15.24%, followed by large holdings (7.59%), marginal holdings (3.95%) and semi-medium holdings (3.25%). There was a decline in the irrigation level on small holdings between 1981-82 and 1996-97.

Across the crops the increase was high under ragi and groundnut. Cotton faced a decline in the irrigated area. The farm-size differences across crops shows that in marginal holdings, higher increases in irrigated area was observed for the maize (29.55%) and groundnut (20.28%). The least increase was in sugarcane. For Paddy and ragi there was a decline under irrigated area.

In the case of small holdings, maize registered a higher increase in irrigated area by 36.10% while the increase was least under cotton. There was also a decline in the irrigated area under paddy, ragi and jowar on the smallholding. Under semi-medium holdings, groundnut shows a higher

increase by 5.32% in irrigated area. Cotton on the other hand reported a decline. In medium holdings groundnut has a higher increase in irrigated area by 28.24% followed by the sugarcane. In the case of medium holdings most of the crop shows increase in various magnitude. In the case of large holdings, the increase in irrigated area was found to be higher in cotton (32.43%) and groundnut (30.87%). (Refer table no. 1 in the appendix)

### **Cropping Pattern:**

This section deals with the cropping pattern on sample farms in Andhra Pradesh by farm-size at overall level and for irrigated and unirrigated. Farms Cropping Pattern is measured in terms of percentage of area under different crops at total cropped area for 1996-97 and 1981-82.

At the overall level paddy is the dominant crop with 35.29% of area followed by groundnut (19.08%), redgram (9.42) and jowar (7.13). Paddy occupied the highest percentage of cropped area under all size holding. However the percentage of area differed across five size categories. The maximum area for paddy was 42% under marginal followed by semi-medium (37%) and medium (36%) holdings. The second most important crop was groundnut and its area was relatively high among the marginal, small and semi-medium as compared with rest of the holdings. (Refer table no. 2)

In the case of irrigated farms also, paddy is the dominant crop, having 46% area followed by groundnut (13.42%) and maize (7.35%). Rest of the crops has less than 5% of the cropped area. However, significant variations are observed across farm size categories. The share for paddy is the highest for small and semi-medium holdings at 59% followed by large holdings (46%), medium holdings (36.84%) and marginal (27%). Thus the marginal holdings allocate a much less area under irrigated paddy. In the case of groundnut, the

percentage of cropped area is higher in all holdings, except in marginal holdings. (Refer table no. 3).

The cropping pattern on unirrigated farm is different. Groundnut with 33.38% occupied the most dominant position followed by redgram (25.8%), jowar (17.89%) and cotton (6.92%). Unlike in the irrigated farms, the share of paddy is much less in the unirrigated farms. There is no systematic pattern across farm size categories for groundnut and jowar. In the case of redgram the marginal farms devoted slightly more area as compared with other size holdings. (Refer table no. 4).

To put in brief, the cropping pattern of the sample farms is dominated by paddy. On irrigated farm close to half (i.e, 47%) of area is under paddy. Other important crops are groundnut, blackgram and maize. In unirrigated farms, groundnut has the highest cropped area as it occupied more than one-third area (33%) followed by redgram (26%) and jowar (18%). So the cropping pattern on unirrigated farms is different. As soon as irrigation is available the farms switch over to paddy, blackgram and maize.

Between 1981-82 to 1996-97, the cropped area under paddy increased by 2.05%. The increase was also higher in maize (14.46%). The cropped area under groundnut declined. Among the various farms, only on smallholdings, area under paddy declined. Maize showed a very high increase in cropped area in the case of semi-medium holdings. Groundnut registered a decline in marginal, medium and large holdings. (Refer table no. 2 in the appendix).

In the case of irrigated farms, cropped area under paddy declined under all size-holdings. In the case of maize and groundnut the cropped area increased. Maize in all holdings registered an increased in cropped area with a higher increase in medium holdings. Groundnut with a high-cropped area under

small holdings registered an overall increase. In rest of the crops the area declined in all the size holdings. (Refer table no. 3 in appendix)

In unirrigated farms, cropped area under paddy, groundnut and maize increased. The increase was marginal for groundnut and maize. Paddy showed highest increase in smallholdings. In maize and groundnut semi-medium holdings experienced a high-cropped area. (Refer table no. 4 in the appendix).

Across the farm size categories we don't find a systematic relationship with respect to cropping pattern. However there are some differences, which needs to be mentioned. As mentioned earlier, paddy is a main crop in irrigated region. The marginal farms devote a relatively less proportion of area as compared to other holdings. Small and semi-medium holding devote somewhat higher area than other holdings. Blackgram, groundnut and maize seems to have a positive relationship indicating higher area on larger size holding. In the case of unirrigated holdings, jowar and redgram, which are the main crops, devote a little higher percentage of areas in the marginal holding. But opposite was the case for groundnut.

To put it in brief, following main features emerged. The irrigated area increased from 18% in 1981-82 to 24% in 1996-97. Across crops the highest irrigated area is under sugarcane (50%), paddy (48.28), ragi (49.48) and maize (46.81). Blackgram has the lowest irrigated area. Paddy, sugarcane and maize did not shown much variations across farm size holdings. The percentage of irrigated area under ragi increased with the increase in the farm size.

As stated earlier paddy with a gross cropped area of 46.22% dominated under the irrigated farms. Groundnut is the next dominant crop with an irrigated area of 13.43%. Groundnut is followed by blackgram (8.25%) and maize (7.35%). Paddy showed higher variations across farm size holdings with small and semi-medium holdings occupying a comparatively higher gross

cropped area under the irrigated farms. In blackgram the gross cropped area increased with the farm size holdings, except in medium holdings. In the unirrigated farms, groundnut (33.38%) and jowar (17.9%) are the only two crops, which are dominant. In groundnut the farm-size variations are however low. But in the case of jowar, the gross cropped area varies between a low of 7.97% to a high of 25.8% in marginal holdings. However both these crops occupied a higher gross cropped area. Over the time the gross cropped area in irrigated farms as well as in unirrigated farms, for paddy declined and for groundnut and maize it increased marginally.

TABLE NO:1

## PERCENTAGE OF IRRIGATED AREA TO TOTAL AREA

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<UPTO 1	BET 1-2	BET 2-4	BET 4-6	ABOVE 6	
PADDY	48.5	47.13	47.46	50	48.25	49.28
RAGI	20	44.16	42.83	50	50.82	49.48
JOWAR	n.a	2.57	10.69	35.04	18.88	29.45
BAJRA	50	22.86	n.a	40.24	n.a	39.67
MAIZE	45.06	49.87	39.24	44.21	45.98	46.81
REDGRAM	2.06	n.a	n.a	38.73	12.19	25.79
GREENGRAM	32.08	26.35	24.26	45.12	34.58	41.81
GROUNDNUT	28.66	15.2	17.69	40.16	25.02	34.28
COTTON	39.37	27.72	15.76	41.6	37.97	39.93
SUGARCANE	50.82	50	50	50	50	50
TOTAL	35.13	18.28	31.91	44.14	36.17	24.7

source: computed By The Data Based On Report Of The Cost Of Cultivation Of Principal Crops In Andhra Pradesh, Vol: no:8, 1996-97, Directorate Of Economics And Statistics, Ministry Of Agriculture.

BLACKGRAM	45.93	0.19	36.06	49.06	40.07	4.44
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TABLE NO:2 PERCENTAGE OF GROSS CROPPED AREA TO TOTAL CROPPED AREA IN ALL FARMS

CROPS	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	TOTAL
PADDY	42.74	31.96	37.4	36.84	33.45	35.29
RAGI	0.78	1.5	1.78	1.64	0.89	1.3
JOWAR	6.2	6.61	3.88	7.54	9.78	7.63
BAJRA	0.35	0.68	0.15	2.07	n.a	0.62
MAIZE	3.99	2.23	5.36	5.84	7.6	6.01
REDGRAM	10.12	9.46	6.65	11.39	9.39	9.42
GREENGRAM	3.39	4.85	7.03	5.37	4.17	5.03
BLACKGRAM	3.35	7.77	8.16	6.92	9.4	8.11
GROUNDNUT	22.79	28.02	22.42	14.96	17.36	19.08
COTTON	5.5	6.13	4.83	5.51	5.09	5.27
SUGARCANE	0.8	0.79	2.36	1.94	2.87	2.23

source:ibid.



TABLE NO:3 PERCENTAGE OF GROSS CROPPED AREA TO TOTAL CROPPED AREA  
IN IRRIGATED FARMS

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	TOTAL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	27.31	59.24	58	36.84	45.67	46.22
RAGI	0.13	2.76	2.19	1.64	1.3	1.61
JOWAR	n.a	0.53	1.23	7.54	4.92	4.71
BAJRA	0.24	0.47	n.a	2.07	n.a	0.74
MAIZE	2.41	4.47	6.84	5.84	9.52	7.35
REDGRAM	0.26	n.a	n.a	11.39	3.14	5.07
GREENGRAM	1.44	4.4	4.87	5.37	3.87	4.53
BLACKGRAM	2.02	4.52	8.6	6.92	10.26	8.25
GROUNDNUT	7.75	15.34	11.88	14.96	12	13.43
COTTON	2.7	6.68	2.5	5.51	5.27	5.06
SUGARCANE	0.55	1.59	3.88	1.94	4.05	3.03

Source: ibid.

TABLE NO:4 PERCENTAGE OF CROPPED AREA TO TOTAL CROPPED AREA  
IN UNIRRIGATED FARMS

CROPS	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	TOTAL
PADDY	3.11	2.86	5.34	n.a	5.34	3.65
RAGI	n.a	0.7	n.a	n.a	n.a	0.09
JOWAR	25.78	10.08	7.97	24.21	20.67	17.8
BAJRA	n.a	0.32	0.52	3.78	n.a	1.05
MAIZE	1.75	n.a	3.62	5.75	1.37	2.71
REDGRAM	34.98	28.28	22.47	24.93	26.25	25.8
GREENGRAM	4.93	3.74	7.44	4.37	4.07	4.81
BLACKGRAM	0.88	3.57	3.73	1	5.93	3.79
GROUNDNUT	25.51	43	37.74	27.59	32.32	33.38
COTTON	3.05	7.45	11.16	8.36	4.06	6.92

Source;ibid

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## CHAPTER 2

### USE OF FARM INPUTS

The efficiency of a farm in terms of productivity level and income depends on the level of use of inputs and their efficient application on farms. In this chapter we discuss the use of various inputs in all farms, irrigated farms and unirrigated farms for the important crops. For each of these crops we also study the variations in input use across five farm-size categories. The inputs, which have been selected for the analysis, include human labour (family and casual labor), and bullock labour, machine labour, fertilizers, high yielding variety of seeds. The level of human labour, bullock labours and machine are given in labour hours per hectare of cropped area under the crop. Fertilizers and High Yielding Variety (HYV) seeds are taken in kilograms per hectare. We have analysed the variations in the level of these inputs for important crops across and five farm size categories for the year 1996-97 and also seen the changes between 1981-82 to 1996-97 for all farms, irrigated farms and unirrigated farms separately. The reference tables are given at the end of the chapter.

#### **Total human labour:**

The total human labour comprises family labour, casual labour and attached labour. In this chapter the discussion is to human labour, family labour and casual labour separately. First we begin with human labour.

In all farms, the use of total human labour hours in the year 1996-97 on an average is at 1137.31 labour hrs. per hectare. Across crops sugarcane (2903.77 labour hours/hectare) used a large number of human labour hours. Sugarcane is the only crop which employs a comparatively higher number of

labour hours followed by ragi (1940 labour hours/hectare), paddy (1523 labour hours/hectare), and cotton (refer table no:1).

Across farm size groups, variations can be observed in the use of human labour. In the case of paddy, no systematic relationship is found. It is the same in the case of redgram. Groundnut shows a positive relationship till semi-medium holdings and then the use of human labour hours falls gradually, indicating lower use in larger farms. In the case of blackgram, there is an inverse relationship between farm size and human labour indicating that small farms use a higher amount of human labour than the large farms. It can be observed that medium size holdings generally perform better with respect to the use of human labour use and therefore, form an exception to the inverse relationship in the crops where it is observed.

The average use of human labour in the irrigated farms is at 1245.55 labour hours per hectare. The human labour hours use is high on sugarcane (2904 lab hrs/hect). followed by ragi (1964 labour hours per hectare), paddy (1532 labour hours per hectare), groundnut (1106 labour hours per hectare) and maize (1049 labour hours per hectare) while it is much lower in other crops (refer table no:2).

In the case of relationships between farm size and labour use in the irrigated farms, the following are the finding, out of the four major crops paddy, groundnut, blackgram and maize, only blackgram and maize showed the presence of an inverse relationship indicating greater number of human labour hours by small farmers. In the case of paddy and groundnut there is no systematic relationships between farm size and human labour use. Sugarcane, which uses a greater amount of labour hours tended to show an inverse relationship though not specific. But cotton the next highest crop using a greater amount of labour hours shows an inverse relationship between farm

size and labour hours use, signifying greater use of human labour by marginal and small farmers.

Coming to unirrigated farms, about 761 labour hours per hectare are used for all crops. Among the crops, paddy (1272 labour hours per hectare) used a higher amount of human labour hours hrs/hectare followed by ragi (1108 labour hours per hectare) and cotton (1028 labour hours per hectare). Paddy employed more no. of labour hours across marginal, semi-medium and large holding thus showing wide variations across size holdings (Refer table no. 3).

The farm size and labour use relationships across the crops in the unirrigated farms tended to show the presence of an inverse relationship between farm size and human labour use. In the other crops, no definite relationships could be established. The results generally provide an evidence of an inverse relationship between labour use and farm size indicating a greater use of labour in small size holdings as compared to the larger holdings.

To put in brief, human labour use in all farms is greater under marginal holdings. In irrigated farms, semi-medium holdings dominate. In irrigated farms marginal holdings use a higher human labour. Among crops sugarcane dominates in all farms of using a higher labour hours. In irrigated farms also sugarcane dominates. Cotton in unirrigated farms absorbed a higher number of human labour hours. The lowest number of human labour hours was consumed by blackgram in the three categories of farms.

Coming to the changes between 1981-82 to 1996-97, in the case of all farms, the total number of human labour hours declined by -1.34% at an aggregate level. A higher decline was under semi-medium (-1.18%) followed by large holdings (-1.61%). Except for ragi (0.19%), jowar (0.42%), blackgram (1.28%) and cotton (5.25%), all other crops registered a decline. Cotton is the only crop in which all size holdings registered an increase with a higher

increase in semi-medium holdings. Besides this, jowar registered an increase in all other sizes with an exception in large holdings (Refer table no. 5 in appendix).

In irrigated farms, the total human labour hours also declined by (-0.58%). A decline can be observed in all size holdings across crops. Only ragi (0.13%) registered an increase. Cotton in medium and large holdings and ragi and marginal and medium holdings registered an increase. In rest of the crops, the total human labour hours declined (Refer table no: 6 in the appendix).

Even in unirrigated farms, the use of human labour hours declined. Cotton (7.88%) and blackgram (5.61%) are the only two crops which registered an increase in total human labour hours with a higher increase under small holdings for cotton and a higher increase in marginal holdings for black gram (Refer table no. 7 in the appendix).

It can be concluded that the human labour hours declined in all farms. irrigated and unirrigated farms. Significant increase can only be seen for cotton in irrigated farms.

The use of family labour in all farm situations is about 426 labour hours per hectare. Marginal farms (617 lab hrs /hect) dominated in the use of family labour hrs followed by small semi- medium, medium and large holdings. Across crops, the highest use of family labour hours is found in sugarcane (986 labour hours/hectare) followed by ragi, (872 labour hrs/hectare). paddy (504 labour hours/hectare) and red gram (445 labour hours per hectare). In sugarcane, the family labour hours is found to be high in semi-medium holdings and smallholdings. There are variations across the sizes in sugarcane as it can be seen that in smallholdings the use of family labour is very low. In ragi, the use of family labour hours varied between a low in marginal holdings to a high in semi-medium holdings. In paddy also, the family labour hours

varied between a high in small holding to a low in large holding. Also in the case of red gram, the family labour hours varied below a high in marginal holdings to a low in large holdings.

Generally the small farms use more of labour than the large ones. In all farm situations the family labour use for paddy shows a declining trend in the use of family labour depicting an inverse relationship between farm size and family labour hours used. The second major crop, groundnut, also showed an inverse relation between use of family labour hours and farm size. Even in the case of redgram and jowar the situation is the same. The other crops, which used a relatively higher number of family labour hours is sugarcane and ragi.

Regarding farm-size and labour use relationships, paddy, jowar, maize, redgram, blackgram, groundnut and cotton showed a definite trend of inverse relationship between family labour and farm size indicating that the use of family labour is higher in marginal and small farms (Refer table no. 4).

Coming to irrigated farms, 456.6 hours of family labour are used per hectare for the total crops. In irrigated farms also the marginal holdings dominated in the utilisation of family labour. Sugarcane (986 labour hours) leads in the use of this input, varying between a high in small farms to a low in marginal farms. Across the crops there are wide variation in the use of family labour hours of sugarcane. In the irrigated farm, paddy, groundnut, blackgram and maize all of which tended to show a negative relationship between farm size and family labour hours used with a minor exception in the large holding of maize (Refer table no:5).

Under the unirrigated farm about 291 labour hours per hectare are utilised. Marginal holdings dominated in the use. Ragi (620 labour hours per hectare), red gram (448.67) labour hours per hectare, paddy (418 labour hours per hectare) and cotton (341 labour hours per hectare) are in the lead. Under

redgram the use varied between a high in marginal to a low in small holdings. For paddy it varies between a high in large holdings to a low in small holdings. And in cotton, the variations are high in marginal farms than in small farms (Refer table no. 6).

Thus it can be said that marginal farm as a whole dominated in the use of family labour hours in all the three categories of farms. Sugarcane is the crop, which utilised a maximum number of labour hours in irrigated farm, followed by ragi and paddy.

Between 1981-82 to 1996-97, in all farms, the use of family labour hours declined on total holdings for most of the crops as well as in all size holdings. The exceptions are blackgram (3153 labour hours/hectare) followed by groundnut (1.67 labour hours/hectares) redgram (1.26 labour hours/hectare), jowar (0.49 labour hours/hectare) and ragi (0.29/labour hours/hectare) which showed an increase in family labour use. In the rest of the crops, there was a decline. Under blackgram, except in semi-medium holdings an increase was found in all sizes with a higher increase in marginal holdings and lower in medium holdings. In groundnut, the increase varied between a high under small holding to a low under marginal and a decline in large (Refer table no. 8 in appendix).

In irrigated farm, the use of family labour hours also declined. Only ragi (3.60%) showed an increase. According to data available for a few crops, the medium holdings only registered an increase (Refer table no. 9 in appendix).

In unirrigated farm also there is a decline in the use of family labour hours in all size holdings. Across the crops, blackgram (12.91 labour hours/hectare), followed by cotton (6.25 labour hours/hectare), groundnut (1.43 labour hours/hectare) and jowar (0.37 labour hours/hectare) were the only crops in which family labour hours use increased. Under blackgram, marginal



holding dominated in the use of family labour hours followed by medium, large, small and semi-medium holdings. For groundnut with an exception of large holdings which registered a negative growth in the use of family labour the change varied between a high in semi-medium holdings to a low in marginal holdings. Even in cotton, semi medium holding registered a decline (Refer table no. 10 in the appendix).

Thus between 1982-1997, the use of family labour hours has declined in all farms as a whole and as well as in both, irrigated farms and unirrigated farms. Blackgram and ragi in irrigated farm registered an overall increase in all size holding. Sugarcane, which utilised a higher number of human labour hours in irrigated farms, registered a decline between 1981-82 to 1996-97 in the use of labour hours.

### **Casual labour use**

The use of casual labour hours at the aggregate level on average is 670.49 labour hours per hectares. Across size holdings for the aggregate crops, small farms, has the highest number of labour hours. However, there are not many variations found across the size holdings. Sugarcane (1846 labour hours/hectare), paddy (1067 labour hours/hectare), ragi (1015 labour hours/hectare) utilised higher casual labour hours. Regarding the farm size relationships paddy and jowar tends to show an inverse relationship, while ragi, redgram and groundnut showed a tendency towards a positive relationship (Refer table no. 7).

In the irrigated farms, the use of casual labour on an average is 725 labour hours per hectare. Across size holdings, medium holdings used a higher number of casual labours. Among the crops sugarcane absorbed a higher number of casual labour hours followed by ragi. In the case of sugarcane the casual labour hours use varied between a high in small holdings to a low in

marginal holdings. In paddy, the variations are marginal. Here also none of the crops showed a systematic relationship. Paddy and groundnut showed a positive relationship between farm size and casual labour use. In rest of the crops systematic relationship is not found (Refer table no. 8).

In the unirrigated farm about 426 number of casual labour hours were used in 1996-97. Paddy and cotton used a higher number of casual labour hours. In paddy, the use of casual labour varied between a high marginal to a low on small holding (data not available under medium holdings). In cotton, it varied between a high in small to a low in marginal holdings. Cotton tends to show an inverse relation in unirrigated farms between farm size and casual labour use. Maize and redgram tends to show positive relation whereas paddy and jowar tends to show a negative relationship between farm size and casual labour used. This implies large farms under maize and redgram utilise a greater number of labour hours in irrigated conditions, while paddy and jowar consumes a relatively larger number of casual labour hours under small farms (Refer table no. 9).

To put in brief, the use of casual labour for paddy is higher number of casual labour hours in unirrigated farms. The data shows that small holdings in all farms and unirrigated farms and medium holdings in irrigated farms has a higher use of casual labour. Between 1981-82 to 1996-97, in all farm, the use of casual labour hrs. declined. Across all size holdings, casual labour, registered a decline. Across crops, only cotton (2.99) followed by jowar (0.61), ragi (0.28) and paddy (0.15) registered an increase in the use of casual labour hrs. In cotton the use of casual labour hrs increased due to a higher, increased in large holdings (Refer table no. 11 in appendix)

In irrigated farms, also the casual labour hours declined for the available crops and in all size holdings. Only maize registered an increase in the use of casual labour and the use varied between a high of 7.79% in large holdings and

a low of 5.14% in medium holding. However, an also recorded in the marginal holdings for maize (Refer table no. 12 in the appendix).

In the unirrigated farms, the casual hours declined in all size except in a marginal increase in small holdings. But for the overall holdings, it declined. Here cotton followed by blackgram, bajra and jowar registered an increase. Cotton registered an overall increase in all size holdings ranging between a higher increase in small holdings to very low increase in marginal holdings. Blackgram also registered an increase in all size holdings with an exception of large holding (Refer table no. 13 in the appendix).

### **Bullock labour hours use**

Total bullock labour comprises of hired and owned bullock labour. The variation in total bullock is examined and changes are brought out between 1981-82 and 1996-97.

In all farm situation, the total bullock labour hours use is 77 bullock paired hours on an average. Among various size holdings, marginal holdings show a higher use. Among crops, the highest number of bullock hours used on maize, jowar, ragi and paddy. Marginal holdings for maize and jowar and semi-medium holdings for paddy and ragi utilised a higher number of bullock paired hours. No systematic relationship between farm size and bullock labour use for crops like paddy and groundnut is found. The other crops redgram and blackgram also did not show a systematic relation between farmsize and bullock labour use. Ragi generally showed a positive relationship with an exception of medium holdings. In the case of cotton, generally an inverse relationship is found with an exception of medium holdings (Refer table no. 10).

In the irrigated farms, the available data reveals that 86 bullock labour hours were used on an average. In crops, cotton and jowar utilised a larger

number of bullock labour hours. For cotton, the use varied between a low in medium holdings to a high in small holdings. In jowar it varied between a minimum on large holdings to a maximum on small holdings. This shows that there are variations across different size holding. While studying the farm size relationships in the irrigated farms, inverse relationship is found in the case of groundnut. For paddy, no systematic relation is observed. No definite relationships can be established crops like jowar, blackgram and redgram (Refer table no. 11).

The total bullock labours in the unirrigated farms on an average work out to 77.64 labour hours per hectare. Paddy occupied first place followed by jowar. For paddy, the number of bullock labour hours varied between a low in small holdings to a high in large holdings. Among the major crops in the unirrigated holdings, groundnut tends to show a positive relationship till semi-medium holdings followed by a negative relationship. Cotton, on the other hand, tends to show an inverse relationship with an exception of semi-medium holdings. The other important crops cultivated in the unirrigated farms like redgram shows variation without any pattern between farm size and bullock labour use (Refer table no. 12).

During 1981-82 to 1996-97, in all farms, the bullock labour use has declined across all sizes and all crops. Only jowar (68%) under medium holdings, blackgram (5.65%) Under large, medium and marginal holdings and cotton under marginal and small holding registered an increase (Refer table no. 14 in the appendix).

In the irrigated farms also bullock labour has declined. Only cotton under marginal (2.55%) and small holding (4.77%) registered an increase (Refer table no. 15 in the appendix). In the unirrigated farms also, bullock labour declined. Only blackgram (1.13%) and jowar (0.53%) under marginal holdings registered an increase (Refer table no. <sup>15&</sup>16 in the appendix).

Thus the use of bullock labour declined in all farms, irrigated and in unirrigated farm. Only blackgram registered an increase under large holdings in all farm, situation. Cotton in small holding of irrigated farm registered an increase.

### **Fertilizers use**

After having analysed the human and bullock labour use, we now look at physical inputs. We begin with the use of fertilizers. The use of fertilizers in all farms on an average of 149.1 kilograms of nutrients per hectare. The use of fertiliser is higher under marginal holdings followed by small, semi-medium and large farms. Among crops, sugarcane and paddy consumed higher amount of fertiliser. In paddy, the fertiliser use varied from a high of 452.87 in small holdings to a low of 174.86 kilograms in large holdings; where as sugarcane in semi-medium and medium are also on par with that of small holdings. Blackgram consumed the lowest amount of fertiliser.

Paddy with an average consumption of about 297 kilograms per hectare shows a clear inverse relationship between farm size and fertilizer use. Redgram with an average consumption of 59 kilograms per hectare also tends to show an inverse relationship. The other two main crops like groundnut (88 kilograms/hectare) and jowar (82kilograms/hecare) failed to show systematic relationship. The less important crops like sugarcane and ragi with an average consumption of 319 kilograms per hectare and 178 kilograms per hectare respectively do not reveal any relationship between farm size and fertilizer use. For the aggregate crops the use of fertilizers does not show any relationship (Refer table no. 13).

In the irrigated farm, also sugarcane (319 kgs/hect) occupied first position followed by paddy (294 kgs/hect). Farm size and input use relationship shows that paddy which consumes about 294 kilograms per hectare on an

average show a clear inverse relationship between farm size and fertilizer use. Other important crops like groundnut with a consumption level of about 121 kilograms per hectare also tend to show an inverse relationship with an exception of medium holdings. For maize and blackgram, definite pattern is not seen. In the less important crops with a higher consumption level, sugarcane (319 kgs/hect) shows an inverse relationship. On the other hand ragi tends to show a positive relationship (Refer table no. 14).

In the unirrigated farm, paddy consumed a relatively higher amount of fertilizers (306 kilograms per hectare) with a very high use in marginal farms. Thus among all the crops sugarcane and paddy consume a high amount of fertilizers, and it's use is high in marginal holdings. A clear inverse relationship between fertilizer use and farm size is found only for paddy in all farms and irrigated farms. For none of the other crops, such a relationship could be established. Few exceptions are found medium holding. Medium holdings generally utilised a higher amount of fertilizers compared to the farm size categories (Refer table no. 15)

Between 1981-82 to 1996-97, the use of fertiliser increased on all farms. Jowar recorded a higher increase in the use of fertilisers, followed by ragi, cotton and paddy. Cotton registered an increase in all size holdings with a higher increase in large holdings. For ragi, the higher increase varies between a high in semi-medium to a low in marginal holdings. Across total size holdings, the increase varied between a high in marginal holdings to a low in large holdings (Refer table no. 17 in the appendix).

In irrigated holdings, the use of fertiliser increased. The increase varied from a high in marginal holdings to a low in semi-medium and large holdings. The increase across crops is found under ragi, paddy and maize (Refer table no. 18 in the appendix).

In the unirrigated farm also there was an increase in the use of fertilizers, the use being high under small and marginal farms. Across crops, cotton, jowar and paddy registered a higher increase with wide variations (Refer table no. 19 in the appendix).

It can be concluded that the use of fertilisers increased from 1981-82 to 1996-97. Unirrigated farms registered higher increase, compared to irrigated farms. On the other hand irrigated ragi consumed a higher amount of fertilisers. Also consumption was high on irrigated marginal holdings.

### **Use of High Yielding Variety (HYV) seeds in 1996-97**

Since the use of HYV seeds in physical terms cannot be compared across the crops, we look at the use of seeds per hectare and farm size. Only bajra tends to show an inverse relationship between farm size and use of HYV seeds. In rest of the crops there is no trend. Same is the situation for most of the farms. In the case of unirrigated farms, the use of HYV seeds for paddy (47 kilograms/hectare). It is at a high in marginal holdings (75 kilograms/hectare) to a low in large holdings (46.3 kilograms/hectare).

There no clear picture of an established relationship between the use of HYV seeds in kgs/hectare and farm size as such in all the major crops groundnut (47.14 kgs), redgram (6.677 kgs/hect), jowar(6.98 kgs/hect) in irrigated farms. The same is the situation with cotton (2.66 kgs/hectare) cultivated in the unirrigated farms. Only jowar tended to show positive relationship from marginal to medium holdings (Refer table no. 16,17 and 18).

Thus it can be said that in 1996-97, HYV seeds of paddy and groundnut are used extensively. A definite size – input relationships could not be established in any of the important crops except in the irrigated greengram (not a major crop in the irrigated farms) where a positive relationship is established.

## **Use of machine labour**

The use of machine labour was 3.48 hours per hectare on all farms. The large holding used more hours of machine followed by semi medium and medium holdings. Across crops, paddy (11.05%) has the highest use in machine labour hours which varies from a high in small holdings and low in marginal holdings. Paddy is followed by ragi (8.1%).

At the aggregate level there is a clear inverse relationship between farm size and use of machine in hours. Among the major crops paddy, groundnut, redgram and jowar did not reveal a definite relationship. Ragi which is not an important crop with an average consumption of 8 machine labour hours per hectare showed a clear positive relationship between farms size and machine labour use (Refer table no. 19)

On an average about 4.38 labour hours are used on irrigated farms. The use of machine labour is higher under large holdings followed by medium, semi-medium, small and marginal holdings indicating a positive relationship at an aggregate level. In irrigated farms, also the use of machine labour is high under paddy followed by ragi and groundnut. For the major crops (paddy, groundnut, blackgram and maize), we do not see any systematic relationship between farm size and machine labour hours used per hectare (Refer table no. 20).

In unirrigated farms, the use of machine labour is only for groundnut and redgram with groundnut having a higher use of machine labour hours. Marginal variations are found across farm size for groundnut and redgram (Refer table no. 21).

Thus unirrigated farm consume less number of machine labour hours in groundnut. Under irrigated condition food crops like paddy use greater amount of machine labour and the use of machine labour is relatively more under large



holdings. Generally, at aggregate level, there is evidence of positive relationship for all farms, irrigated farms and unirrigated farms. But this is not found at the crop level for all major crops. Changes could not be calculated due to data constraints.

## **CONCLUSION**

The use of human labour as whole is higher under marginal farms and sugarcane consumed a greater amount of human labour in irrigated farms and cotton in unirrigated farms than any other crops. Regarding family labour the use was higher under marginal holdings in all farms. Whereas sugarcane consume a larger amount of family labour in irrigated farms and redgram in unirrigated farms. The casual labour hours were high on small farmers in all farms. Sugarcane and paddy in irrigated and unirrigated farms absorbed a greater number of casual labour hours. Coming to the bullock use, large number of bullock paired hours was used in marginal holdings. Jowar in irrigated farms and ragi in unirrigated farms consumed larger amount of bullock paired hours. Again marginal farms consumed a higher kilograms of fertilizers. Sugarcane in irrigated farms and paddy in unirrigated farms consumed higher kilograms of fertilizers. The use of HYV seeds was found to be higher in small farms. Machine labour on the other hand is highly used under large farms. Paddy in the irrigated farms and groundnut in the unirrigated holdings consumed a greater amount of machine labour hours.

Coming to the farm size and input use relationships only few crops presented a definite trend. Family labour in all farms under paddy, redgram and groundnut established a perfect inverse relationship. Similarly in irrigated farms also inverse relationship is found under paddy, blackgram and groundnut. In unirrigated farms this relationship is prevalent for jowar, redgram and cotton in the use of family labour. A positive relationship for cotton in all farms and an inverse relationship for groundnut in unirrigated farms was

observed in the use of bullock paired hours. In the case of fertilizers paddy in all farms and paddy in irrigated farms showed an inverse relationship. Lastly HYV seeds for irrigated greengram and machine labour for paddy in all farms established an inverse and positive relationship.

During 1981-82 and 1996-97, the use of human labour hours declined drastically; the only exception was cotton. The use of family labour hours declined in all the holdings. The casual labour hours also declined in all the farms with a few exceptions like cotton where it has increased. Cotton in irrigated small holdings and blackgram in the large holdings registered an increase in the use of total bullock labour hours per hectare. The consumption of fertilizers increased in both the irrigated farms and unirrigated farms and total farms as well for most of the crops.

TABLE NO :1

## HUMAN LABOUR IN 1996-97

## ALL FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	1566.44	1509.74	1576.10	1516.62	1445.79	1522.93
RAGI	1704.43	1702.52	1947.53	2426.55	1921.82	1940.57
JOWAR	691.20	619.05	625.39	525.73	394.41	571.15
BAJRA	360.00	569.14	461.43	790.29	n.a	545.22
MAIZE	1081.34	1166.72	928.53	849.47	992.51	1003.71
REDGRAM	897.25	783.98	780.50	676.00	785.75	784.69
GREENGRAM	564.93	432.70	513.78	287.48	382.67	436.31
BLACKGRAM	517.99	423.35	340.24	348.74	341.78	394.42
GROUNDNUT	917.54	929.84	1041.84	909.88	837.29	927.00
COTTON	1707.83	1528.92	1139.95	1349.59	1170.15	1379.28
SUGARCANE	3290.69	3043.27	2733.03	3219.73	2232.17	2903.77
AVG	1209.06	1155.38	1098.94	1172.73	1050.43	1137.31

Source: Data Based On The Report Of Cost Of Cultivation Of Principal Crops In Andhra Pradesh , Volume No:8, 1996-97, Directorate Of Economics And Statistics, Ministry Of Agriculture.

TABLE NO :2

## HUMAN LABOUR IN 1996-97

## IRRIGATED FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	1573.26	1534.64	1589.75	1516.62	1445.71	1531.99
RAGI	1704.43	1821.36	1947.53	2426.55	1921.82	1964.33
JOWAR	n.a	940	512.5	785.8	423.52	655.455
BAJRA	360	711	n.a	915	n.a	662
MAIZE	1137.67	1166.72	1038.79	938.12	962.66	1048.79
REDGRAM	1047.5	n.a	n.a	646.5	932.05	875.35
GREENGRAM	559.36	443.09	488.5	302.53	451.32	448.96
BLACKGRAM	433.72	427.7	291.82	284.54	338.51	355.25
GROUNDNUT	1148.91	1233.18	1174.48	984.5	991.22	1106.45
COTTON	2025.95	1753.01	1567.5	1568.64	1265.51	1636.2
SUGARCANE	3290.69	3043.27	2733.03	3219.73	2232.17	2903.77
AVERAGE	1328.15	1307.40	1260.43	1235.32	1096.45	1245.55

source:ibid.

TABLE NO:3

## HUMAN LABOUR IN 1996-97

## UNIRRIGATED FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	1331.25	961.87	1346.87	n.a	1447.93	1271.98
RAGI	n.a	1108.33	n.a	n.a	n.a	1108.33
JOWAR	691.2	586.96	650.47	445.68	376.97	550
BAJRA	n.a	427.27	461.43	707.15	n.a	531.95
MAIZE	743.33	n.a	634.44	605.63	1350.66	833.515
REDGRAM	875.78	783.98	780.5	685.32	742.73	773
GREENGRAM	571.88	471.14	551.72	247.4	245.37	417
BLACKGRAM	1108	410.37	566.22	605.54	354.85	608
GROUNDNUT	764	669.83	944.91	844.19	710.84	786
COTTON	912.5	1259.99	1011.7	1042.95	915.88	1028
AVERAGE	874.7425	742.1933333	772.02889	647.9825	768.1538	761

source:ibid.

TABLE NO:4

## FAMILY LABOUR IN 1996-97

## ALL FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	680.03	553.48	516.98	469.23	303.34	504.612
RAGI	791	979.25	1036.43	744.24	812.37	872.658
JOWAR	338.73	288.78	251.75	243.68	126.23	249.834
BAJRA	240	359.19	55.24	310.42	n.a	241.2125
MAIZE	558.48	402.3	332.39	200.88	227.5	344.31
REDGRAM	674.11	508.04	499.26	278.38	266.96	445.35
GREENGRAM	271.3	224.69	177.11	79.1	113.49	173.138
BLACKGRAM	238.29	184.54	138.77	126.5	82.85	154.19
GROUNDNUT	501.51	408.83	383.4	264.37	121.49	335.92
COTTON	596.28	518.82	320.57	245.58	194.57	375.164
SUGARCANE	1901.25	387.6	1097.47	1367.24	177.36	986.184
AVERAGE	617.36	437.77	437.22	393.60	242.62	425.68

source: ibid.

TABLE NO:5

## FAMILY LABOUR IN 1996-97

## IRRIGATED FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	690.3	566.43	522.56	469.23	287.52	507.208
RAGI	791.93	1050.94	1036.43	744.24	812.37	887.182
JOWAR	n.a	140	188.75	431	122.88	n.a
BAJRA	240	662	n.a	490	n.a	n.a
MAIZE	566.56	402.3	367.45	241.62	246.08	364.802
REDGRAM	537.5	n.a	n.a	256.29	300.26	n.a
GREENGRAM	250	254.49	146.61	91.05	113.02	171.034
BLACKGRAM	254.63	181.85	100.18	79.16	61.37	135.438
GROUNDNUT	619.65	583.25	424.98	310.63	139.78	415.658
COTTON	615.78	586.46	436.11	240.39	197.28	415.204
SUGARCANE	1901.25	387.6	1097.47	1367.24	177.36	986.184
AVERAGE	646.76	481.53	480.06	429.1681818	245.79	456.66

source: ibid.

TABLE NO :6

## FAMILY LABOUR IN 1996-97

in labour hours per hectare

CROPS	UNIRRIGATED FARMS					
	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	326.25	268.54	423.28	n.a	655.44	418.38
RAGI	n.a	620.83	n.a	n.a	n.a	620.83
JOWAR	338.73	303.66	265.75	185.98	129.86	244.79
BAJRA	n.a	56.36	55.24	190.70	n.a	100.77
MAIZE	510.00	n.a	238.89	88.44	4.67	210.50
REDGRAM	693.62	508.04	499.26	285.33	257.10	448.67
GREENGRAM	297.92	180.01	222.77	47.28	115.93	173.78
BLACKGRAM	484.00	192.60	318.89	315.83	168.79	296.02
GROUNDNUT	366.49	259.33	353.01	221.90	106.46	261.33
COTTON	547.50	427.62	293.99	248.68	187.45	341.08
AVERAGE	445.56	313.00	296.79	198.02	203.21	291.00

source: ibid.



TABLE NO:7

## CASUAL LABOUR IN 1996-97

CROPS	ALL FARMS					in labour hours per hectare	
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	AVERAGE	
PADDY	1560.94	893.953	989.21	925.55	968.52	1067.63	
RAGI	912.5	723.27	911.1	1415.06	1117.45	1015.87	
JOWAR	352.47	299.36	322.28	243.59	214.02	286.34	
BAJRA	120	209.95	406.19	389.87	n.a	281.5025	
MAIZE	552.26	722.62	504.8	466.89	576.96	564.7	
REDGRAM	223.14	261.93	258.92	354.32	371.65	293.99	
GREENGRAM	293.6	208.01	306.57	196.57	237.01	248.35	
BLACKGRAM	231.05	190.84	188.13	218.6	240.28	213.78	
GROUNDNUT	404.11	519.4	632.73	578.04	624.98	551.85	
COTTON	1091.93	969.64	735.88	975.26	825.66	919.67	
SUGARCANE	1389.44	2655.67	1489.34	1780.88	1915.63	1846.19	
AVERAGE	648.31	695.88	613.20	685.88	709.216	670.49	

source: ibid.

TABLE NO :8

## CASUAL LABOUR IN 1996-97

in labour hours per hectare

## IRRIGATED FARMS

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	TOTAL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	877.32	957.44	996.66	925.45	978.74	947.12
RAGI	912.5	770.42	911.1	1415.06	1109.45	1023.7
JOWAR	n.a	460	323.75	325.86	208.34	329.4875
BAJRA	120	49	n.a	425	n.a	198
MAIZE	571.11	722.62	573.88	513.63	526.81	581.61
REDGRAM	510	n.a	n.a	383.54	350.74	414.76
GREENGRAM	309.63	188.6	309.25	203.56	295.8	261.36
BLACKGRAM	174.92	181.89	175.44	200.83	255.58	197.73
GROUNDNUT	506.92	649	705.56	558.63	700.26	624.07
COTTON	1382.17	1092.36	1090.89	1198.86	929.22	1138.7
SUGARCANE	1389.44	2655.67	1489.34	1780.88	1915.63	1846.19
TOTAL	675.401	772.7	730.6522	721.0272727	727.057	725

source: ibid.

TABEL NO:9

## CASUAL LABOUR IN 1996-97

in labour hours per hectare

CROPS	UNIRRIGATED FARMS					
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	
PADDY	1005	647.08	864.09	n.a	741.26	814.3575
RAGI	n.a	487.5	n.a	n.a	n.a	487.5
JOWAR	352.47	283.3	321.95	218.26	217.44	278.684
BAJRA	n.a	370.5	406.19	363.12	n.a	379.9367
MAIZE	233.33	n.a	320.55	338.35	1178.66	517.7225
REDGRAM	182.16	261.93	258.92	345.09	377.8	285.18
GREENGRAM	273.96	237.53	303.07	177.96	119.44	222.392
BLACKGRAM	624	217.71	247.33	289.71	179.05	311.56
GROUNDNUT	286.62	408.38	579.51	595.1	563.14	486.55
COTTON	365	822.37	629.38	662.22	549.5	605.694
TOTAL	415.3175	415.1444	436.7767	373.7263	490.7863	425

source: ibid.

TABLE NO:10

BULLOCK LABOUR IN 1996-97  
ALL FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	96.35	104.19	109.44	105.19	86.19	100.27
RAGI	60	109.35	118.48	113.91	115.86	103
JOWAR	145.92	107.13	103.63	78.4	80.91	103
BAJRA	n.a	7.64	8.1	139.09	n.a	51.61
MAIZE	169.02	134.64	77.78	85.46	108.39	115
REDGRAM	73.9	47.01	84.53	56.67	75.76	67
GREENGRAM	65.28	63.49	44.06	34.35	27.98	47
BLACKGRAM	37.05	24.89	27.84	52.18	55.81	39
GROUNDNUT	80.32	80.46	93.95	80.56	75.21	82
COTTON	114.96	109.68	93.55	82.28	87.94	97
SUGARCANE	60.83	0.66	23.43	29.48	46.5	32
AVG	90.363	71.74	71.34	77	76.055	77.29

source: ibid.

TABLE NO:11

## BULLOCK LABOUR IN 1996-97

## IRRIGATED FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	95.67	103.92	109.64	105.19	81.24	99
RAGI	60	85.39	118.48	113.91	115.86	98
JOWAR	n.a	300	142.5	86.46	93.88	155.71
BAJRA	n.a	8	n.a	152.5	n.a	80.25
MAIZE	165.53	134.64	79.55	86.89	110.3	115
REDGRAM	120	n.a	n.a	64.99	138.62	107.87
GREENGRAM	55.67	74.16	46.8	30.19	37.57	48
BLACKGRAM	29.76	16.41	24.17	16.29	50.28	27
GROUNDNUT	103.34	111.26	94.66	91	9.89	82
COTTON	136.45	162.97	104.89	88.26	111.74	120
SUGARCANE	60.83	0.66	23.43	29.48	46.5	32
AVG	91.91677	99.741	82.68	78	79.588	86.38

source: ibid.

TABLE NO:12

## BULLOCK LABOUR IN 1996-97

## UNIRRIGATED FARMS

in labour hours per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	120	110	105.98	n.a	196.22	133.05
RAGI	n.a	229.17	n.a	n.a	n.a	229.17
JOWAR	145.52	87.84	94.98	75.93	73.17	95
BAJRA	n.a	7.27	8.1	130.15	n.a	48.50667
MAIZE	190	n.a	73.06	85.51	85.33	108.475
REDGRAM	67.31	47.01	84.53	54.03	57.27	62
GREENGRAM	77.29	47.5	39.94	45.43	8.8	43
BLACKGRAM	40.31	18.65	n.a	n.a	n.a	29.48
GROUNDNUT	54.01	54.06	93.43	71.37	54.92	65
COTTON	61.25	45.73	90.15	73.88	24.46	59
SUGARCANE	755.69	647.23	590.17	536.3	500.17	605.6
AVG	94.46	71.91	73.77	76.61	71.45	77.64

source: ibid.

TABLE NO:13

## FERTILIZER USE IN 1996-97

## ALL FARMS

in kilograms per hectare

CROPS	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	AVERAGE
PADDY	452.87	312.78	302.42	242.59	174.86	297.1
RAGI	86.42	204.72	323.32	136.53	143.3	178.85
JOWAR	87.91	87.4	101.68	93.44	42.12	82.51
BAJRA	n.a	138.72	87.62	124.16	n.a	70.1
MAIZE	240.53	229.7	152.67	130.19	145.91	179
REDGRAM	127.1	40.7	39.1	48.95	43.06	59
GREENGRAM	57	39.15	51.56	44.87	26.41	43.79
BLACKGRAM	39	43.44	30.94	41.29	15.6	34.05
GROUNDNUT	122.69	72.73	80.88	90.9	69.27	88.89
COTTON	369.32	176.75	238.24	181.57	197.67	232.7
SUGARCANE	907.78	158.77	188.63	187.78	153.79	319.35
AVERAGE	249.06	136.8	145.18	120.2	91.99	149.14

Source: ibid.

TABLE NO:14

## FERTILIZER USE IN 1996-97

CROPS	IRRIGATED FARMS					AVERAGE
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	
PADDY	448.12	318.00	292.64	242.52	171.46	294
RAGI	86.26	207.33	323.32	136.53	143.40	179.36
JOWAR	n.a	275.00	68.75	225.78	56.95	156.62
BAJRA	n.a	92.00	n.a	242.00	n.a	167
MAIZE	236.17	229.70	153.66	137.99	151.95	181.89
REDGRAM	275.00	n.a	n.a	54.70	150.89	160
GREENGRAM	n.a	19.17	35.55	61.69	39.62	39
BLACKGRAM	n.a	32.50	21.90	51.61	16.01	30.5
GROUNDNUT	145.38	120.77	105.52	135.71	100.52	121
COTTON	377.54	195.46	320.78	227.69	246.82	273
SUGARCANE	907.78	158.77	188.63	187.78	153.79	319
AVERAGE	353.75	164	167.86	154	123.411	161.35

Source: ibid.



TABLE NO:15

## FERTILIZER USE IN 1996-97

## UNIRRIGATED FARMS

in kilograms per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	183	197.5	466.79	n.a	250.57	306
RAGI	n.a	191.67	n.a	n.a	n.a	38
JOWAR	87.91	68.64	109.01	52.71	33.23	70
BAJRA	n.a	185.46	87.62	45.27	0	63
MAIZE	266.66	0	150	108.75	73.34	119
REDGRAM	105.98	40.7	39.1	47.13	11.34	48
GREENGRAM	130	69.13	75.56	n.a	0	54
BLACKGRAM	312	76.25	73.09	n.a	13.98	95
GROUNDNUT	96.78	31.54	62.88	51.48	43.61	57
COTTON	348.75	154	213.47	116.01	66.56	179
SUGARCANE	1964.33	1014.89	1277.52	421.35	492.63	1029
AVERAGE	218.26	112.77	141.95	105.34	61.58	177

Source: ibid.

TABLE NO:16

## HIGH YIELDING VARIETY SEEDS IN 1996-97

## ALL FARMS

in kilograms per hectare

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	AVERAGE
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	57.24	97.44	63.31	62.5	58.97	67.89
RAGI	n.a	8.61	3.74	2.5	3.27	3.62
JOWAR	5	7.39	7.91	6	4.01	6.06
BAJRA	n.a	7.73	5.24	3.5	n.a	3.29
MAIZE	15.74	23.65	21.85	17.94	18.42	19.522
REDGRAM	5.18	5.12	6.81	9.18	5.26	6.31
GREENGRAM	5.56	6	7.26	4.21	0.6	4.72
BLACKGRAM	9.26	13.74	10.84	13.35	12.8	11.99
GROUNDNUT	39.65	41.62	41.43	53.08	41.5	43.45
COTTON	2.52	2.62	3.06	2.15	2.53	2.57
SUGARCANE	140.15	213.92	171.45	174.41	147.36	169.52

source: ibid.

TABLE NO:17

HIGH YIELDING VARIETY SEEDS IN 1996-97  
UNIRRIGATED FARMS

in kilograms per hectare

CROPS	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	AVERAGE
PADDY	56.73	154.29	63.29	62.5	59.96	79.34
RAGI	n.a	2	3.74	2.5	3.27	2.3
JOWAR	n.a	n.a	3.75	4.23	n.a	1.59
BAJRA	n.a	10	n.a	3.75	n.a	2.75
MAIZE	15.31	23.65	32.79	18.06	18.29	21.62
REDGRAM	n.a	n.a	n.a	7.19	3.75	2.18
GREENGRAM	10	10	9.88	5.79	0.45	7.22
BLACKGRAM	10.58	17.49	31.16	16.68	14.09	18
GROUNDNUT	31.05	43.2	31.53	49.3	36.1	38.23
COTTON	2.53	2.77	3.33	2.26	2.21	2.62
SUGARCANE	126.2	263.4	179.47	172.26	138.12	175.59

source: ibid.

TABLE NO:18

## HIGH YIELDING VARIETY SEEDS IN 1996-97

## UNIRRIGATED FARMS

in kilograms per hectare

CROPS	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	AVG
PADDY	75	54.12	63.66	n.a	46.3	47
RAGI	n.a	41.67	n.a	n.a	n.a	8.33
JOWAR	5	8.13	8.83	6.54	6.42	6.98
BAJRA	n.a	5.45	5.24	3.33	n.a	2.08
MAIZE	18.33	n.a	16.67	17.63	20	14.522
REDGRAM	5.92	5.12	6.81	9.81	5.7	6.67
GREENGRAM	n.a	n.a	3.33	n.a	0.89	0.84
BLACKGRAM	n.a	2.5	n.a	n.a	7.64	2.02
GROUNDNUT	49.48	40.25	48.66	56.41	45.93	47.14
COTTON	2.5	2.45	2.97	2	3.39	2.66

source: ibid.

TABLE NO:19

## MACHINE LABOUR IN 1996-97

CROPS	ALL FARMS					AVERAGE
	MARG <one hect	SMALL 1-2 hect	SE-MED 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	
PADDY	8.6	15.11	15.1	6.83	9.64	11.05
RAGI	n.a	0.42	2.45	16	21.67	8.1
JOWAR	n.a	0.45	n.a	0.23	0.38	0.21
BAJRA	n.a	3.41	4.76	n.a	n.a	1.63
MAIZE	n.a	3.26	2.09	4.22	1.16	2.14
REDGRAM	1.12	0.47	0.43	1.51	0.86	0.87
GREENGRAM	0.66	0.43	1.18	1.33	3.23	1.36
BLACKGRAM	1.32	0.73	0.7	1.06	2.4	1.24
GROUNDNUT	3.22	1.63	2.02	3.93	2.94	2.74
COTTON	0.7	0.23	2.05	1.87	0.7	1.11
SUGARCANE	n.a	0.66	7.71	0.72	4.51	2.72
AVERAGE	2.60	2.44	3.849	3.77	4.749	3.47

Source: ibid.

TABLE NO:20

## MACHINE LABOUR IN 1996-97

CROPS	IRRIGATED FARMS					AVERAGE
	MARG <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	
PADDY	8.84	15.76	15.74	6.83	10.07	11.48
RAGI	n.a	0.5	2.45	16	21.67	10.55
BAJRA	n.a	5	n.a	n.a	n.a	5
MAIZE	n.a	3.26	2.25	5.76	1.26	3.13
REDGRAM	n.a	n.a	n.a	1.25	n.a	1.25
GREENGRAM	1.19	0.72	1.22	1.82	2.98	1.58
BLACKGRAM	1.51	0.83	0.85	1.32	2.5	1.4
GROUNDNUT	3.69	2.36	2.3	4	2.36	2.94
COTTON	0.98	n.a	5.56	2.5	0.97	10.01
SUGARCANE	n.a	0.66	7.71	0.72	4.51	3.4
AVERAGE	3.24	3.63	4.76	4.46	5.79	4.38

Source: ibid.

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TABLE NO:21

## MACHINE LABOUR IN 1996-97

CROPS	UNIRRIGATED FARMS					AVERAGE
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	
PADDY	n.a	0.83	4.43	n.a	0.31	1.14
JOWAR	n.a	0.5	7.0	0.3	n.a	0.16
BAJRA	n.a	1.82	4.76	n.a	n.a	1.31
MAIZE	n.a	7.0	1.67	n.a	n.a	0.33
REDGRAM	1.28	0.47	0.43	1.59	1.12	0.97
GREENGRAM	7.0	7.0	1.14	n.a	3.74	0.97
BLACKGRAM	7.0	0.39	7.0	n.a	2.01	0.48
GROUNDNUT	2.69	1.01	1.83	3.87	3.4	2.56
COTTON	n.a	0.5	1	1	n.a	0.5
SUGARCANE	3.97	5.52	15.26	6.76	10.58	42.09
AVERAGE	1.99	0.69	2.18	1.69	2.12	2.01

Source: ibid.

## CHAPTER 3

### YIELD RATES, PRODUCTIVITY AND INCOME LEVEL

In this chapter we discuss variations in the level of physical yield rate of productivity in terms of gross value of output per hectare and finally net incomes per hectare, for major crops. This is done separately for total farms, irrigated farms and unirrigated farms for 1996-97 in A.P. The purpose is to bring out the variations in yield rate, productivity and income levels across the principal crops for various size farms. Later on the changes on these three variables are analysed for a period between 1981-82 to 1996-97. (The Reference tables are given at the end of the chapter).

#### Yield Rates and Farms Size

This section deals with yield rates in quintals per hectare in all farms, irrigated farms and unirrigated farms in the agricultural year 1996-97 for the major crops. The yield is given in terms of quintals per hectare.

We begin with the situation on all farms, which is shown the table. Paddy, groundnut, redgram and blackgram are the major crops. Paddy with an aggregate yield of 45.75 quintals per hectare shows a gradual decline in the yield from marginal to large farms from 47.61 to 43.92 quintals per hectare respectively indicating an inverse relationship. The next major crop is groundnut with an average yield of 9.82 quintals per hectare. Groundnut showed a positive relationship between yield and farm size. Blackgram tends to show an inverse relationship and redgram a positive relationship (Refer table no. 1).

The yield rates are comparatively higher in irrigated farms, compared with unirrigated farms. Across farm-size, the difference is not large although



there is a tendency towards inverse relation between farm-size and yield in quintals. In the case of groundnut there is an indication of positive relationship between farm-size and yield rate. Next important crop is blackgram, where the average yield per hectare is 17.62 quintals per hectare. It shows a positive relationship between farm size and yield rate. In the case of blackgram, the yield rate increased with the increase in the farm-size. Thus among the major crops while paddy generally showed an inverse relationship between yield rate and farm size, in other major crops like groundnut, blackgram and maize, the evidence is in favour of a positive relationship on the irrigated farms (Refer table no. 2).

In the unirrigated farms, the yield rates are generally low compared with the irrigated farms for the major crops like jowar, redgram and cotton. The same is the case with minor crops. An evidence of a positive relationship in the case of groundnut between farm size and yield rate is observed indicating higher yield rates under large holdings. Other crops did not show any systematic pattern of relationship between farm size and yield rates (Refer table no. 3)

### **Farm size and Productivity (Value of Output Per Hectare)**

At all farm level an average of Rs 12928 per hectare is obtained. Among the major crops, paddy with an average overall gross output of 21785 Rupees per hectare tends to show an inverse relationship. Other major crops like groundnut with an overall average gross productivity of 11081 Rupees per hectare established a positive relationship between farm size and productivity (Refer table no. 4).

In irrigated farms about an average of Rs 13211.2 per hectare gross output is realised. The gross value of the output is the highest for sugarcane (Rs 29287/hect), followed by cotton (Rs 23563/hect), and paddy (Rs 21966/hect).

For the major crops like, groundnut, blackgram and maize the value of the gross output is Rs 21966 per hectare, Rupees 13750 per hectare, Rs 4763 per hectare, and Rs 10404 per hectare respectively (Refer table no. 5).

Unirrigated farms on an average earned about 10812 Rupees per hectare, which is lower than irrigated farms. Groundnut with an average of 8,708 Rs/hectare, redgram with an average gross productivity of 14,697 Rs/hectare, jowar with an average gross productivity of 6931 Rupees per hectare and cotton with an average gross productivity of 15,217 Rupees per hectare are the main crops cultivated in the unirrigated farms. The output per hectare is high on cotton and redgram (Refer table no. 6).

Among the major crops, paddy shows an evidence of an inverse relationship is observed. Groundnut on the other hand showed a positive relationship. In the case of redgram (14.038 per hectare) and for maize no definite relationship is observed.

Between 1981-82 and 1996-97, in all farms the productivity at an aggregate level registered an increase by 3.5%. The highest increase was under large holdings at 12.42% followed by marginal medium, and small holding. The only exception was in semi-medium holdings in whose case productivity declined. Jowar experienced a highest increase in productivity by 54.92% especially it being high under semi-medium holdings. Paddy and cotton also registered an increase in the value of output per hectare. Sugarcane did not show any substantial change (Refer table no. 20 in the appendix)

In the case of irrigated farms, at the aggregate, level there was a positive change by 6.67% in productivity between 1981-82 to 1996-97. Across the sizes the increase was higher under large farms by 13.33% followed by medium, marginal, small and semi-medium holdings. The increase in productivity under paddy in irrigated farms is the same as the increase in all

farms situation. In the case of sugarcane, the increase was low. For cotton, the productivity levels declined (Refer table no. 21 in the appendix)

Productivity also increased on <sup>un</sup>irrigated farms by 2.41% between 1981-82 to 1996-97. Except a decline in semi-medium holdings, all the other size holdings registered as increase in productivity. Large holdings registered a higher increase by 21.94% followed by marginal, small and medium holdings. Jowar (63%) and blackgram (52%) registered a higher increase in unirrigated farms. In the case of paddy, the growth rates declined whereas for cotton, the growth rates registered a higher increase in almost all the size holdings (Refer table no. 22 in the appendix)

### **Farmsize and Income levels**

In the preceding section, we examined the farm-size wise variations in value of output per hectare in gross terms. In this section we study the farm-size-wise variations in net incomes. Three concepts of costs are used to work out the three income concepts namely  $A_2$ ,  $C_1$  and  $C_2$ .  $A_2$  costs includes all the expenses in cash and kind and rent paid for leased in land;  $C_1$  concept includes  $A_2$  costs along with the rental value of owned land, interest on capital assets and imputed value of family labour. And finally  $C_2$  costs includes all the costs including the fixed costs. Thus, three income concepts were derived by deducting these costs from gross value of output.

### **Incomes Based on Cost $A_2$**

To begin with, in the all farm situation, the incomes based on  $A_2$  costs are higher in the case of sugarcane (Rs 18453/hect), paddy (Rs 8721/hect) and cotton (Rs 6133 /hect). In paddy, highest income was obtained by marginal holdings of Rupees 10570 per hectare followed by small farms (Rs 10087/hectare). Paddy showed an evidence of an inverse relation between farm size and net average incomes based on  $A_2$  concept (Refer table no. 7)

For groundnut and redgram, no systematic relationship emerged. In the case of jowar, small and large farms incurred losses but the other categories of farms indicated net gains over A2 costs. Net incomes were also positive for the remaining crops like cotton and maize.

Besides, the minor crops like sugar cane which yield higher net incomes of Rs 18453 per hectare compared to other crops generally indicate an inverse relationship between farms size and net incomes.

The incomes based on A2 costs in irrigated farms are higher for sugarcane (Rs 14572/hect) followed by paddy (Rs 9707/hect), cotton (Rs 7385/hect). Of these main crops, paddy showed a higher net income on marginal and small farms compared to other farms, which shows a presence of an inverse relationship between farm size and incomes.

In the case of other main crops like groundnut, blackgram and maize, there is no clear relationship. Sugarcane, which experienced a relatively higher net income of Rupees 1472 per hectare also did not show any definite relationship. Non food crops and cash crops in the irrigated farms show higher returns compared to cereals and pulses. Among cereals and pulses, maize and greengram obtained a higher net income compared to blackgram and ragi (Refer table no. 8).

In unirrigated farms, the crops which obtained higher returns based on A2 costs are blackgram (Rs 7452/hect), maize (Rs 7323/hect) and paddy (Rs 6584/hect) in that order. The main crops on unirrigated farms are groundnut (Rs 2321/hectare), redgram (Rs 8128/hectare), jowar (Rs 2985/hectare) and cotton (Rs 3838 /hectare).

Jowar showed highest income in the semi-medium holdings but there is a lack of relationship between farm size and net average incomes. Groundnut registered a higher net average income in small holdings. Here also no

systematic relationship is found. Redgram, which obtained a higher net average income in marginal holdings also didn't show any clear relationship. Other important crops like paddy with a net average income of Rupees 6584 per hectare and maize with Rupees 7323 per hectare enjoyed a relatively higher net average income. Blackgram also obtained a net income of Rupees 7452 per hectare (Refer table no. 9).

There is a decline by 2.08% in the net average income between 1981-82 to 1996-97. Across the size holdings, the higher increase is observed under marginal and large holdings. Cotton has the highest increase of 17.95% followed by paddy (17.20%) and bajra (16.28%). Other crops like ragi, jowar, maize and redgram showed a decline in incomes (Refer table no. 23 in the appendix).

The growth rates of the incomes are based on  $A_2$  concepts costs in irrigated farms. An increase of 0.51% in incomes is observed. Across size holdings, small farms with the higher increase of 9.78% are followed by marginal and large holdings. A decline is observed in the semi-medium and medium holdings. Only paddy registered an increase in marginal holding (20.11%) followed by medium holdings (14.14%), small (12.30%) and semi-medium holdings (11.15%). Greengram under medium holding showed a significant increase of 64.15%. Similarly, Bajra and Maize also showed significant increase under marginal holding (Refer table no. 24 in the appendix).

In the unirrigated farms, an overall decline in the incomes is by -1.78%. The only exceptions are paddy, ragi and redgram. Across size holdings, large holdings has a higher increase of 14.12% followed by medium holdings (7.38%), marginal holdings (5.15%) and small holding, a s (2.39%) in semi-medium holdings, a decline in incomes is observed (Refer table no. 25 in the appendix).

## **Income Based on C<sub>1</sub> Concepts of Income**

This concept of income is derived by deducting C<sub>1</sub> costs from gross product. C<sub>1</sub> costs concept includes the cash and kind expenses, rental value of owned land and interest on capital assets.

In all farm situations, the incomes based on C<sub>1</sub> costs are higher for sugarcane (Rs 12636/hectare) and paddy (Rs 5074/hectare). Across the farm size groups, the pattern varies from crop to crop. In the case of sugarcane no systematic relationship is observed between farm size and income per hectare. The per hectare incomes were highest on small holdings for sugarcane. In the case of paddy, there is trend towards negative relationship between net income and farm size. Groundnut on the other hand tends to show a positive relationship where as in redgram and jowar no definite relationship between farm size and income is found. At the aggregate level, there is no definite trend between farm size and income level. Minor crops like cotton also doesn't show any relation (Refer table no. 10).

Coming to the irrigated farms, sugarcane has the highest income of Rupees 8755 per hectare followed by paddy (Rs 5996/hectare), and cotton (Rs 5447/hectare). Sugarcane under small holdings (Rs 16204/hectare) and paddy under marginal holdings (Rs 7168/hectare) realised the highest net average income. Out of the main crops, only groundnut showed a definite positive relationship. The other main crops, paddy, blackgram and maize did not show any systematic relationship (Refer table no. 11).

In unirrigated farms, the main crops like groundnut, jowar and cotton incurred net losses. Redgram is the only important crop which obtained net income of (Rs 910 /hectare). None of these crops showed any systematic relationship between farm size and net income. The other crops which obtained

net positive income are maize (Rs 2992/hectare), greengram (Rs 1527/hectare) and blackgram (Rs 4073 /hectare) (Refer table no. 12).

### **Income Based on C<sub>2</sub> Concepts of Costs**

C<sub>2</sub> incomes are obtained by deducting C<sub>2</sub> costs from gross income. In all farm situation, except sugarcane, all other crops incurred losses. At farm size level, crops like redgram (Rs 1702/hectare), greengram (Rs 594/hectare), blackgram (Rs 55/hectare) and sugarcane (Rs 3339/hectare) are a few exceptions with net positive gains under marginal holdings. Redgram and greengram in small holdings also obtained net gains. Jowar and redgram under semi-medium holdings showed net positive gains. Greengram and sugarcane under medium holdings also showed signs of positive gains. Redgram, blackgram and sugarcane under large holdings also obtained positive net returns.

At the farm level in the case of sugarcane, large holdings generally obtained higher level of net income per hectare compared to smaller holdings. The only exception was semi-medium holdings where the net income was negative. In rest of the crops, most of the size holdings show losses (Refer table no. 13).

The incomes based on C<sub>2</sub> concept in the irrigated farms also incurred losses in all size holdings. Only sugarcane registered net gains in incomes in small (Rs 5284 /hectare), medium (Rs 4450/hectare) and large holdings (Rs 50/hectare) (Refer table no. 14)

The incomes based on C<sub>2</sub> costs for most of the crops incurred losses at an overall level. Only four crops showed positive gains and the rest showed losses. These are maize (Rs 7874/hectare), redgram (Rs 3160/hectare), greengram (Rs 1812/hectare), blackgram and cotton (Rs 1497/hectare) under marginal farms. Also paddy, redgram, greengram, blackgram in small farms,

paddy, jowar, maize and redgram in semi-medium holdings, jowar, bazra, maize and redgram in medium farms and cotton and greengram in large holdings registered net positive gains (Refer table no. 15).

## **Conclusion**

To summarise, regarding size, productivity and yield relations, no definite relationship is found for crops, except a few. Paddy showed a systematic and inverse relationship between farm size and yield and between the farm size and gross productivity. Similarly groundnut showed a positive relationship with respect to farm size, yield and gross productivity.

In the case of net incomes, severe losses were found when incomes based on  $C_1$  and  $C_2$  costs concepts are derived. Only a few exceptions are there where net average gains are positive. The incomes obtained on the basis of  $A_2$  cost concepts only showed net positive gains. The farm size and income relationship shows a definite inverse relationship for paddy in all farm situations based on the incomes obtained from  $A_2$  costs.



TABLE NO:1

## YIELD IN ALL FARMS

in quintals per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	47.61	46.73	45.9	44.58	43.92	45.75
RAGI	17.6	13.73	12.85	17.98	16.74	15.78
JOWAR	12.28	11.5	15.61	1.8	9.79	10.2
BAJRA	5	9.36	15.24	7.24	n.a	9.21
MAIZE	24.23	22.65	24.08	21.74	26.47	28.83
REDGRAM	11.69	8.51	10.02	11.29	12.36	10.77
GREENGRAM	5.9	3.81	4.15	4.55	5.59	4.8
BLACKGRAM	16.5	27.82	17.35	8.17	7.65	15.5
GROUNDNUT	7.85	9.35	9.96	9.85	12.11	9.82
COTTON	11.86	6.75	10.02	12.21	11.83	10.53
SUGARCANE	463.89	12.19	584.67	569.58	421.47	511.36

source: Based On The Report Of cost of Cultivation Of Principal Crops In Andhra Pradesh, Volume: 8, 1996-97, Directorate of Of Economics And Statistics, Ministry Of Agriculture.

TABLE NO:2

## YIELD IN IRRIGATED FARMS

in quintals per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	47.5	47.43	46.05	46.05	44.45	46.296
RAGI	17.6	15.98	12.85	17.98	16.74	16.23
JOWAR	n.a	15	11.25	9.92	10.05	11.55
BAJRA	5	6	n.a	8.13	n.a	6.38
MAIZE	22.44	22.65	24.25	21.21	26.62	23.434
REDGRAM	1.5	n.a	n.a	9.9	10.65	7.35
GREENGRAM	4.5	2.66	3.76	4.18	5.57	4.134
BLACKGRAM	14.57	34.89	19.95	9.59	9.11	17.622
GROUNDNUT	9.92	12.07	12.47	10.96	14.72	12.028
COTTON	13.22	15.36	13	13.86	11.79	13.446
SUGARCANE	463.89	519.98	584.67	569.58	421.47	511.918

source: ibid.

TABLE NO:3

## YIELD IN UNIRRIGATED FARMS

in quintals per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	51.25	31.46	43.39	n.a	32.23	39.58
RAGI	n.a	1.5	n.a	n.a	n.a	1.5
JOWAR	12.28	11.15	16.59	12.38	9.63	12.41
BAJRA	n.a	12.73	15.24	6.65	n.a	11.54
MAIZE	35	n.a	23.61	23.21	24.67	26.62
REDGRAM	13.15	8.51	10.02	11.72	12.86	11.25
GREENGRAM	7.65	5.53	4.74	5.56	5.64	5.82
BLACKGRAM	30	6.63	5.52	2.47	1.78	9.28
GROUNDNUT	5.49	7.02	8.02	8.88	9.97	7.88
COTTON	8.44	8.38	9.13	9.9	11.94	9.56

source:ibid.

TABLE NO:4

## GROSS PRODUCTIVITY IN ALL FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	22388	22056	21995	21293	21193	21785
RAGI	6407	6431	5789	9134	8449	7242
JOWAR	6991	6606	9171	7138	5382	7058
BAJRA	4000	3414	6343	3639	n.a	4349
MAIZE	10274	9969	11104	9949	11588	10577
REDGRAM	15803	11011	13216	14569	15592	14038
GREENGRAM	7272	4656	4837	5164	7093	5804
BLACKGRAM	5761	5232	5233	3009	6204	5088
GROUNDNUT	9412	11286	11337	11935	11433	11081
COTTON	20491	21523	17382	21217	20470	20217
SUGARCANE	38550	36398	31045	33399	26450	33168
AVG	13395	12598	12496	12768	13385	12928

source:ibid.

TABLE NO.5

## GROSS PRODUCTIVITY IN IRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	22319	22233	21924	21924	21429	21966
RAGI	8117	7467	5789	9134	8449	7791
JOWAR	n a	9750	7450	6847	6756	7701
BAJRA	2923	2100	n.a	4000	n.a	3008
MAIZE	9945	9964	10414	9949	11749	10404
REDGRAM	1071	n a	n.a	12656	11536	8421
GREENGRAM	5309	3308	4614	4745	6651	4925
BLACKGRAM	4096	4526	5094	2935	7165	4763
GROUNDNUT	11937	14681	14642	13363	14126	13750
COTTON	23017	27580	22472	24304	20439	23563
SUGARCANE	25145	36399	31045	33399	20450	29287
AVG	1388	15055	13715	13023	12875	13211

source ibid

TABLE NO.6

## GROSS PRODUCTIVITY IN UNIRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	14310	18158	23187	n.a	15952	17901
RAGI	n.a	1250	n.a	n.a	n.a	1250
JOWAR	6268	6606	9171	7228	5382	6931
BAJRA	n.a	4727	6343	3398	n.a	4822
MAIZE	15894	n.a	12944	9947	9660	12111
REDGRAM	17303	11011	13215	15173	16785	14697
GREENGRAM	8450	6678	5172	6280	7976	6913
BLACKGRAM	35389	3359	5881	3304	2361	10859
GROUNDNUT	6344	9375	8922	10678	9222	8708
COTTON	14530	14254	15855	10895	20553	15217
AVG	14812	5773	11187	8363	10986	10810

source ibid

TABLE NO:7

## INCOMES BASED ON A2 COSTS IN ALL FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	10571	10087	7503	7873	7573	8721
RAGI	2670	2303	-180	-2460	-771	312
JOWAR	2672	-37689	4666	2856	-3496	-6198
BAJRA	3508	-109	3235	-3441	n.a	798
MAIZE	3910	1474	4280	1387	2088	2628
REDGRAM	10598	6404	9052	9048	2408	7502
GREENGRAM	4376	2636	1428	2961	3940	3068
BLACKGRAM	3339	2578	2885	-2454	3169	1903
GROUNDNUT	3208	5627	3682	4150	4340	4202
COTTON	5361	7882	4848	6007	6569	6133
SUGARCANE	25620	19433	10339	21365	15508	18453
AVG	6894	1875.09	4703.45	4299.27	4132	4380

source:ibid.

TABLE NO:8

## INCOMES BASED ON A2 COSTS IN IRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	11663	11149	8526	8526	8670	9707
RAGI	4039	2368	-657	-3134	-1376	248
JOWAR	n.a	4051	3681	237	-11564	-898.75
BAJRA	2431	-1635	n.a	-5393	n.a	-1532
MAIZE	3203	1368	2884	470	1981	1981.4
REDGRAM	-6158	n.a	n.a	6631	2195	889.3333
GREENGRAM	2197	1281	884	2146	2573	1816
BLACKGRAM	1972	1449	2672	-2550	3813	1471
GROUNDNUT	3500	6582	3043	3795	4557	4295.4
COTTON	4718	13034	6607	7576	4994	7385.8
SUGARCANE	12215	19434	10339	21364	9508	14572
AVG	3978	5908.10	4219	3606.18	2535.10	4049.28

source:ibid.



TABLE NO:9

## INCOMES BASED ON A2 COSTS IN UNIRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	-1326	10399	11855	n.a	5407	6583.75
RAGI		-917	n.a	n.a	n.a	-917
JOWAR	1948	2785	4398	3776	2021	2985.6
BAJRA	n.a	956	3235	-1312	n.a	959.67
MAIZE	13007	n.a	8457	5194	2635	7323.25
REDGRAM	12787	6404	9052	9715	2686	8128.8
GREENGRAM	5980	4281	1942	4774	6211	4637.6
BLACKGRAM	29542	4888	3204	-366	-7	7452.2
GROUNDNUT	855	3021	2502	2812	2417	2321.4
COTTON	6757	1177	4095	-2243	9404	3838
AVG	8694	3666	5416	2794	3847	4122

source:ibid.

TABLE NO:10

## INCOMES BASED ON C1 COSTS IN ALL FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	6055	6077	3774	4392	5074	5074.4
RAGI	-765	-2072	-4164	-4935	-4280	-3243.2
JOWAR	1579	982	3033	1280	-4301	514.6
BAJRA	2986	-1913	2782	-4805	n.a	-237.5
MAIZE	-640	-1039	2071	-142	311	112.2
REDGRAM	6442	3685	6233	7165	461	4797.2
GREENGRAM	2776	1656	487	2452	3075	2089.2
BLACKGRAM	1869	1332	1905	-3510	2548	828.8
GROUNDNUT	440	3262	1399	2444	3456	2200.2
COTTON	4419	4957	2974	4373	4686	4281.8
SUGARCANE	14904	16204	3620	14469	13985	12636.4
AVG	3642.27	3011.91	2192.09	-95242.09	2501.6	

source:ibid.

TABLE NO:11

## INCOMES BASED ON C1 COSTS IN IRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	7168	7059	4751	4751	6253	5996.4
RAGI	604	-3903	-4642	-5608	-4885	-3686.8
JOWAR	n.a	3218	2714	-4063	-12361	-2623
BAJRA	1908	-10405	n.a	-7420	n.a	-5305.666667
MAIZE	-1389	-1205	343	-1480	95	-727.2
REDGRAM	-6770	n.a	n.a	4839	802	-376.3333333
GREENGRAM	578	186	55	1610	1749	835.6
BLACKGRAM	493	112	1869	-3339	3275	482
GROUNDNUT	128	2968	348	1690	3523	1731.4
COTTON	4180	9749	3867	6295	3147	5447.6
SUGARCANE	1499	16204	3620	14469	7985	8755.4
AVG	1162.20	2188.50	1436.22	1067.64	1018.90	

source:ibid.

TABLE NO.12

## INCOMES BASED ON C1 COSTS IN UNIRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	-14792	2700	1880	n.a	-3533	-3436.25
RAGI	n a	-3312	n.a	n.a	n.a	-3312
JOWAR	-1651	-737	-329	380	-401	-547.6
BAJRA	n a	-803	879	-3234	n.a	-1052.666667
MAIZE	7874	n a	3107	1595	-606	2992.5
REDGRAM	3160	270	2222	3252	-4352	910.4
GREENGRAM	1812	1441	-666	2448	2603	1527.6
BLACKGRAM	22798	1593	-160	-1854	-2010	4073.4
GROUNDNUT	-3170	-907	-2164	-1798	-1140	-1835.8
COTTON	1497	-6105	-3000	-9624	1167	-3213
SUGARCANE						
AVG	6591.25	732.36	3634.78	2379.50	2265.50	

source:ibid.

TABLE NO:13

## INCOMES BASED ON C2 COSTS IN ALL FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	Some hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	-819	-840	-2832	-2049	-1284	-1564
RAGI	-2687	-4001	-5901	-7675	-6815	-5415
JOWAR	-927	-1199	323	-861	-6070	-1746
BAJRA	1786	-2937	879	-5897	n.a	-1542
MAIZE	-3722	-4032	-1261	-3127	-3105	554
REDGRAM	1702	270	2222	2794	-4216	348
GREENGRAM	594	260	-964	903	948	-714
BLACKGRAM	55	-238	335	-4412	687	-1200
GROUNDNUT	-2732	-124	-2002	-1136	-3105	-2335
COTTON	-3157	-1936	-2721	-2409	-4216	2887
SUGARCANE	3339	5284	-5694	4470	6050	2689
AVG	-2340	-1913	-3053	-3445	-4115	

source:ibid.

TABLE NO:14

## INCOMES BASED ON C2 COSTS IN IRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	AVG
PADDY	372	76	-1834	-1834	-175	-679
RAGI	-1318	-6143	-6378	-8348	-7420	-5921
JOWAR	n.a	293	479	-6117	-14388	-4933
BAJRA	708	-11035	n.a	-8620	n.a	-6315
MAIZE	-4282	-4194	-2781	-4465	-3430	-3830
REDGRAM	-7348	n.a	n.a	1043	-2659	-2988
GREENGRAM	-1159	n.a	-879	186	-247	-583
BLACKGRAM	-920	-1245	341	-4220	1126	-983
GROUNDNUT	-4161	-1436	-4045	-2319	-750	-2542
COTTON	-4704	1075	-2874	-1710	-2985	-2239
SUGARCANE	-10066	5284	-5694	4450	50	-1195
AVG	-4246	-4143 83	-3497	-4740	-4006	

source:ibid

p

TABLE NO:15

INCOMES BASED ON C<sub>2</sub> COSTS IN UNIRRIGATED FARMS

in rupees per hectare

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	AVG
	<one hect	1-2 hect	2-4 hect	4-6 hect	Above 6	
PADDY	14792	2700	1880	n.a	-3533	-3436
RAGI	n.a	-3312	n.a	n.a	n.a	-3312
JOWAR	-1651	-737	-329	380	-401	-5477
BAJRA	n.a	-803	879	-3234	n.a	-1052
MAIZE	7874	n.a	3107	1595	-606	2992
REDGRAM	3160	270	2222	3252	-4352	910
GREENGRAM	1812	1441	-666	2448	2603	1527
BLACKGRAM	22798	1593	-160	-1854	-2010	4073
GROUNDNUT	-3170	-907	-2164	-1798	-1140	-1835
COTTON	1497	-6105	-3000	-9624	1167	-3213
AVG	7428	-2372	2022	-4127	-2007	

source ibid

## **SUMMARY AND CONCLUSION**

The main purpose of this study is to examine the inter-farm variations in input use, productivity and farm income for selected crops in Andhra Pradesh during 1996-97. We examined the differences in the irrigation level, cropping pattern, input use, yield rates and productivity (gross output per hectare) and income (based on the three concepts of costs A<sub>2</sub>, C<sub>1</sub>, C<sub>2</sub>). Variations are examined for all farms, irrigated and unirrigated farms separately for principal crops grown in the state. Agricultural year 1996-97 was selected to examine variations across farm size holdings for the selected crops. The changes in the irrigation levels, cropping pattern, input use, yield level, productivity and income levels are then studied during 1981-82 to 1996-97.

The analysis is based on the data drawn from the reports of cost of cultivation of principal crops in Andhra Pradesh undertaken by Agricultural University sponsored by the Directorate of Economics and Statistics, Delhi. In this chapter we summarise the main results and present their implications.

### **IRRIGATION AND CROPPING PATTERN**

Starting with irrigation levels, in 1996-97, about 24.7% of cropped area was irrigated. Sugarcane (50%), paddy (49%), ragi (49.48%), maize (46.81%), greengram (41.81%), cotton (39.93%), groundnut (34.28%), redgram (25.79%) has a relatively higher area under irrigation, in that order. The percentage of irrigated area is higher under medium holdings (44.14%), followed by large holdings (36.17%) and marginal holdings (18.28%), indicating a higher irrigated area under medium size holdings. Area under irrigation is nearly constant with marginal differences across farm size for sugarcane and paddy. A definite positive relationship is observed in case of ragi indicating an increase in the irrigation level with the increase in farm size. Thus in the case of paddy and sugarcane which are high moisture needing crops, the irrigation level



didn't differ much across farm size groups. Maize with an irrigated area of 46.81% did not show many differences across size holdings. In the case of greengram, irrigated area varies from a low of 24.26% in semi-medium holdings to a high of 45.12% in medium size holdings. Blackgram also shows extreme variations with a very low irrigated area of 0.19% under small holdings to a high of 49.06 under medium-size holdings.

The irrigated area increased by 2.19% during 1981-82 to 1996-97. All crops, also showed an increasing trend. The highest increase is registered for ragi (120%). Ragi is followed by jowar (56.67%) and bajra (22.62%) . Cotton registered a decline in the irrigated area by -1.34%.

Coming to the cropping pattern, in all farm situation, the percentage of cropped area is highest for paddy (35.29%) followed by groundnut (19.08%) and redgram (9.42%). Bajra (0.62%), ragi (1.30%) and sugarcane (2.23%) occupied a smaller proportion of area.

In the irrigated farms, the gross cropped area is highest for paddy (46.2%) followed by groundnut (13.42%), blackgram (8.24%), and maize (7.35%). . In unirrigated farms cropping pattern changed with a higher proportion of cropped area in groundnut (33.385) followed by redgram (25.78%) and jowar (17.80%). Maize (2.71%), blackgram (3.79%) and greengram (4.81%) occupied a smaller proportion of area.

The comparison between the irrigated and the unirrigated farms shows groundnut, redgram and jowar as the main crops in unirrigated farms. On irrigated farms paddy, blackgram and maize replace these crops. Besides these, groundnut remains the main crops in both irrigated and unirrigated farms. Cotton with about 5 to 7 percent nearly occupied the same area on irrigated and unirrigated farms.

Coming to the farm size categories, generally for the irrigated crops no systematic relationship is observed with respect to cropping pattern and farm-size. However there are some exceptions. Maize and blackgram on irrigated farms tends to show a positive relationship between farm size and cropped area though not very significant. The remaining crops on irrigated farms did not show any systematic relationship. On the unirrigated farms, for greengram & redgram not much variations across farm-size is visible. Unirrigated paddy tends to show a positive relationship between cropped area and farm size.

## **INPUT USE**

The next important aspect is the use of physical inputs. The inputs include human labour (both family labour hours and casual labour hours), bullock labour, fertilizers use (in kilograms of nutrients) and the use of HYV seeds (in kilograms) per hectare.

First, in all farm situations, human labour absorption on an average was about 1137 labour hours per hectare. The use of labour sugarcane (2903 labour hours/hectare), followed by ragi (1940 labour hours/hectare), paddy (1523 labour hours/hectare) and cotton (1379 labour hours/hectare). A lower absorption is in jowar (571 labour hours/hectare) and redgram (785 labour hours/hectare).

Human labour hours in irrigated farms on an average are at 1245 labour hours/hectare. A higher number of labour hours are used in the case sugarcane (2903.77 labour hours/hectare), followed by ragi (1964 labour hours/hectare), cotton (1636 labour hours/hectare). The crops, which have the lowest labour hours are blackgram (3.65 labour hours/hectare) and greengram (448 labour hours/hectare).

Coming to the unirrigated farms the average human labour hours used was 761 labour hrs /hect which was much lesser than the irrigated farms. The crops which used the highest human labour hours are paddy (1272 labour hours/hectare) and ragi (108 labour hours/hectare), whereas greengram (417 labour hours/hectare), jowar (550 labour hours/hectare), and blackgram (608 labour hours/hectare) used the lowest labour hours.

A comparison between irrigated and unirrigated farms reveals that paddy utilised a lower number of human labour hours in unirrigated farms (1272 labour hours) compared to a higher use in irrigated farms (1532 labour hours/hectare). Greengram also used a higher number of human labour hours on irrigated farms (448 labour hours per hectare) than on the unirrigated farms (417 human labour hours per hectare) used a lower number of labour hours than in the irrigated farms. Under unirrigated farms, blackgram (355 labour hours /hectare). Under irrigated farms, groundnut and cotton consumed a higher number of human labour hours than under unirrigated farms.

Coming to the farm size relationships, human labour hours consumed under irrigated farms for paddy and blackgram, tends to show an inverse relationship while ragi shows a positive relationship between farm size and labour hours used. In the unirrigated farms, redgram, greengram, blackgram tends to show an inverse relationship between farm size and labour hours used. A comparison between irrigated and unirrigated farms shows that paddy which tended to show an inverse relation in irrigated farms showed an opposite trend on irrigated farms. This reveals that in irrigated farms, a higher human labour is used by marginal and small farms.

Family labour which is the most important component of human labour is used on an average of 426 lab/hrs per hect in all farm situations. The highest number of family labour hours per hect is utilised in sugarcane (986 lab

hrs/hect), followed by ragi (873 lab hrs/hect) and paddy (505 lab hrs/hect). Crops like blackgram and green gram used a less than 200 labour hrs /hectares.

Family labour use in irrigated farms 456 labour hours per hectares are used . The consumption on the irrigated farms is the highest for sugarcane (986 labour hours/hectare) followed by ragi (887.18 labour hours/hectare). The lower labour is used for greengram (171.03 labour hours/hectare) and blackgram (135.43 labour hours/hectare).

In unirrigated farms, the average family labour hours used are 260 labour hours per hectare. A higher number of labour hours are used by ragi (620 labour hours/hectare) followed by paddy (418 labour hours/hectare), whereas the least number of labour hours are used by greengram (173 labour hours/hectare) followed by jowar (245 labour hours/hectare).

The use of family labour used is more in unirrigated farms than in irrigated farms for jowar, redgram, greengram and blackgram. It is more in irrigated farms than in unirrigated farms for paddy, ragi, bajra, maize, groundnut and cotton.

In irrigated farms, paddy, maize, groundnut and cotton shows an inverse relationship between farm size and use of family labour. In the remaining crops no consistent relationship could be found. Under unirrigated farms, paddy tends to show a positive relation while jowar, redgram and groundnut tends to show an inverse relationship between farm size and family labour used.

A comparison of irrigated and unirrigated farms, shows that paddy bears an inverse relation under irrigated farms indicating that under irrigated conditions the use of family labour becomes more intensive in marginal and small farms.

The next main component of human labour is casual labour. The casual labour use in all farms situation is 670 labour hours per hectare. Sugarcane used a higher number labour hours (1846 labour hours/hectare), followed by paddy (1067 labour hours/hectare) and ragi (1015 labour hours/hectare). The lowest number of casual labour hours is utilised by blackgram (213 labour hours/hectare).

On the irrigated farms the use of casual labour is high. Among the crops sugarcane (1846 labour hours/hectare) used more casual labour followed by cotton (1138 labour hours/hectare). Same is lowest for blackgram (197 labour hours/hectare) and greengram (261 labour hours/hectare).

On unirrigated farms, the average use of casual labour hours use is about 426 lab hrs/hect. Which is quite low compared to irrigated farms. The use of casual labour hours is higher for paddy (814 labour hours/hectare), cotton (605 labour hours/hectare) and maize (517 labour hours/hectare). Lowest casual labour is used for greengram (222 labour hours/hectare) followed by jowar(278 labour hours/hectare).

A comparison of the use of casual labour hours per hectare between irrigated and unirrigated farms shows that cotton consumed a higher number of labour hours in irrigated farms than in unirrigated farms. Same is the case for paddy,ragi, maize, greengram and groundnut. Only blackgram used a higher number of casual labour hours under unirrigated farms than in irrigated the farms.

Comparing between casual labour and family labour used, it is found that under irrigated farms, the casual labour hours used in cultivation is more than family labour hours used for all crops except bajra.

In irrigated farms, paddy, ragi, blackgram and groundnut tends to show positive relationship between farm size and casual labour use

indicating higher use on large farms. This shows that casual labour hours are employed in larger numbers in the irrigated large holdings to the small ones in the case of paddy, ragi, blackgram and groundnut. While cotton tends to show an inverse relation in unirrigated farms between farm size and casual labour use. Maize and redgram tends to show positive relation whereas paddy and jowar tends to show a negative relationship between farm size and casual labour used. This signifies the fact large farms under maize and redgram utilise a greater number of labour hours in irrigated conditions. While paddy and jowar consumes a relatively larger number of casual labour hours under small farms.

Comparing between irrigated and unirrigated farms, paddy shows a positive relation under irrigated farms. This means that under irrigated conditions the use of casual labour is relatively higher under large farms. The opposite is the case for unirrigated paddy.

Bullock labour is another traditional input which is used both in irrigated and unirrigated cultivation. The bullock labour used on an average on all farms is about 77 labour hours per hectares. At all farms level, the highest bullock hours is used by ragi and jowar (103 labour hours /hectare) and paddy (100 labour hours/hectare).

Irrigated farms absorbed an average of 86.39 bullock labour hours. Out of which, jowar absorbed highest 155.71 labour hour per hectare followed by cotton (120 labour hours/hectare) and maize(115 labour hours/hectare). The lowest is for blackgram (27 labour hours/hectare) followed by sugarcane(32 labour hours/hectare) and greengram(48 labour hours/hectare).

The average number of bullock labour hours absorbed in the unirrigated farms stood at 77.64 lab hrs/hect. In unirrigated farms, ragi has the highest bullock labour used (229.17 labour hours/hectare) followed by paddy

(133.05 labour hours/hectare) and maize(108.48 labour hours/hectare). Bullock labour hours used is lowest for blackgram (29.48 labour hours/hectare), greengram(43labour hours/hectare) and cotton (59 labour hours/hectare).

Bullock labour on irrigated farms is more that that of unirrigated farms for jowar, maize, greengram, groundnut and cotton. Whereas it is more under unirrigated for paddy .

In the case of irrigated farms, ragi showed a positive relation showing that bullock labour use increase with an increase in farm size for ragi. Whereas for jowar and groundnut the existance of an inverse relationship between farm size and bullock labour used is observed.

In the case of unirrigated farms, groundnut tends to show positive relation while jowar and greengram tends to show inverse relationship between farm size and bullock labour use. That is groundnut under unirrigated conditions consumes a higher bullock labour on the larger holdings. While jowar and greengram consume a higher bullock labour in marginal and small size holdings.

High yielding variety (HYV) seeds, fertilizers and modern machinary are used on irrigated and unirrigated farms. In irrigated farms ,greengram tends to show an inverse relation between farm size and HYV seeds used . None of the other crops show any definite relationship. In unirrigated farms, paddy and bajra tends to show an inverse relationship while maize shows a positive relationship between farm size and HYV seeds use

In the case of irrigated farms, highest number of machine labour hours is used for paddy (40.62 labour hours/hectare) followed by ragi (40.62 labour hours/hectare) and groundnut. The use is lower for blackgram and greengram .

In unirrigated farms, machine labour used is higher for groundnut (2.56 labour hours/hectare) and redgram (.96 labour hours/hectare). On irrigated farms, greengram tends to show an inverse relation upto medium holdings. The overall use of machine labour shows a positive relationship between farm size and machine labour use. Groundnut, under irrigated farms tends to show an inverse relationship whereas under unirrigated farms, a positive relationship is observed.

Regarding fertilizers a higher use is under irrigated farms of sugarcane (319 kg), paddy (294 kg) cotton (273 kg). Fertilizer use is lower for blackgram (24 kg) and greengram (31 kg). In the case of unirrigated farms, fertilizer consumption is highest for paddy (306 kg), followed by cotton (179 kg) and maize (119 kg). Fertilizer use is lower for redgram (48 kg) and groundnut (57 kg).

Comparing the irrigated and unirrigated farms, consumption of fertilizer under irrigated farms is more than unirrigated farms for jowar, maize, groundnut and cotton. But the consumption of fertilizers is less in irrigated farms than in the unirrigated farms of paddy and blackgram. In case of irrigated farms, paddy, maize and groundnut tends to an inverse relationship and greengram tends to show a positive relationship between farm size and fertilizer use. Under unirrigated farms, jowar, maize, redgram, blackgram, groundnut and cotton tended to show an inverse relationship between farm size and fertilizer use.

We now summarise the results on the changes on the use of inputs between 1981-82 to 1996-97.

In all farm situation, the increase in human labour use is found under cotton (5.25%), blackgram (1.28%), ragi (0.19%) and jowar (0.42%). In irrigated farms, except for ragi (0.13%) and maize (.06%), all other crops



registered a decline in human labour hours use. Coming to the unirrigated farms, an increase is observed for cotton (7.88%), blackgram (5.61%) and jowar (.36%). Decline is observed in maize (-4.22%), bajra (-3.16%) greengram (-3.15%), paddy (-1.16%) and ground (-0.77%).

A comparison between irrigated and unirrigated farms shows that human labour hours consumption declined for paddy in both irrigated and unirrigated farms. But the decline is higher in unirrigated farms. Groundnut and cotton also shows a decline in both irrigated and unirrigated farms.

The family labour used in all farms declined for all crops except in groundnut (1.67%), blackgram (3.53%), jowar (0.49%), and ragi (0.28%). In case of irrigated farms, family labour use showed an increase only for ragi (3.6%). For all other crops, family labour consumption declined. Under unirrigated farms, highest percentage increase of family labour occurred for black gram (12.91%) followed by cotton (6.25%), groundnut (1.43%) and jowar (.37%). The highest decline is for bajra (5.96%) followed by maize (-4.46%), greengram (-4.03%) and paddy (-1.58%).

For paddy, the relative decline in family labour is more under unirrigated farms than irrigated farms. While for groundnut and cotton, family labour hours use declined under irrigated farms. Under unirrigated farms, the same crops showed an increase.

There is an increase in casual labour hours for paddy (0.15%), ragi (0.28%), jowar (0.61%), blackgram (0.40%) and in rest of the crops, use of casuals labour declined. In the case of unirrigated farms, the highest increase is for cotton (15.63%) followed by blackgram (30.63%), bajra (3.20%) and jowar (.79%). Highest decline is registered for maize (-3.28%), greengram (-1.84%), groundnut (-1.27%) and paddy (-1.02%).

A Comparison between the irrigated and unirrigated farms showed that, for paddy, the decline in casual labour is more under unirrigated farms than in irrigated. While for groundnut, the decline is more under irrigated than under unirrigated farms. And for cotton, casual labour hours use declined under irrigated farms and increased under unirrigated farms.

In irrigated farms, all types of human labour hour used (human, family, casual) declined for paddy, groundnut, cotton and sugarcane. While for ragi, human labour and family labour hour increased, whereas casual labour declined. In case of unirrigated farms, use of all the three types of labour declined for paddy, maize and greengram and increased for jowar, blackgram, and cotton. For bajra, human and family labour declined whereas casual labour hours increased. Human and casual labour hour used declined and family labour increased for groundnut.

Coming to the bullock labour use, in the case of all the crops, a decline is observed both irrigated and unirrigated farms. This is the same for all crops. Comparison of the irrigated and unirrigated farms indicated that the decline under irrigated farms is more than unirrigated farms for groundnut only. For paddy and cotton, the decline is higher in the later.

The consumption of fertilizers increased for all the crops in all farm situations. And for both irrigated and unirrigated farms, increase is more in unirrigated than in irrigated farms for paddy and groundnut.

### **YIELD RATES, GROSS INCOME AND NET INCOME LEVELS:**

We begin with the variations in yield rates. A comparison between the irrigated and unirrigated farms indicated that, paddy, blackgram, groundnut and cotton obtained a high yield on irrigated farms. Whereas in the case of

groundnut higher yields are observed in unirrigated farms. The yield rates are also higher for sugarcane, ragi for irrigated farms. An inverse relationship is found between farm size and yield rates in irrigated farms for paddy. For blackgram the relation tends to be inverse indicating a higher yields in marginal and small farms.

In the unirrigated farms, blackgram, groundnut and cotton showed a positive relationship indicating the fact that yield increases with an increase in size holdings. However under paddy the existence of an inverse relation between yield rate and farms-size is observed showing that yield rates for paddy are higher under marginal and small farms.

After a discussion on yield rates we now discuss about the value of the output obtained in Rupees per hectare .

In all farm situations, the gross income on an average is about Rs 12928 per hectare. Sugarcane (33168 Rs/hect), paddy (21785 Rs/hect) and cotton (Rs 20217/hect), are the crops with a higher gross income.

Coming to the irrigated farms gross income is the highest for sugarcane (Rs 29287/hect), followed by paddy (Rs 21966/hect), cotton (23563Rs/hect), and groundnut (13750 Rs/hect). In the unirrigated farms , paddy obtained a higher gross income (Rs 17901/hect), followed by cotton (Rs 5217/hect), redgram (Rs 14697/hect), and maize (Rs 12111/hect).

The comparison between the irrigated and unirrigated farms shows that a higher gross product is obtained by paddy, jowar, groundnut and cotton in the irrigated farms, while maize, groundnut and blackgram in the unirrigated farms. In the case of irrigated farms, the size productivity relationship is clearly negative in the case of paddy , which proves that marginal and small farms gets higher gross incomes than the large farms. A positive relationship is also

observed between farm size and productivity in the case of blackgram and groundnut. While for cotton the relationship is size-neutral.

In the case of unirrigated farms, a definite inverse relationship is found for maize and blackgram. While groundnut and cotton tends to show a positive relationship.

Comparison of irrigated and unirrigated farms shows that blackgram which tends to show a positive relation in irrigated farms but a definite inverse relation in unirrigated farms. Provision of irrigation on small farms yield a higher gross income per hectare in the case of blackgram.

We now discuss net incomes based on three concepts of costs. To begin with A2 incomes, in all farm situations the incomes obtained from A2 costs is higher for sugarcane (18453 Rs/hectare), followed by paddy (8721Rs/hectare), and cotton (6133 Rs/hectare). Only jowar obtained net negative incomes based on A2 costs. Sugarcane (14572 Rs/hectare) also obtained a higher incomes followed by paddy (9707Rs/hectare) and cotton (7385 Rs/hectare) in irrigated farms. Jowar and bajra also showed losses on irrigated farms. In the unirrigated farms blackgram obtained a higher incomes of Rupees 7452/hect followed by maize (7323 Rs/hectare), and paddy (6583 Rs/hectare).

The comparison between the irrigated and unirrigated farms reveals that, paddy, groundnut and cotton have a relatively higher A2 incomes. Jowar which obtained losses in the irrigated farms showed gains in the unirrigated farms.

A systematic relationship could not be established for crops in the irrigated farms except for paddy where the relation between A2 incomes and farm size tends to be negative.

In unirrigated farms, an inverse relationship is found only for maize and blackgram signifying higher gains for marginal and small farms for these two

crops. In rest of the crops a systematic relationship between A2 incomes and farm -size is not found..

Coming to the C1 incomes the average incomes for most of the crops are in negatives . However some crops still show positive gains. Higher incomes are obtained for sugarcane (12636), paddy (5074 Rs/hect), and redgram (4797 Rs/hect) in all farms situation. Losses are found for ragi and bajra.

In the irrigated farms the average incomes based on C1 costs are higher for sugarcane (8755 Rs/hect), followed by paddy (5996 Rs/hect), groundnut (1731 Rs/hect), and green gram (835Rs/hect). Besides this negative incomes are obtained by ragi, jowar, bajra and maize.

In unirrigated farms, blackgram obtained a higher incomes of Rupees 4073 per hectare. followed by maize (2992 Rs/hect). greengram (1527Rs/hectare). and redgram (910 Rs/hectare). Losses are observed for paddy, ragi, bajra, jowar, groundnut and cotton .

A comparison between irrigated and unirrigated farms shows some pattern. In the case of paddy, a net gain in incomes is observed in the irrigated farms. While the opposite in the case for paddy grown in unirrigated farms. Maize and redgram obtained losses in the irrigated farms. Only greengram, and blackgram gained positive incomes based on C1 costs in both irrigated and unirrigated farms.

The last is the incomes based on C2 costs. At overall farm level we observed losses being incurred based on C2 costs in all farm situations. Only sugarcane (2689 Rs/hect), cotton (2887Rs/hect), maize (554Rs/hect), and redgram (348Rs/hect), realized net positive returns. Rest of the crops obtained losses.

In irrigated farms all the crops on an average incurred losses. Paddy under marginal and small holdings, jowar under semi-medium holdings, greengram under medium holdings, blackgram under large holdings, cotton under small holdings, and sugarcane under small, medium and large holdings are a few exceptions.

In the unirrigated farms, net positive gains are obtained for maize (2992 Rs/hect), redgram (910 Rs/hect), greengram (1527 Rs/hect), and blackgram (4073 Rs/hect).

In both irrigated and unirrigated farms losses are incurred by paddy, groundnut and cotton. The losses for paddy and cotton are more in the unirrigated farms (-3436 Rs/hect & -3231Rs/hect respectively) than in the irrigated farms (-679 Rs/hect & -2239 Rs/hect respectively). In the case of groundnut losses are more in the irrigated farms.(-2542 Rs/hect ) than in the unirrigated farms (-1835 Rs/hect). Similarly for greengram and blackgram income based on C2 costs incurred losses in irrigated farms than in unirrigated farms.

To put in brief in irrigated farms, for paddy, greengram, blackgram, redgram, groundnut, cotton and sugarcane registered gains from both A2 & C1 incomes. For the same crops incomes derived from C2 costs incurred losses. Jowar, bajra incurred losses from A2.C1.C2 costs. The losses being the highest for incomes based on C2 costs followed by incomes based on A2 and C1 costs. Ragi, maize and redgram incurred gains in incomes based on A2 costs. While they incurred losses in incomes based on C2 costs. Losses in incomes based on C2 costs is more than C1 costs.

Under the unirrigated farms, for paddy, jowar, bajra, cotton and groundnut, incomes obtained based on A2 costs registered gains. While for the same crops, losses are obtained for the incomes based on C1 and C2 costs.

Ragi registered losses in incomes based on A2,C1 and C2 costs. But the losses obtained from incomes based on C2 is less than that of C1. Maize, redgram, greengram and blackgram obtained net positive incomes based on A2.C1.C2 costs. Gains in incomes base on C1 and C2 costs being equal are less than gains in incomes based on A2 costs.

We now study the changes in, gross income and net returns. In the case of yield rates the growth rate in all farm situation indicates a highest increase for blackgram (27.80%) followed by redgram (7.96%) and jowar (5.08%) for sugar cane . In the case of ragi, the yield declined.

After seeing the changes in, we now summarise the changes in the gross productivity in all farms , irrigated farms and unirrigated farms . It may be noted that changes in the nominal form without price adjustments. This is the limitation, which need to be mentioned.

The productivity in all farms, increased by 3.56 between 1981-82 to 1996-97. The highest increase is seen in case of jowar (54.92%) followed by cotton (28.63%), bajra (21.83%) and paddy (20.50%) . In the rest of the crops, the increase is below 6% . Only ragi registered a decline in the productivity .

In the irrigated farms, the productivity at overall level increased by 6.67% . The highest increase in productivity is in paddy (20.28%) , followed by cotton (13.68%), maize (912.66%), jowar ( 9.29%) groundnut (13.68%) and sugarcane (1.18% ) . Even in irrigated farms, ragi registered a decline in productivity.

Coming to the unirrigated farms, productivity at aggregate level increased by 2.41%. The highest increase is registered for cotton (86.92%) followed by jowar (62.89%), black gram (51.85%) and bajra (25.06%) . There is a decline in ragi (-6.55%) and redgram (-2.74%) .

The changes in incomes based on A-2 costs during 1981-82 to 1996-97, shows the following trends.

In all farms situation, number of crops shows increase. However, across crops the incomes from A-2 increased. The highest increase is for cotton (17.95%) followed by paddy (17.20%) and bajra (16.28%). In rest of the crops, the increase is less than 9.1%. Few crops like ragi (-6.51%) , maize (-1.79%) and redgram (-4.60%) registered a decline .

In irrigated farms, the incomes based on A-2 costs increased by 0.51%. The highest increase is recorded for greengram (64.95%) folowed by for cotton. For other crops, the incomes generally declined with the highest of – 27.42% for paddy to the lowest decline of –0.88% for groundnut.

In unirrigated farms, the incomes based on A-2 costs declined by – 1.78%. The increase, was registered highest is for bajra (230%), jowar (1.77%), cotton (79.65%) and blackgram (54.59%). Paddy (-2.80%) and redgram (-4.33%) exhibit a decline in incomes.

### **Farm -Size-Relationships**

Finally with regard to the farm-size relationships, only few crops showed a definite evidence of either a positive or a negative relationship. A positive relationship has been found between irrigation level and farm size for ragi which reveals that as the farm-size increases the irrigation levels also increases which has been already found in other studies. For crops like paddy and sugarcane irrigation levels has been constant across the farm-size holdings. Regarding the cropping pattern none of the crops tended to show a definite relation between farm size and percentage of cropped area, though a few crops showed the near existence of farm size relationships.



Some definite relationships is also found between farm size and the inputs use for some crops. Irrigated cotton showed an inverse relationship between farm size and human labour use signifying the that as farm size increases the human labour use declines. But paddy and blackgram showed tended to show a positive relationship between farm size and human labour use under irrigated conditions the large farms showing more use of human labour . An inverse relationship is observed between the family labour use and farm size in almost all the crops signifying high use of family labour in small farms. This inverse relationship has been established for paddy, blackgram and groundnut in irrigated farms. In the unirrigated farms paddy tended to show a positive relationship between farm size and family labour use. While jowar, redgram, groundnut tend to show an inverse relationship signifying that fact in unirrigated conditions these crops use a greater amount of family labour in marginal and small farms. Coming to the use of bullock labour an inverse relationship is observed for irrigated groundnut only. Regarding the use of fertilizers irrigated paddy showed an inverse relationship between farm size and fertilizers use revealing more use by marginal and small farmers. But this relationship is not found in other crops as such. A positive relationship has be found in the case of greengram showing that large farms use a higher amounts of fertilizers.

Certain relationships are found for yield rates, productivity, and incomes based on A2 costs. Under irrigated farms paddy and blackgram we found higher yields in the marginal and small farms indicating an inverse relationship between farm size and yield rates. Crops like groundnut and cotton has a higher yields in large farms. A distinction is found for irrigated and unirrigated blackgram in size and yield rate relationships. Under irrigated conditions blackgram yields better in small farms and under unirrigated conditions blackgram performs better in large farms. Similarly irrigated paddy obtained better gross productivity in marginal and small farms. Blackgram, greengram

and groundnut obtained a higher productivity in large size farms. While blackgram in unirrigated farms obtained a higher productivity in small farms. A2 incomes in the case of irrigated paddy received greater incomes in small holdings.

The use of traditional inputs like human labour and bullock labour is found to be higher under irrigated farms than in the unirrigated farms. Irrigated farms also dominated in the use of machine labour use. The gross incomes and the net incomes are also higher under irrigated farms. These shows that irrigated farms comparatively placed at a more advantageous position than in the unirrigated farms.

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TABLE NO:1  
CHANGES IN THE IRRIGATED AREA (1981-82 TO 1996-97)

*in Percentages*

CROPS	MARGINAL	SMALL	SEMI- MEDIUM	MEDIUM	LARGE	ALL
	<UPTO 1	BET 1-2	BET 2-4	BET 4-6	ABOVE 6	
PADDY	-0.08	-0.31	0.05	1.94	0.22	7.15
RAGI	-1.83	-0.78	5.32	13.57	6.35	120.03
JOWAR	n.a	-0.01	n.a	n.a	21.64	56.67
BAJRA	3.89	n.a	-6.67	20.4	n.a	22.62
MAIZE	29.56	36.1	n.a	n.a	20.34	n.a
GROUNDNUT	20.28	15.5	1.88	28.25	30.87	10.11
COTTON	2.36	3.28	-3.24	18.66	32.34	-1.34
SUGARCANE	0.11	n.a	n.a	4.46	n.a	n.a
TOTAL	3.95	-1.23	3.26	15.24	7.6	2.19

source: computed By The Data Based On Report Of The Cost Of Cultivation Of Principal Crops In Andhra Pradesh, Vol: no: 2 & 8, 1981-82 & 1996-97, Directorate Of Economics And Statistics. Ministry Of Agriculture

TABLE NO:2  
CHANGES IN THE GROSS CROPPED AREA IN ALL FARMS(1981-82 TO 1996-97)

CROPS	In percentages					TOTAL
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	
PADDY	4.09	-0.62	1.37	2.64	2.48	2.05
RAGI	-4.32	-1.56	-3.36	-2.97	-5.48	-4.42
JOWAR	-4.5	-4.78	-5.58	-4.29	-3.96	-4.45
BAJRA	-6.33	-0.16	-6.43	-1.86	-6.67	-5.78
MAIZE	1.47	-2.21	59.5	13.07	18.12	14.46
REDGRAM	n a	44.73	16.97	46.56	17.14	25.12
GREENGRAM	-1.83	1.9	4.93	-1.71	0.91	0.33
BLACKGRAM	25.23	26.38	17.63	13.16	44.39	24.53
GROUNDNUT	-0.83	1.5	0.01	-2.57	-1.69	-1.24
COTTON	-0.13	4.56	1.96	-0.63	1.62	0.95
SUGARCANE	-5.56	-4.34	-0.2	-2.81	-0.26	-1.69

Source: *ibid.*

TABLE NO:3  
 CHANGES IN THE GROSS CROPPED AREA IN IRRIGATED FARMS(1981-82 TO 1996-97)

CROPS	in percentages					
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	ALL
PADDY	-3.66	-1.65	-1	-3.17	-2.19	-2.23
RAGI	-6.36	-2.48	-3.01	-1.48	-5.55	-4.5
JOWAR	n.a	-5.35	n.a	24.01	-1.5	3.05
BAJRA	-6.5	n.a	-6.67	n.a	n.a	-0.32
MAIZE	6.17	18.8	n.a	40.21	39.32	46.12
GREENGRAM	n.a	42.1	n.a	69.92	n.a	153.12
GROUNDNUT	-0.48	15.34	-1.18	2.19	6.44	3.14
COTTON	-3.84	9.86	-3.44	2.24	18.37	3.93
SUGARCANE	-6.34	-4.58	-2.12	-5.28	-3.64	-4.17

Source: ibid.

TABLE NO:4  
 CHANGES IN THE GROSS CROPPED AREA IN UNIRRIGATED FARMS(1981-82 TO 1996-97)

CROPS	in Percentages					
	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	7.63	13.1	5.5	-6.67	6.59	4.54
RAGI	-6.67	7.0	-6.67	-6.67	-6.67	-5.24
JOWAR	-1.84	-5.01	-5.4	-1.74	-2.53	-3.29
BAJRA	-6.67	-6.62	-6.04	-1.2	-6.67	-5.67
MAIZE	-4.4	-6.67	18.58	7.6	-2.89	0.48
REDGRAM	n.a	75.86	38.3	66.01	36.65	46.99
GREENGRAM	-2.89	-2.49	0.27	-3.95	-1.85	-2.37
BLACKGRAM	-2.16	1.49	-0.39	-4.88	14.29	2.32
GROUNDNUT	-2.43	0.94	2.15	-0.78	0.06	0.33
COTTON	2.96	9.96	26.59	1.07	-0.14	3.32

Source: Ibid.

TABLE NO:5

## CHANGES IN THE USE OF HUMAN LABOUR BETWEEN 1981-82 TO 1996-97

CROPS	ALL FARMS						ALL
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	in percentages	
PADDY	-1.24	-1.09	-0.67	-1.05	-0.50	-0.93	
RAGI	-0.65	-1.88	-0.27	2.90	2.12	0.19	
JOWAR	1.47	1.92	0.08	0.10	-1.44	0.42	
BAJRA	-3.37	-2.35	-2.36	4.21	-6.67	-2.40	
MAIZE	-3.94	-1.39	-3.51	-2.72	-1.37	-2.85	
REDGRAM		0.44	-4.25	-0.09	-0.79	-0.80	
GREENGRAM	-2.54	-3.01	-2.22	-4.05	-2.36	-2.83	
BLACKGRAM	3.20	2.71	-0.15	-0.24	1.10	1.28	
GROUNDNUT	-1.18	0.46	0.30	-0.76	-1.55	-0.61	
COTTON	0.07	3.82	39.04	9.47	9.90	5.25	
SUGARCANE	-2.06	-2.41	-3.49	-2.03	-3.77	-2.80	
ALL	-1.32	-1.18	-1.99	-0.49	-1.61	-1.34	

source: Ibid.

TABLE NO:6

## CHANGES IN THE USE OF HUMAN LABOUR BETWEEN 1981-82 TO 1996-97

## IRRIGATED FARMS

in percentages

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-1.24	-1.06	-0.77	-1.16	-0.65	-0.99
RAGI	0.47	-1.55	-1.25	1.04	4.21	0.13
JOWAR	n.a	-1.94	n.a	-1.52	-1.58	-0.54
MAIZE	-3.43	-0.02	n.a	0.96	0.75	0.06
GROUNDNUT	-1.91	-0.90	-0.43	-1.85	-3.23	-1.80
COTTON	-1.96	-1.64	-3.07	2.41	3.73	-1.25
SUGARCANE	-2.06	-2.41	-3.49	-6.66	-3.77	-6.65
ALL	-1.14	-0.94	-1.80	-6.65	-0.61	-6.58

Source: ibid.

TABLE NO :7

## CHANGES IN THE USE OF HUMAN LABOUR BETWEEN 1981-82 TO 1996-97

## UNIRRIGATED FARMS

*In Percentages*

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-1.78	-1.89	2.31	-6.67	2.34	-1.16
RAGI	-6.67		-6.67	-6.67	-6.67	-5.58
JOWAR	1.47	2.42	0.36	-0.69	-1.62	0.36
BAJRA	-6.67	-3.43	-1.64	3.06	-6.67	-3.16
MAIZE	-4.83	-6.67	-4.51	-4.07	0.20	-4.22
REDGRAM		0.44	-4.25	0.00	-1.11	-0.89
GREENGRAM	-2.49	-3.25	-1.89	-4.50	-3.90	-3.15
BLACKGRAM	14.48	2.42	4.18	4.48	1.40	5.61
GROUNDNUT	-1.91	-0.28	0.53	-0.19	-1.73	-0.77
COTTON	5.28	21.70	1.70	12.66	9.16	7.88
ALL	-2.20	-0.43	-2.31	-2.41	-1.72	-1.89

TABEL NO:8

## CHANGES IN THE USE OF FAMILY LABOUR BETWEEN 1981-82 TO 1996/97

## ALL FARMS

in percentages

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-1.09	-1.35	-1.20	-0.81	0.54	-0.97
RAGI	-1.74	1.81	1.21	-1.11	2.71	0.28
JOWAR	0.20	1.12	-1.02	2.42	0.90	0.49
BAJRA	-3.46	-3.56	-5.72	1.52	-6.67	-3.69
MAIZE	-4.70	-2.55	-3.42	-4.57	-2.68	-3.96
REDGRAM	n.a	4.09	-3.34	1.07	-1.07	1.26
GREENGRAM	-3.92	-3.62	-4.05	-4.82	-2.98	-3.91
BLACKGRAM	11.37	7.61	-1.59	2.25	3.77	3.53
GROUNDNUT	0.52	3.29	2.93	2.81	-1.36	1.67
COTTON	-0.72	2.62	-2.65	3.72	2.32	0.00
SUGARCANE	-0.69	-4.77	-3.45	0.90	-5.73	-2.67
ALL	-1.40	-1.35	-2.44	-0.48	-2.33	-1.62

source:ibid.



TABLE NO:9

## CHANGES IN THE USE OF FAMILY LABOUR BETWEEN 1981-82 TO 1996/97

## IRRIGATED FARMS

in percentages

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-1.10	-1.36	-1.12	-0.89	0.23	-1.00
RAGI	12.60	2.43	1.73	-0.44	18.46	3.60
JOWAR	n.a	-3.93	n.a	n.a	-1.56	5.07
BAJRA	-3.98	n.a	-6.67	n.a	n.a	6.91
MAIZE	-3.90	-3.46	n.a	-3.63	-1.20	-2.66
GROUNDNUT	-1.90	1.67	1.24	7.47	-3.47	-0.16
COTTON	-3.03	-2.30	-3.22	0.54	-2.52	-2.61
SUGARCANE	-0.69	-4.77	-3.45	0.90	-5.73	-2.67
ALL	-0.66	-0.70	-0.93	2.19	-0.85	-0.33

source: ibid.

TABEL NO :10

## CHANGES IN THE USE OF FAMILY LABOUR BETWEEN 1981-82 TO 1996/97

## UNIRRIGATED FARMS

in percentages

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-2.89	-0.86	-2.29	-6.67	7.59	-1.58
RAGI	-6.67	n.a	-6.67	-6.67	-6.67	-5.68
JOWAR	0.20	1.71	-0.71	-0.01	1.50	0.37
BAJRA	-6.67	-6.18	-5.81	-1.63	-6.67	-5.69
MAIZE	10.93	-6.67	-4.33	-5.77	-6.59	-4.46
REDGRAM	n.a	4.08	-3.34	1.26	-1.28	1.32
GREENGRAM	-3.65	-4.57	-3.38	-5.61	-2.91	-4.03
BLACKGRAM	29.98	8.24	4.99	15.59	14.60	12.91
GROUNDNUT	1.37	1.40	3.89	0.56	-1.24	1.43
COTTON	10.86	18.92	-0.60	5.51	5.68	6.25
ALL	-0.98	-0.86	-3.24	-3.51	-2.68	-2.29

source: ibid.

TABLE NO:11

## CHANGES IN THE CASUAL LABOUR BETWEEN 1981-82 TO 1996-97

## ALL FARMS

in percentages

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	TOTAL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	2.70	-0.84	-0.02	-0.95	-0.32	0.15
RAGI	0.76	-3.66	-0.29	7.19	2.44	0.28
JOWAR	3.33	2.27	1.16	-0.98	-1.80	0.61
BAJRA	-3.17	6.25	2.18	8.86	-6.67	0.52
MAIZE	-1.80	0.21	-3.47	-2.28	-1.00	-1.84
REDGRAM	n.a	-2.51	-5.17	-1.36	-0.01	-2.56
GREENGRAM	0.98	-1.88	0.11	-2.84	-1.13	-1.06
BLACKGRAM	-0.77	-0.30	1.19	1.12	1.31	0.40
GROUNDNUT	-2.52	-0.86	-0.26	-1.27	-1.62	-1.33
COTTON	0.46	4.11	-2.06	14.32	24.43	2.99
SUGARCANE	-3.17	-0.66	-3.36	-2.77	-2.68	-2.52
TOTAL	-0.71	-0.81	-2.13	-0.36	-0.83	-1.02

source:ibid.

TABLE NO:12

## CHANGES IN THE CASUAL LABOUR BETWEEN 1981-82 TO 1996-97

## IRRIGATED FARMS

*in Percentages*

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-1.37	-0.42	-0.21	-1.06	-0.46	-0.72
RAGI	-4.14	-3.46	-2.25	0.57	1.42	-2.18
JOWAR	n.a	-3.55	n.a	-0.09	-3.15	-1.53
BAJRA	-4.10	n.a	-6.67	n.a	n.a	-4.28
MAIZE	-2.77	7.79	n.a	5.14	5.66	3.61
GROUNDNUT	-2.13	-2.15	-0.63	-2.95	-3.47	-2.46
COTTON	-1.38	-1.57	-3.14	4.10	10.78	-0.67
SUGARCANE	-3.17	-0.66	-3.36	-2.77	-2.68	-2.52
ALL	-2.13	-1.11	-2.10	-0.79	-0.34	-1.35

source: ibid.

TABLE NO:13

## CHANGES IN THE CASUAL LABOUR BETWEEN 1981-82 TO 1996-97

## UNIRRIGATED FARMS

*in percentages*

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	TOTAL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-1.26	-2.51	10.98	-6.67	0.73	-1.02
RAGI	-6.67	n a	-6.67	-6.67	-6.67	-5.21
JOWAR	3.33	3.92	1.15	-1.39	-1.54	0.79
BAJRA	-6.67	16.12	10.57	7.79	-6.67	3.20
MAIZE	-4.48	-6.67	-4.64	-3.81	3.90	-3.28
REDGRAM	n.a	-2.51	-5.17	-1.50	-0.39	-2.73
GREENGRAM	0.47	-1.98	0.03	-3.32	-3.88	-1.84
BLACKGRAM	9.26	0.60	3.66	3.65	-0.73	3.63
GROUNDNUT	-3.54	-1.05	-0.29	0.20	-1.50	-1.27
COTTON	1.42	32.25	18.65	19.97	20.99	15.63
TOTAL	-1.50	0.10	-0.91	-1.80	-0.75	-0.99

source: *ibid.*

TABLE NO:14

## CHANGES IN THE USE OF BULLOCK LABOUR BETWEEN 1981-82 TO 1996-97

CROPS	ALL FARMS						ALL
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	in percnatges	
PADDY	-4.41	-4.46	-3.87	-3.84	-3.89	-4.13	
RAGI	-5.47	-4.26	-3.84	-3.55	-2.97	-4.15	
JOWAR	0.55	-1.74	-1.58	68.00	-1.39	-0.11	
BAJRA	-6.67	-6.45	-6.44	-1.92	-6.67	-5.67	
MAIZE	-3.74	-2.29	-4.43	-4.05	-3.07	-3.57	
REDGRAM	n.a	-4.42	-5.78	-4.44	-3.32	-4.61	
GREENGRAM	-4.17	15.44	-3.89	-4.69	-4.91	-3.66	
BLACKGRAM	0.50	-5.57	-1.37	5.65	13.28	-1.74	
GROUNDNUT	-4.40	-3.50	-3.09	-3.69	-3.57	-3.70	
COTTON	2.36	0.87	-3.48	-2.27	-1.69	-1.42	
SUGARCANE	-5.47	-6.65	-6.17	-6.03	-5.76	-6.02	
TOTAL	-3.89	-4.22	-4.66	-3.56	-3.89	-4.09	

source: ibid.

TABLE NO:15

CHANGES IN THE USE OF BULLOCK LABOUR BETWEEN 1981-82 TO 1996-97  
IRRIGATED FARMS

in percenatages

CROPS	MARGINAL	SMALL	SEMI-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-4.42	-4.04	-3.86	-3.86	-3.99	-4.04
RAGI	-4.46	-4.79	-3.17	-2.55	0.18	-3.40
JOWAR	n.a	10.30	n.a	-5.42	2.19	-0.27
MAIZE	-4.60	-4.35	n.a	-4.83	-2.69	-3.96
GROUNDNUT	-5.12	-3.55	-3.16	-3.61	-6.35	-4.51
COTTON	2.55	4.77	-3.18	-1.85	-1.14	-0.48
SUGARCANE	-5.47	n.a	-6.17	-6.03	-4.36	-5.69
ALL	-3.98	-1.93	-2.80	-3.55	-1.60	-2.97

source: ibid.

TABLE NO:16

## CHANGES IN THE USE OF BULLOCK LABOUR BETWEEN 1981-82 TO 1996-97

CROPS	UNIRRIGATED FARMS						ALL
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6		
PADDY	-4.16	-4.88	-4.09	-6.67	-1.55	-4.19	
RAGI	-6.67	n.a	-6.67	-6.67	-6.67	-5.50	
JOWAR	0.53	-2.67	-2.00	-2.10	-2.04	-1.64	
BAJRA	-6.67	-6.53	-6.45	-2.23	-6.67	-5.83	
MAIZE	-3.10	-6.67	-4.57	-3.79	-3.87	-4.25	
REDGRAM	n.a	-5.14	-5.78	-4.55	-4.14	-4.88	
GREENGRAM	-3.71	-4.73	-4.15	-4.21	-6.11	-4.50	
BLACKGRAM	1.13	-1.92	-6.67	-6.67	-6.67	-3.70	
GROUNDNUT	-4.30	-4.23	-3.07	-3.90	-2.63	-3.70	
COTTON	-0.92	-3.55	-2.88	-1.85	-4.87	-2.88	
ALL	-3.85	-4.22	-5.00	-4.33	-4.44	-4.41	

Source: *ibid.*



TABLE NO:17

## CHANGES IN THE USE OF FERTILIZERS BETWEEN 1981-82 TO 1996-97

CROPS	ALL FARMS					in percenatges
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	ALL
PADDY	22.25	9.56	12.07	7.00	3.28	10.52
RAGI	10.03	12.80	49.57	26.37	15.93	21.36
JOWAR	48.99	233.11	71.16	107.42	14.00	60.88
BAJRA	n a	n a	48.03	137.04	-6.67	110.75
MAIZE	9.21	21.67	1.40	11.07	4.37	7.66
GROUNDNUT	16.21	8.12	n.a	16.98	14.00	8.23
COTTON	10.73	6.66	8.72	11.06	30.44	11.09
SUGARCANE	26.15	4.67	-1.98	-0.72	-2.64	3.86
ALL	20.46	14.19	7.65	10.52	5.03	11.44

Source: ibid.

TABEL NO:18

CHANGES IN THE USE OF FERTILIZERS BETWEEN 1981-82 TO 1996-97  
IRRIGATED FARMS

in percents

CROPS	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	ALL
PADDY	21.58	9.30	10.61	6.55	2.41	9.70
RAGI	n.a	13.05	37.72	2.44	11.28	15.32
MAIZE	4.45	29.43	n.a	6.48	7.80	12.04
GROUNDNUT	5.25	5.70	0.99	18.49	5.47	5.63
COTTON	2.23	-1.75	4.46	-0.81	23.84	1.99
SUGARCANE	26.15	4.67	-1.98	-0.72	-2.64	3.86
ALL	14.07	9.76	5.93	7.57	6.01	8.74

Source: ibid.

TABLE NO.19

## CHANGES IN THE USE OF FERTILIZERS BETWEEN 1981-82 TO 1996-97

CROPS	UNIRRIGATED FARMS					in percenatges
	MARGINAL <one hect	SMALL 1-2 hect	SEMI-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	ALL
PADDY	44.23	40.61	206.48	-6.67	53.64	52.51
RAGI	-6.67	n.a	-6.67	-6.67	-6.67	3.82
JOWAR	48.99	170.01	76.01	55.09	12.78	53.43
BAJRA	n.a	n.a	n.a	45.73	-6.67	223.52
MAIZE	12.54	-6.67	1.26	9.54	-1.30	3.05
GROUNDNUT	30.16	2.65	14.87	9.90	10.29	12.92
COTTON	n.a	n.a	26.13	161.46	7.69	69.29
ALL	45.07	48.52	29.51	16.95	8.55	29.78

source: ibid.

TABLE NO.20  
CHNGES IN THE GROSS PRODUCT IN ALL FARMS(1981-82 TO 1996-97)

CROPS	in percentages					
	MARGINAL <one hect	SMALL 1-2 hect	SEM-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	ALL
PADDY	19.43	14.86	17.84	18.61	48.11	20.5
RAGI	-4.01	-4.23	-5.39	-0.39	8.34	-3.55
JOWAR	46.37	51.18	73.99	54.1	49.54	54.92
BAJRA	12.34	26.14	36.03	35.29	-6.67	21.83
MAIZE	-0.13	9.25	10.53	2.37	24.64	5.59
REDGRAM	n a	-1.77	-5.73	1.97	14.71	-2.92
GREENGRAM	3.54	4.1	3.13	3.05	11.65	4.68
BLACKGRAM	23.57	25.79	10.8	6.73	112.53	20.75
GROUNDNUT	5.17	9.42	6.22	16.49	28.74	10.57
COTTON	16.2	35.26	9.83	112.67	85.06	28.63
SUGARCANE	4.78	5.54	0.71	0.88	0.26	2.15
TOTAL	6.56	5.33	-1.64	5.92	12.42	3.56

Source: ibid

TABLE NO:21

CHNGES IN THE GROSS PRODUCT IN IRRIGATED FARMS(1981-82 TO 1996-97)

*in percentages*

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	19.22	14.99	17.34	18.51	46.51	20.28
RAGI	-1.96	-3.84	-5.35	15.08	38.56	-2.5
JOWAR	n a	12.35	n.a	-1.42	53.1	9.29
MAIZE	11.63	4.05	n.a	9.66	12.62	12.66
GROUNDNUT	3.54	3.44	3.92	18.2	14.83	6.55
COTTON	10.12	11.72	4.67	165.6	19.03	13.68
SUGARCANE	0.8	5.54	0.71	0.88	-1.1	1.18
TOTAL	5.67	5.7	2.61	10.39	13.33	6.67

Source:ibid

TABLE NO 22

CHNGES IN THE GROSS PRODUCT IN UNIRRIGATED FARMS(1981-82 TO 1996-97)

*in percentages*

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	12.78	11.94	-2.91	-6.67	64.92	2
RAGI	-6.67	n.a	-6.67	-6.67	-6.67	-6.55
JOWAR	40.88	66.12	73.99	99.59	50.63	62.89
BAJRA	-6.67	38.76	52.24	32.52	-6.67	25.06
MAIZE	2.66	-6.67	13.38	1.63	22.58	4.23
REDGRAM	n.a	-1.77	-5.73	2.32	16.34	-2.74
GREENGRAM	5.2	7.1	3.8	4.49	13.93	6.42
BLACKGRAM	179.09	38.98	12.97	8.05	38.69	51.85
GROUNDNUT	3.14	11.13	7.22	14.48	27.47	10.51
COTTON	157.39	703.24	29.85	50.66	249.9	86.92
TOTAL	9.1	8.64	-3.04	3.9	21.94	2.41

Source:ibid.

TABLE NO.23

CHANGES IN INCOMES BASED ON A2 COSTS IN ALL FARMS(1981-82 TO 1996-97)

CROPS	<i>in percentages</i>					
	MARGINAL <one hect	SMALL 1-2 hect	SEM-MEDIUM 2-4 hect	MEDIUM 4-6 hect	LARGE above 6	ALL
PADDY	17.76	10.51	9.14	13.41	-139.73	17.2
RAGI	-5.46	-24.53	-6.71	-8.7	-8.94	-6.51
JOWAR	52.38	880	212.13	85	-920.34	-220.81
BAJRA	20.2	-37.32	75.43	n.a	-6.67	16.28
MAIZE	-3.31	-2.42	9.75	-5.07	32.58	-1.79
REDGRAM	n.a	-3.58	-6.01	-0.98	-2.95	-4.6
GREENGRAM	0.49	1.45	-3.13	0.43	7.85	0.9
BLACKGRAM	22.45	19.26	4.99	-22.4	-389.47	8.96
GROUNDNUT	-0.83	6.04	-0.57	9.24	58.44	4.25
COTTON	5.07	28.3	2.23	-146.4	100.21	17.95
SUGARCANE	5.05	3.16	-3.11	0.15	-0.34	0.62
TOTAL	4.28	0.57	-4.48	-0.83	4.23	-2.08

Source: ibid

TABLE NO:24

CHANGES IN INCOMES BASED ON A2 COSTS IN IRRIGATED FARMS(1981-82 TO 1996-97)

*in percentages*

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	20.11	12.3	11.15	14.14	-8.71	-27.42
RAGI	-4.19	-5.61	-6.83	-43.24	34.98	-6.51
BAJRA	18.43	n.a	-6.67	n.a	n.a	-18.55
MAIZE	20.85	-4.69	n.a	-5.68	-1.18	-0.65
GREENGRAM	n.a	6.61	n.a	64.15	n.a	64.95
GROUNDNUT	n.a	-0.57	-21.89	11.3	10.99	-0.96
COTTON	2.05	11.39	-0.17	-27.92	1.08	7.71
SUGARCANE	-1.08	3.16	-3.11	0.15	-2.68	-0.88
TOTAL	0.66	9.78	-2.75	-20.36	0.63	0.51

Source:ibid.



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TABLE NO:25

CHANGES IN INCOMES BASED ON A2 COSTS IN UNIRRIGATED FARMS(1981-82 TO 1996-97)

UNIRRIGATED

in percentages

CROPS	MARGINAL	SMALL	SEM-MEDIUM	MEDIUM	LARGE	ALL
	<one hect	1-2 hect	2-4 hect	4-6 hect	above 6	
PADDY	-10.61	11.44	-4.68	-6.67	-174.44	-2.8
JOWAR	36.39	111.5	199.56	-311.96	587.78	177.47
BAJRA	-6.67	261.61	878.97	1084.07	-6.67	230.15
MAIZE	3.33	6.67	25.78	-1.18	1443.77	3.84
REDGRAM	n.a	-3.58	-6.01	-0.56	-2.32	-4.43
GREENGRAM	3.11	5.14	-1.86	4.07	15.01	4.41
BLACKGRAM	250.91	42.48	6.28	-9.02	-5.79	54.49
GROUNDNUT	-4.72	6.42	-0.35	3.22	18.4	1.27
COTTON	164.5	-58.28	11.15	-18.16	-118.16	79.65
TOTAL	5.15	2.39	-4.79	7.38	14.12	-1.78

Source:ibid.

132

