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Economic Analysis Of Rainfed Agriculture In Prakasam District Of Andhra Pradesh

[1] **Dr.Karri Kishore Babu**

[1]Faculty, Department of Economics, Acharya Nagarjuna University

ABSTRACT

Andhra Pradesh, the granary of India, has played a historic role in transforming India from a nation that was food deficient to one that is self-sufficient. The turnaround was so dramatic and achieved in a very short time that it was called a revolution, the Green Revolution. It is highly skewed in favour of certain regions and states. The Andhra Pradesh state with only 4.96 per cent of geographical area of the country has been contributing major proportions to national food reserves for the last few decades. Since the 2014s, however the colour has been fading. After attaining an exemplary growth in agriculture in Andhra Pradesh has reached the crossroads from where sustaining growth appears to be an arduous task. Many observers on agricultural issues in Andhra Pradesh paint a picture of decay and degradation of agriculture. Most of the experts have expressed persistent concerns and focused on the margin of profit from major crops and farm income. The agrarian economy of Andhra Pradesh today stands at crossroads. The majority (nearly 80%) of the cultivators and all the agricultural labourers are beleaguered by stagnation. A majority of small and marginal farmers have already been pushed below the poverty line.

Keywords: Economic Analysis ,Rainfed Agriculture ,Prakasam District

1. INTRODUCTION

Andhra Pradesh, the granary of India, has played a historic role in transforming India from a nation that was food deficient to one that is self-sufficient. The turnaround was so dramatic and achieved in a very short time that it was called a revolution, the Green Revolution. It is highly skewed in favour of certain regions and states. The Andhra Pradesh state with only 4.96 per cent of geographical area of the country has been contributing major proportions to national food reserves for the last few decades. Since the 2014s, however the colour has been fading. After attaining an exemplary growth in agriculture in Andhra Pradesh has reached the crossroads from where sustaining growth appears to be an arduous task. Many observers on agricultural issues in Andhra Pradesh paint a picture of decay and degradation of agriculture. Most of the experts have expressed persistent concerns and focused on the margin of profit from major crops and farm income. The agrarian economy of Andhra Pradesh today stands at crossroads. The majority (nearly 80%) of the cultivators and all the agricultural labourers are beleaguered by stagnation. A majority of small and marginal farmers have already been pushed below the poverty line.

In the state of Andhra Pradesh nearly 60 per cent of the net sown area in the state is under rainfed conditions. The depletion of ground water, degradation of soil health and soil texture, deterioration of ecology and environment in rainfed agriculture are other very serious challenges that agriculture in Andhra Pradesh is facing. The existing cropping pattern and crop-technology in rainfed agriculture offer no solution to these problems. This has led to the source of misery in agriculture, where the only source of income for the people is cultivation. This challenge which rainfed agriculture faces today is also bound to have social effects. In fact, rainfed agriculture in Andhra Pradesh has reached a stage where its viability and sustainability is in doubt.

The Andhra Pradesh farm economy has reached at a stage rendering the fate of large agricultural population in doldrums. There has been growing concern that declining rates of productivity growth due to diminishing growth in yields of the major crops, and degradation of the water and land resource base. Owing to sheer stagnation in yield, the per hectare return on land for major crops continues to decline. The per annum trend growth rate of return from major crops, over variable cost had declined during 1990's.This has further aggravated the problems of Andhra Pradesh agriculture and farmers, in particular of rainfed agriculture and that of Andhra Pradesh economy in general.

The growth of agriculture depends to a large extent on the potential of rainfed agriculture in the Prakasam district, which has not been harnessed effectively so far. This characteristic among others has resulted in grave economic fallouts for the farmers leading them to suicides among them. The economic and social problems relate to rainfed agriculture are numerous, but it appears that the greatest concerns today are the issues of declining livelihood conditions, which manifest into various forms and with varied and complex results leading to social implications also.

In spite of the policies and programmes that are being implemented over the years, the factors and processes underlying the agrarian distress among dry land farmers have found to be unaddressed. Inspite of huge investments in dry land regions agricultural yields are more unstable in rainfed areas than those in the areas where incretion is assured. Hence, incomes of the farmers are unstable in rainfed areas. These areas are characterized by higher poverty than that of irrigated areas. The measures taken by the government have not helped to raise the income of the farmers and not reduced the poverty much.

2.Review of literature

Kiran Kumara, et al. (2021)[71] the present investigation measures economic impact of tanks restoration on productivity and income of 240 farm households in rainfed region of India. The detailed information was collected with designed questionnaire for the period 2017–18 from farm households using tank irrigation in two districts in the state of Andhra Pradesh. Propensity score matching technique was employed to assess the impact of tank rehabilitation. Findings revealed that restoration of tanks leads to an improvement in production and livelihood of tank water users in the study area. Yield and income of rice crop is increased by a magnitude of 0.54–0.62 tonne/ha and Rs.6045/ha to Rs.8278/ha respectively. Study suggests that to achieve food security and to mitigate the scarcity of water, restoration of tanks is inevitable for rainfed regions. Further, recasting such protocols and replicating similar models to other regions not only enhance the sustainable agricultural production but also improve livelihoods of millions of small and marginal farmers in the country.

Review of Literature

Reddy PVRM et.al., (2021) in their paper titled " Multiple Impact of NationalWatershed Project in Low Rainfall Region: A Case Study from Prakasam District, Andhra Pradesh" Vaggampalli Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) watershed project was implemented from 2011-2018 with treatable area of 4644 hectares covering four micro watersheds. This paper discuss the impact of watershed interventions on bio-physical, hydrological, agricultural and socio-economic indicators. Changes were detected in land use for agriculture crops, water body coverage and area under very good soil moisture. Ground water table and crop productivity were improved. Migration of workers from rural to urban areas was declined. The mean gross income of households increased by 59.8 per cent from Rs.88,170 to Rs. 1,40,882 at the end of project period.. the impacts of watershed management interventions were observed in increase of cultivation area by 16% especially horticultural crops,

expansion of water bodies, better soil moisture in the profile.The water resources improved through soil and water conservation measures, groundwater recharge and harvesting of rain water. Higher crop and milk yields, increase in employment and wage rates helped in reduction of migration and higher income to households in the watershed project. These positive outcomes on successful implementation of the watershed program were translated into sustainable livelihoods. The impact of watershed interventions in ground water recharges and overall growth of agricultural production would have been greater, but for six deficit rainfall years.

Narayanamoorthy. A, R. Suresh and K. S. Sujitha (2022) Tanks are the important traditional source of irrigation in India. They are a low-cost source with fewer management problems, but their performance has been deteriorating over the years. Using time-series data from the periods 1960–61 to 2013–14, this paper analyses the performance of tank irrigation across the districts, regions and categories of farmers in Andhra Pradesh, India. The study shows that districts that traditionally had a large tank irrigated area have registered a sharp reduction in that area. A substantial reduction in tank irrigated area is found in the Rayalaseema region where tanks are critical for farming. Correlation analysis suggests a significantly negative impact of groundwater area on tank irrigated area in most districts.

Objective and Methodology

The main objective of the paper is to analyse the economics of rainfed agriculture in the study area. The study used a multi-stage random sampling method. At the ***first stage*** the district is dividing three revenue divisions, namely, Ongole revenue division, Markapuram and Kandukur revenue division. In the second stage each revenue division two mandals are selected, among two mandals one is rainfed and another one representing the large number of watershed has been selected. In the ***Second stage,*** **f**or the purpose of this study, Korisapadu and Naguluppalapadu mandal from Ongole revenue division, Pullalacheruvu and Yerragondapalem from Markapuram revenue division and Pamuru and VV Palem from Kandukur revenue division. Two aspects are taken into consideration while choosing the village in the mandal. They are one mandal is rainfed area and another mandal representing the watershed area (Irrigated) and social composition of the village in terms of castes and communities in the village. In the ***Third stage*** each mandal two villages are selected on the above criteria, the villages are under watershed for cultivated, so altogether 12 villages selected namely Pamidipadu and Ravinuthala from Korisapadu mandal, Kothakota, Obennapalem from Naguluppalapadu manada, Marrivemula and Thellagatla from Giddaluru mandal and Venkatadri palem and Gurejepalli from Yerragondapalem manadal, Dubbagunta and Inimerla from Pamuru mandal. And Chilamkuru and Bhumireddy palli from V.V Palem mandal. Finally, farm households who are completely depending on rainfed crops and watersheds in each of the selected village are listed by farm size. There are 6 villages rainfed cultivation and remaining 6 villages areunder watersheds, such villages are namely Obennapalem, K. Thakkallapadu, Chilamkuru, Bhumireddy palli, Venkatadri palem and Gurejepalli. From each village 50 respondents were randomly selected. Thus, the total number of schedules covered 300 respondents. 150 farmers under watersheds and 150 farmers under rainfed conditions are selected.

Resource Use Pattern among Rainfed and Irrigated Cultivation: All Crops

The cost of cultivation of different crops in different agro-climatic conditions and cost complex conditions are useful to assess the conditions of farm households, farm employment, income and quality of life. The per acre input use pattern, operational and overhead costs, paid out and imputed costs and different cost concepts are calculated and analysed for both crop situations.

Intensity of resource use pattern:

The data relating to per acre investment and its distribution among different inputs both in irrigated and rainfed cultivation along with breakup of investment on different size groups of farm holdings is presented in table-1. Contrary to the expectations, it is observed from the table that use of fertilizers is high in all size groups of irrigated farm holdings when compared with rainfed farms.

Per acre expenditure on fertilizers is found to be higher in irrigated farms and rainfed farmers in semi medium holdings, when compared to other farming categories of both situations. Per acre expenditure on fertilizer is found to be high in irrigated farms in the study. Per acre expenditure on pesticides is is more are less in both rainfed farms and irrigated farms.

The ratio of expenditure on fertilizers and pesticides to the total cost of cultivation is 23 per cent in Irrigated farms and 32 per cent in rainfed farms. Another important factor associated with the modern technology is intensive use of inputs like fertilizers and pesticides. Per acre expenditure on these inputs is the major determinant of total cost and yield in both rainfed and irrigated crop cultivation. Difference in the use of these inputs may be due to economic status of the farmers, availability of capital and the level of risk involved with the commercial crop cultivation. The Irrigated farm is expected to have less risk of crop failure due to effective use of irrigation, fertilizers and pest. Consequently the farmers may be induced to use more of these inputs expecting higher returns.

In order to examine the relationship between farm size and cost of fertilizer the following regression equation of the form Log C= log a+ log x (where 'C' is the total cost of fertilizers per acre and 'x' is farm size) is fitted for both irrigated and Rainfed farm situations. The results of estimated regression equations are

Log C = 0.793 + 0.218 log x (Irrigated farms)

Log C = 1.023 + 0.017 log x (Rainfed farms)

From the analysis of the above equation there is a positive relationship between farm size and the value of fertilizers in both rainfed and Irrigated farms. This indicates that the use of fertilizers is increasing with their increasing farm size. There is no consistent variation in the use of fertilizer in both rainfed and irrigated cultivation.

It is expected that irrigation will have direct influence on the cost of pesticides. Irrigated farms crop cultivation requires less number of sprayings of pesticide when compared to rainfed farms cultivation. The difference in the use of pesticides is determined by the factors like economic status of the farmers' variety of seeds used and the extension service available. It is expected that large farmers will have access to all these facilities. In order to find out the exact relationship between value of pesticides and farm size the following regression equation of the form Log C = log a + b log x (where 'C' is the total cost on pesticides per acre and 'x' is the farm size in acres) is fitted for both categories of crop situations.

Log C = 7.08 +0.187 x (Irrigated farms)

Log C = 5.92 + 0.086 x (Rainfed farms)

From the analysis of the results of the estimated equation, it is evident that, there is a positive relationship between farm size and value of pesticides in both rainfed and irrigated farms. This indicates that irrigation facilities is not a deterring factor in the use of pesticides in both crop situations, all the peasants are use high pesticides in both situations.

The expenditure on seeds is one of the important components in cultivation. Per acre expenditure on seeds is found to be 29 per cent higher in irrigated farms than in rainfed farms. A similar difference in expenditure on seeds between Irrigated farms and rainfed farms is found among all size groups of farm holdings. Per acre expenditure on human labour is found to be 41 per cent higher in Irrigated farms than in rainfed farms The per acre expenditure on hired labour is 13 per cent higher in Irrigated farms than in rainfed farms.

As a result of the biological innovations, which are the main components of the green revolution, technology has contributed to high use of human labour. The difference in per acre expenditure on human labour in Irrigated farms and dry land farms is found to be exhibited a similar trend with slight variations among different size groups of farm holdings.

But it is observed that there is a direct relation between hired human labour use and farm size in both the categories of farm holdings. A regression equation of the form Log L = Log a + b log *x* (where 'L' is expenditure on hired labour per acre and '*x*' is farm size in per acre) is fitted to examine the relationship between farm size and labour use. The fitted regression equations are

$$\text{Log } L = 7.37 + 0.172 \log x \quad \text{(Irrigated farms)}$$

$$\text{Log } L = 6.93 + 0.244 \log x \quad \text{(Dry land farms)}$$

The results of the regression equation show that the relationship between size of the farm and expenditure on hired human labour is positive and significant on both Irrigated farms and rainfed farms crop situations. This indicates that the use of the family labour decreases with the increase in farm size.

The rental value of owned land and leased in land is found to be higher in Irrigated farms when compared with rainfed farms. The rental value of land is determined by soil fertility of the land and the infrastructural facilities available to that land. The rental value of owned land in Irrigated farms is found to be 46 per cent higher. Similarly the rental value of leased in land is 27.65 per cent higher for Irrigated farms than in rainfed farms. This leads to the conclusion that use of higher quality inputs is associated with Irrigated farms.

Table-1

Per acre input use

(In rupees)

	Marginal		Small		Semi-medium		Medium and large		Total	
Farming category	Rainfed	irrigated	Rainfed	irrigated	Rainfed	irrigated	Rainfed	irrigated	Rainfed	irrigated
Seeds	3180	3575	4732	5080	5066	5875	5405	5733	4567	5061
Machine labour	1280	1600	1916	1700	1921	2475	1955	2167	1772	2054
Bullock labour	1560	1863	2346	2280	2450	2642	2485	2567	2202	2346
Fertilizers	4367	6250	7179	7086	7243	8733	7085	7100	6503	7555
Manure	383	500	679	300	510	225	350	0	475	293
Pesticides	3677	4231	6061	5480	5820	6658	5585	5067	5291	5584
Hired labour	3520	8275	7628	11440	8722	15496	9497	14183	7328	12568
Owned labour	2863	3006	3454	2860	2690	2821	2461	2183	2844	2813
Irrigation cost	117	2563	505	3440	695	4500	375	4667	457	3775
Rental Value of owned land	1733	1250	2893	6000	4913	4667	8250	9000	4512	8429
Rental value of owned land	10260	14000	13411	14400	12963	20167	13325	18333	12429	17179
Interest on working capital	2261	3155	3847	4264	4045	5224	4490	3985	3665	4329
Interest on fixed capital	794	784	1123	1100	1261	1700	1559	1500	1173	1310

Depreciation	327	488	534	744	634	1260	773	1133	564	934
Miscellaneous	358	388	561	450	611	688	783	750	578	566
Marketing cost	193	200	422	300	530	621	664	533	444	434
Total Cost	36874	52127	57291	66923	60073	83751	65040	78902	54804	75227

Source: Primary data.

The analysis of cost of cultivation further reveals that the difference in cost of cultivation between irrigated farms and rainfed farms is found to be above 5 per cent. A similar difference in expenditure among size groups of farms is found with some variations. In order to examine the relationship between farm size and total cost, the following regression of the form Log C= log a + b log *x* (where 'C' is the total cost per acre and '*x*' is the farm size in acres) is estimated. The estimated regression equations of both Irrigated farms and rainfed farms crop situations are

Log C= 42.8 +0.405 log *x* (Irrigated farms)

Log C= 35.4+ 0.08 log *x* (Rainfed farms)

The results clearly indicate that there is a positive relationship between farm size and total cost. This relationship is significant in Irrigated farms while it is not significant in rainfed farms. This clearly indicates that the intensity in the use of inputs is associated with the farm size. The small farms may have the constraints of resources which are reflected in the relationship. The intensive use of inputs is found to be more in Irrigated farms when compared to rainfed farms as farm size increases.

Thus the above analysis leads to the conclusion that the expenditure on fertilizer and the expenditure on pesticides are higher in rainfed farms. The expenditure on seeds, irrigation, land preparation, hired labour is found to be higher in Irrigated farms.

The result of estimated regression equations reveals that the use of hired human labour input is found to have positive relationship with farm size in both crop situations. But this relationship is significant. A positive relationship between farm size and fertilizers is found in Irrigated farms, and an insignificant positive relationship between farm size and use of fertilizer is found in rainfed farms.

Returns:

The per acre returns from cultivation in both crop situations are analyzed by calculating the following concepts of returns viz., gross returns, farm business income, family labour income, farm investment income and net returns.

Gross income:

The data relating to the per acre gross returns from irrigated and rainfed farm situations by the size of the holdings is given in table-2. The data reveals that the gross returns from irrigated farms are found to be 48 per cent higher than that of rainfed farms. While the gross returns from irrigated farms is Rs.90,229/- per acre, it is Rs. 60,609/- in rainfed farms.

Table-2
Per acre Gross Returns
(In rupees)

Farming category	Rainfed	Irrigated
Marginal farmers	37587 (100.00)	66988 (178.22)
Small farmers	63746 (100.00)	85820 (134.63)
Semi-medium farmers	67580 (100.00)	106200 (157.15)
Medium and large farmers	74375 (100.00)	95667 (128.63)
Total	60609 (100.00)	90229 (148.87)

Source: Primary data.

Note: Figures in the parentheses indicate the percentage to the total.

The intra size group comparison also reveals that gross returns per acre is high in Irrigated farms in all size groups when compared with rainfed farms.

A direct relationship between farm size and gross returns is found in both irrigated farms and rainfed farms situations. This clearly leads to the conclusion that medium and large farm holdings are getting higher returns than small and marginal farmers as a result of provision of irrigation and modern inputs. Large and medium farmers have got higher returns than that small and marginal farmer by efficient management of farms. This finding is not in collaboration with earlier findings of the farm management during green revolution studies.

It could be observed from the analysis that gross returns per acre are increasing with the farm size in both categories of farms. To find out the exact relationship between farm size and gross returns per acre a Log linear equation of the form Log Y= log a+ b log x (where Y=gross returns per acre and x = farm size per acre) are fitted for both categories of crop situations. The estimated regression equations are

Log Y = 4.582 + 0.058 log x (Irrigated farms)
Log Y = 3.528 + 0.028 log x (Rainfed farms)

The estimated regression equations clearly reveal that there is a significant positive relationship between farm size and gross returns from both irrigated and rainfed farms situations, which contradicts some of the earlier studies. This positive relation reflects a superiority of scale over economic peasant production on over large scale farming.

The difference in gross returns may be attributed to the difference in modern inputs like fertilizers and pesticides used per acre. To examine the exact relationship between value of modern inputs used per acre and the gross returns per acre the following regression equation of type, Log Y= log a+ b log x (where Y is gross returns per acre and x is the value of fertilizer per acre) is fitted.

The estimated regression equations are

Log Y= 4.06 + 0.03 log x (Irrigated farms)
Log Y = 4.58 + 0.02 log x (Rainfed farms)

So the results of estimated regression equations clearly reveal that there is a significant positive relationship between value of gross returns per acre and value of modern inputs used per acre in both the crop situations. Hence the difference in gross returns within each category is explained by the difference in use of modern inputs. Further the elasticity of output with respect to fertilizer is found to be higher in irrigated farms than that of in rainfed farms. That is one unit increase in fertilizer and pesticides use yielded high returns in irrigated farms than that of in rainfed farms.

Another important input that contributes to the total cost is the value of human labour. It can be observed from the table that gross returns per acre are associated with the value of human labour per acre. To find out the exact relationship the following regression equation of the form Log Y= log a+ b log *x* (where Y is the gross returns per acre and x is the value of human labour per acre) is fitted. The estimated regression equations are

Log Y= 3.488 + 0.77 log *x* (Irrigated farms)

Log Y = 2.99 + 0.046 log *x* (Rainfed farms)

From the analysis of the above estimated equations, it is evident that there is significant positive relationship between gross returns and value of human labour in both crop situations. This leads to the conclusion that higher gross returns in irrigated crops are associated with higher use of human labour. The elasticity of output with respect to human labour is higher in Irrigated farms than that of in rainfed farms.

Farm Business income:

Farm business income in cultivation represents the returns to the farmers land, family labour, fixed capital and management. It can be obtained by deducting the paid out cost i.e., Cost A1 or Cost A2 as the case may be from gross returns per acre. Farm business income in irrigated and rainfed farms is shown in table-3. The data reveals that the farm business income in Irrigated farms is higher than that of in rainfed farms Per acre farm business income in irrigated farms and rainfed farms is about Rs.22,250/- and Rs. 41303/- respectively. This indicates that farm business income is 86 per cent higher in Irrigated farms than that of in rainfed farms Intra size group comparison also reveals that per acre farm business income is higher in Irrigated farms when compared to rainfed farms. This phenomenon may be attributed to higher productivity associated with provision of irrigation facilities.

Table-3

Per acre Farm business income

(In rupees)

Farming category	Rainfed	Irrigated
Marginal farmers	14630 (100.00)	32651 (223.17)
Small farmers	24444 (100.00)	37257 (152.42)
Semi-medium farmers	24421 (100.00)	47136 (193.02)
Medium and large farmers	26680 (100.00)	47782 (179.09)
Total	22250 (100.00)	41303 (185.64)

Source: Primary data.

Net income:

Net income is the profit or loss from farm enterprise. Net income is obtained by deducting the total Cost-C from gross income per acre. Net income from both the irrigated farms and rainfed farms is given in table-4. The data clearly reveals that irrigated farms given significant higher profits from farm enterprise than from rainfed farms. While in irrigated farms farmers gained a net income of Rs.20,002/- per acre, in rainfed farmers gained a net income of Rs. 5,804/-.

The intra size group comparison also reveals that net income is consistently higher in irrigated farms in all size groups, than that of in rainfed farms However, there is variation in per acre net income

among all size groups of farms. A positive relation between per acre net income and farm size is found in irrigated and dry farms

Table-4

Per acre Net income

(In rupees)

Farming category	Rainfed	Irrigated
Marginal Farmers	713	14861
Small Farmers	6455	18897
Semi-medium Farmers	7507	22449
Medium and large Farmers	9335	25765
Total	5804	20002

Source: Primary data.

Output input ratio:

To estimate the return per a rupee of investment in cultivation output input ratios are calculated. It can be found that the output-input ratio is 1.29 in Irrigated farms and 1.06 in rainfed farms. This clearly reveals that the impact of irrigation on crop cultivation. It is evident from the table that returns on per rupee of investment on both irrigated and rainfed farms are increasing with the farm size. The intra size comparison also reveals that output-input ratios are high in Irrigated farms in all size groups, when compared with rainfed farms Further it is evident that the return per the rupee of investment is higher in medium and large farms. There is a direct relationship between rate of return and farm size on both crop situations.

Conclusion

The use of machines by itself may have no direct output increasing effect, but it plays a complementary or enabling role in the production process which contributing towards increase in output along with irrigation. The use of machines enhances the capability to perform farm operations more intensively by filling the energy gap, which cannot be met by animal labour or human labour when the stress is on economy of time as in multiple cropping.

The per acre expenditure on fertilizers is found to be higher in irrigated farms and rainfed farmers in semi medium holdings, when compared to other farming categories of both situations. Per acre expenditure on fertilizer is found to be high in irrigated farms in the study. Per acre expenditure on pesticides is is more are less in both rainfed farms and irrigated farms. The Irrigated farm is expected to have less risk of crop failure due to effective use of irrigation, fertilizers and pest. Consequently the farmers may be induced to use more of these inputs expecting higher returns.

There is a positive relationship between farm size and the value of fertilizers in both rainfed and Irrigated farms. This indicates that the use of fertilizers is increasing with their increasing farm size. There is no consistent variation in the use of fertilizer in both rainfed and irrigated cultivation. The rental value of owned land in Irrigated farms is found to be 46 per cent higher. Similarly the rental value of leased in land is 27.65 per cent higher for Irrigated farms than in rainfed farms. This leads to the conclusion that use of higher quality inputs is associated with Irrigated farms.

The proportion of overhead cost to total cost is found to be higher in irrigated farms when compared to rainfed farms. While the proportion of overhead cost to total cost is 41 per cent in rainfed farms, it is 47 per cent in Irrigated farms. The difference in proportion of over head cost to total cost is found to be significant between Irrigated farms and rainfed farms. This phenomenon is perhaps due to higher amount of depreciation and interest on fixed capital investment and rental value of the land.

The irrigated farms technology is expected to reduce the risk of crop failure and induces the farmer to invest more on fixed capital. The high amount of depreciation and interest on fixed capital

investment associated with the use of technology might have resulted in the escalation of overhead cost in Irrigated farms. Intra size group comparison also shows a significant difference in proportion of overhead cost to total cost between Irrigated farms and rainfed farms foregoing analysis has revealed that provision of irrigation and modern inputs has reduced the intensive use of pesticides and encourage the intensive use of other inputs. Thus per acre investment by all cost concepts except the expenditure on pesticides is higher in irrigated farms as compared to rainfed farms.

The gross returns from irrigated farms are found to be 48 per cent higher than that of rainfed farms. While the gross returns from irrigated farms is Rs.90,229/- per acre, it is Rs. 60,609/- in rainfed farms. The intra size group comparison also reveals that gross returns per acre is high in Irrigated farms in all size groups when compared with rainfed farms. the analysis that gross returns per acre are increasing with the farm size in both categories of farms. Another important input that contributes to the total cost is the value of human labour. it is evident that there is significant positive relationship between gross returns and value of human labour in both crop situations. This leads to the conclusion that higher gross returns in irrigated crops are associated with higher use of human labour. the farm business income in Irrigated farms is higher than that of in rainfed farms Per acre farm business income in irrigated farms and rainfed farms is about Rs.22,250/- and Rs. 41303/- respectively. This indicates that farm business income is 86 per cent higher in Irrigated farms than that of in rainfed farms Intra size group comparison also reveals that per acre farm business income is higher in Irrigated farms when compared to rainfed farms. This phenomenon may be attributed to higher productivity associated with provision of irrigation facilities.

Net income is the profit or loss from farm enterprise. Net income is obtained by deducting the total Cost-C from gross income per acre. The data clearly reveals that irrigated farms given significant higher profits from farm enterprise than from rainfed farms. While in irrigated farms farmers gained a net income of Rs.20,002/- per acre, in rainfed farmers gained a net income of Rs. 5,804/-. The intra size group comparison also reveals that net income is consistently higher in irrigated farms in all size groups, than that of in rainfed farms However, there is variation in per acre net income among all size groups of farms. A positive relation between per acre net income and farm size is found in irrigated and dry farms. The farm investment income is the income remained with the farmer for his investment which includes the rental value of owned land, interest on fixed capital and returns to the management. The value of farm investment income for both Irrigated farms and rainfed. From the table it is found that the net returns from the investment in Irrigated farms is higher than that of from rainfed farms It is Rs. 38,490/- from Irrigated farms and Rs.19,406/- from rainfed farms. This implies that Irrigated farms technology has enhanced the returns to investment. The intra size group comparison also reveals that returns to investment are consistently high in Irrigated farms than rainfed farms in all size groups. It is also observed from the table that per acre farm returns to investment is increasing with the farm size on both situations.

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