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ABSTRACTS OF Ph. D. THESES

Chand, Puran. 1992. Resource Optimisation and Normative Demand for Irrigation Water in Karnal District of Haryana State Indian Agricultural Research Institute, New Delhi. *Major Advisor* : B.M. Sharma.

The present study was undertaken to optimise resources and to derive the normative demand for irrigation water at various levels of prices on different categories of farms (small, medium, large and overall) under different sources of irrigation (canal, tubewell and canal plus tubewell) in Karnal district of Haryana State. Data were collected from the villages of three community blocks (Israna, Indri and Nis-ing) of Karnal district of Haryana State for the agricultural year 1989-90. The sample comprised one hundred twenty farmers from different farm size categories with forty farmers under each source of irrigation. Synthetic farm situations were developed under each source of irrigation and under each size of farm. Linear programming was used to work out the optimal farm plans with restricted and unrestricted availability of capital, Variable price programming was also used to derive the normative demand for irrigation water at different levels of prices. The results of optimisation of resources with restricted and unrestricted availability of capital were compared with the existing situation.

In the existing plan, a non-uniform resource use pattern was followed by the farmers under a particular cropping pattern adopted across the sources of irrigation. On canal irrigated farms, proportionate area under wheat decreased with area under sugarcane increased with increase in the size of holding. On tubewell and canal plus tubewell irrigated farms paddy and wheat occupied more than 80 per cent of the total cropped area. On these farms about 65 per cent of total water was used during the four months June to September and about 35 per cent in eight months from October to May. On canal irrigated farms about 47 per cent water was used from June to September and the remaining 53 per cent from October to May. Utilization of human labour was 128, 127 and 96 mandays on canal plus tubewell, tubewell and canal irrigated farms, respectively. Net returns per hectare were highest (Rs. 7082) on tube-

well followed by canal plus tubewell irrigated farms (Rs. 6039) and the lowest (Rs. 4430) on canal irrigated farms.

Optimisation with restricted availability of capital shifted the cropping pattern towards more profitable crops. The intensity of cropping under resource optimisation with restricted availability of capital on all sources of irrigation except canal irrigated large farms and canal plus tubewell irrigated small farms was less than existing one. On tubewell irrigated farms, existing intensity was higher than in optimal plans whereas on canal irrigated farms highest intensity was under optimal plans with unrestricted capital outlay. With the relaxation of capital constraint, the intensity of cropping increased on all categories of farms under different sources of irrigation.

Water utilization decreased by 3 to 11 per cent under optimal plans with restricted availability of capital and it increased by 1 to 69 per cent with unrestricted capital outlay in comparison to existing plans. However, net returns per hectare centimetre of water increased by Rs 108 to Rs 233 in the former and by Rs 111 to Rs 235 in the latter case. Labour employment increased between 2 to 108 per cent over existing plan. Through optimisation of resources with limited and unlimited supply of capital per farm net returns increased from 28 to 119 per cent on canal, 21 to 26 per cent on tubewell and 32 to 38 per cent on canal plus tubewell irrigated farms. The study clearly shows that there is a scope to increase the income and employment by allocating the resources rationally. The relaxation of capital constraint further boosted up the income and employment implying that capital was a major constraint in adoption of the new capital intensive technology. If adequate capital at the desired level can be provided to the needy farmers, income and employment could increase.

The elasticities of demand for irrigation water under restricted availability of capital varied from -0.0067 to -0.0768 at a price level of rupees 5 per hectare centimetre of water and -0.0449 to -0.4133 at a price level of rupees Rs 30 per hectare centimetre of water. Under unrestricted capital availability elasticities of demand for irrigation ranged from -0.0085 to -0.0449 at a price level of rupees 5 and -0.0382 to -0.2207 at a price level of rupees 30 per hectare centimetre of water. Price elasticities were less than unity on all sizes of farms under different sources of irrigation.

The study suggested certain policy measures for optimal utilization of irrigation water. Some important policy options are exploitation of

ground water, adoption of multiple cropping, changing the cropping pattern in favour of more remunerative crops requiring less water, investment in minor irrigation schemes, construction of micro reservoirs, strengthening of credit agencies and gearing up of extension agencies to implement the optimal plans and adoption of new methods of irrigation which save water losses and increase the water returns in the study area.

Chandra, Naresh. 1992. Determinants and Impact of Technology Adoption on the Farm Economy in Chotanagpur Region of Bihar. Indian Agricultural Research Institute, New Delhi. *Major Advisor*: R P. Singh.

The Chotanagpur region of South Bihar is an agriculturally backward region with merely 10 per cent of net sown area under high yielding varieties (HYVs). Consequently it merits attention of researchers and policy makers in order to know the potentialities of new technologies and their implications for regional planning and agricultural development policies and programmes in meeting the socio-economic goals of this region. The present study attempts to (i) determine the level and determinants of technology adoption in crop production; (ii) examine the input and output response and economic efficiency at different levels of technology adoption in crop production, (iii) study the impact of technology adoption on income distribution, (iv) determine the impact of technology adoption on labour absorption in crop production and (v) suggest measures for accelerating technology adoption on the farms.

Using the three-stage stratified random sampling technique with blocks, villages and farm holdings as the first, second and third stages, respectively, 160 farm holdings, proportionate to their number in respective size groups were selected from Hazaribagh and Ranchi districts in Chotanagpur region and classified into marginal, small and other categories. The data were subjected to tabular and regression analysis to examine various issues of significance. In order to identify the level of technology adoption, adoption indices (AI) of individual farmers were computed with the help of an appropriately developed formula taking into account all the major crops and the rest of the analysis was based on low (0 to 20 per cent AI), medium (21 to 40 per cent AI) and high (above 40 per cent AI) levels of adoption.

The results revealed that the area under study was characterised by preponderance of low level of technology adoption and smaller sized farms. The income from crops, credit orientation, attitude towards

HYVs, risk orientation, age of the entrepreneur and land owning ratio had a significant bearing, in that order, on the adoption of new technology.

The cultivation of potato was found to be the most profitable, followed by that of paddy, wheat and ragi. The human labour cost accounted for lion's share of the total input cost in growing major crops, except in potato cultivation. The utilisation of all the three inputs, i. e., land, labour and capital, was highly inefficient by almost all the categories of farmers in growing the major crops at almost all the levels of adoption except that of labour by high adopter group in paddy, and land by low adopters in wheat cultivation.

The disparity of income distribution was found to be the least among the farmers at low and high levels of adoption and marginally higher at medium level of adoption. The investigation indicated that adoption of higher level of agricultural technology would not increase the disparity of income distribution among the farmers.

The increase in labour absorption with increase in the level of technology adoption in major crops' production was only marginal. However, in the cultivation of individual crops the picture was hazy and it did not show any trend with the levels of adoption. Family labour constituted the bulk of farm labour at all the levels of adoption and showed decreasing trend with the increase in the adoption, while hired labour revealed an increasing trend.

In order to enhance technology adoption, the findings call for adequate and timely supply of institutional credit coupled with prompt extension support, implementation of crop insurance scheme, involvement of village youth in the rural welfare programmes and making the technology easily accessible to farmers, land reform measures, intensive cultivation of crops and development of suitable irrigation watersheds in the area under study.

Dastagiri, M.B. 1992. Resource Use Efficiency, Farm Income and Labour Employment Under Different Situations of Irrigation in Chittoor District of Andhra Pradesh. Indian Agricultural Research Institute, New Delhi. *Major Advisor* : R.P. Singh.

The contribution of irrigation in Indian agriculture has been widely recognised. However, there exists a wide variation in the level of irrigation potential and their utilization which leads to significant change in resource use, productivity, income and employment generation across the

regions. The present investigation is an attempt to quantify the changes in economic parameters under varying levels of irrigation in Chittoor district of Andhra Pradesh. The specific objectives are (i) to examine the existing resource endowment and cropping pattern on farms under different irrigation situations, (2) to examine the costs, returns and employment opportunities in growing major crops on farms under different irrigation situations, (3) to examine the resource use and allocative efficiency on different categories of farms under different irrigation situations and (4) to decompose the total change in returns into irrigation and other constituent causal forces.

Using the three-stage sampling technique with mandals, villages and farm holdings as the first, second and third stages, respectively, a total of 195 farm holdings distributed among 4 villages were selected randomly for collection of farm level primary data. These holdings were then classified into four categories based on their existing irrigation potential, namely, no irrigation, low irrigation (less than 25 per cent irrigated area), medium irrigation (between 25 to 50 per cent irrigated area) and high irrigation (more than 50 per cent irrigated area).

The data were subjected to tabular analysis to examine the changes in resource endowment and its utilization and costs and returns structure on farms due to change in irrigation potential. Functional analysis was also performed to examine the resource use efficiency under different levels of irrigation. The total change in gross returns was decomposed into change in irrigation potential and other constituent causal forces, using Bisalaiah's decomposition model.

The findings of this study reveal that the distribution pattern of operational holding didn't follow any specific trend with level of irrigation. The resource endowment and their utilization bore direct relationship with level of irrigation. Paddy, groundnut and sugarcane were the major crops grown by almost all the farmers with exception to unirrigated farmers who confined to groundnut cultivation only. The share of sugarcane and *rabi* groundnut crops in total cropped area showed increasing trend with increase in the irrigation level. With increase in the level of irrigation the participation of female workers in crop production tended to decrease. However, the farm incomes such as net income, farm business income, family labour income tended to increase with the level of irrigation. Interestingly the benefit-cost ratio was relatively higher on unirrigated farms than on the irrigated farms. This implies that the unirrigated farmers still continue their traditional way of farming under low investment which gives relatively higher returns to the initial stage of their own

resources. Groundnut appeared to be the most remunerative crop followed by sugarcane and paddy. The cultivation of paddy by the irrigated farmers was mainly for their family consumption.

Devoting entire area under rainfed *kharif* groundnut by unirrigated category of farmers was on account of its remunerativeness, besides ease of its cultivation. Human labour ranked highest followed by seed and fertilizer in almost all the categories of farms. The cost and returns showed increasing trend with increase in the level of irrigation for almost all crops under study. Income and employment generation in all the major crops bore direct relationship with level of irrigation.

Interestingly, none of the farmers appeared to be efficient in use of their farm resources. There exists a greater scope of reallocating the existing fund to realise higher returns on different categories of irrigated farms. On the whole, the high level irrigated farmers appeared to be slightly better than the other categories of farmers in respect of use of their resources.

The change in the farm returns was mainly due to shift in the production process rather than change in the level of input use. However, among different categories of irrigated farms, medium irrigated farmers have gained the most from technological change and high irrigated farmers from the increased levels of input use.

Kiresur, Virupaxappa. 1992. Technological Dualism in Agriculture : An Econometric Analysis of Diffusion of Technology of Jowar Production in Karnataka. Indian Agricultural Research Institute, New Delhi. *Major Advisor* : R.K. Pandey.

The present study was undertaken in Karnataka State to examine the pattern and growth of diffusion of jowar production technology in different districts of the State, to evaluate the productivity differences among jowar farms under traditional and modern technologies and to analyse the factors responsible for the coexistence of the two technologies. Modern and traditional technologies were defined to include production practices associated with modern cultivars (hybrids plus improved varieties) and local or traditional varieties, respectively. Primary data from 180 farmers of Dharwad district and time-series secondary data of 15 jowar growing districts for the period 1966-89 were used for the study. Logistic trend functions were used to examine the growth of diffusion. Multiple linear regressions and discriminant functions were employed to study the inter-district variation in diffusion of technology. To evaluate

the productivity difference, the decomposition model based on production function analysis was used. Logit and discriminant models were used for partial adoption of the modern technology.

The growth of diffusion of modern technology was high for many of the districts, but the ceiling levels were generally low. The ceiling level for the State was 23.50 per cent. There was a wide variation in the logistic diffusion parameters across the districts. The observed levels of diffusion also exhibited similar pattern. The regional diffusion pattern was positively influenced by proportion of jowar area irrigated, rainfall and plant protection measures while it was inversely related to net sown area per farm and irrigation intensity. There was a structural break in the production relations due to the introduction of modern technology. The productivity of modern technology was higher than that of the traditional technology by 45 per cent. Technology was the major component contributing to the extent of 35 per cent to the productivity gap while the remaining was shared by differences in the inputs-use levels. The probability of a farmer's decision to adopt the modern technology was significantly influenced by the seasonal factors, size of operational holding, quantity of jowar grains required for family consumption, social participation and net returns per hectare of jowar crop. All these factors had positive influence on the probability of adoption except the operational holding size.

The farmers perceived that the modern technology was superior to traditional technology in terms of grain and fodder yields. However, they opined that the modern varieties were relatively inferior with regard to grain and fodder qualities. Therefore, while developing the second and third generation hybrids and varieties, the quality aspects of grain and fodder have to be taken care of by the crop improvement research in order to meet the taste and preferences of the farmers in the study area.

Saran, Sandeep. 1992, Acreage Response Analysis of Major Edible Oilseed Crops in the Districts of Uttar Pradesh. Indian Agricultural Research Institute, New Delhi. *Major Advisor* : B.M. Sharma.

The production along with hectareage of the edible oilseeds in the State of Uttar Pradesh declined during the post-Green Revolution period, through the average productivity and prices of the same increased during the period. Therefore, the present study was attempted (i) analyse the hectareage response behaviour of the major oilseed crops, viz., rapeseed-

mustard, groundnut and sesamum with respect to price and non-price factors such as gross returns, risk, rainfall, irrigation, etc. in the districts of Uttar Pradesh, (ii) to estimate short run and long run elasticities of hectareage response to such factors in the districts of the State, (iii) to identify the favourable growth areas for edible oilseeds production in the State on the basis of district-wise growth rates in area, production and productivity of the oilseed crops, and (iv) to measure the effects of area, productivity and their interaction on the changes in production of the edible oilseeds in the districts of the State.

Using secondary data from various sources, the hectareage response relationship of rapeseed-mustard *vis-a-vis* its competing crops with respect to various factors was analysed using Nerlovian adjustment lag model in the linear form and the short run and long run elasticities were also estimated for these factors. Identification of favourable growth areas and measurement of impact of area, yield and their interaction on change in oilseeds production were performed through growth rate analysis and component analysis, respectively.

Increase in rapeseed-mustard hectareage was attributed to expansion in irrigated area in Western U.P. Mainly gram and barley areas shifted to rapeseed-mustard in Central and Eastern U.P. districts having poor irrigation base because of higher gross returns from rapeseed-mustard and non-availability of better crop options, particularly in the rainfed areas. Area under groundnut declined significantly in the Western and Central U.P., whereas it increased in Southern and Eastern U.P. Groundnut area largely shifted to jowar and bajra in Western U.P., since groundnut yielded higher variability in income as compared to the latter. Expansion in irrigation had trivial influence on groundnut hectareage. Since under rainfed conditions rice and maize yielded higher income variability, their areas shifted in favour of sesamum in Western and Eastern U.P. districts. However, in Central U.P., farmers responded to expansion in irrigated area. In general, farmers in the State indicated poor response to most of the factors as reflected by poor short run elasticities of hectareage response to various oilseeds which were grown primarily with traditional practices.

The divisions of Meerut, Agra, Lucknow, Jhansi and Gorakhpur were identified as favourable growth areas for rapeseed-mustard. The districts of Saharanpur, Etah, Shahjahanpur, Bijnor, Farukhabad, Jhansi and Kheri were identified as favourable growth areas for groundnut and sesamum cultivation. Change in area was found to be the major factor to have affected production of all the edible oilseeds in the State.

Wader, Laxman Kallayya. 1992. A Study of Quality, Grading and Prices in Cotton Marketing in Karnataka. Indian Agricultural Research Institute, New Delhi. *Major Advisor* : Praduman Kumar.

The relationship between price and quality of cotton in the State of Karnataka are analysed in this study. The variations in prices are caused by several factors like variety of cotton, geographical location, seasonality in market arrivals and qualitative and non-qualitative characteristics of cotton. These aspects of cotton price variations are studied in detail in this study. The Raichur and Hubli cotton markets were selected for this study. The data used in this study were of two types. The time series data on prices of cotton for the period 1981 to 1989 was used to study price variations. The cotton samples of Raichur (100 samples) and Hubli (94 samples) were collected and were analysed at cotton classing centre, Surat, for quality factors of fibre which were used for this study as basic data. The other data included the primary data on eye-sight grades, prices and other relevant information collected by interviewing the producers and buyers of cotton.

The results of the study indicated that cotton marketing in Karnataka is fairly integrated. However, the seasonal and temporal variations in prices calls for urgent steps to arrest such tendencies in the market. This is necessary to provide remunerative prices to the producers whenever there is glut in the market. Therefore, it is suggested that purchase by agencies like cooperatives and Cotton Corporation of India should be stepped up so that more and more cotton is purchased at or above the support price. This would go a long way in protecting the farmers who are affected by seasonal variations in prices of cotton in Karnataka State.

The study revealed that DCH-32 cotton variety was superior in fibre length and ginning percentage in comparison to other varieties. But LK cotton variety exhibited highest uniformity ratio among all the cotton varieties. All the cotton varieties had the fibre strength and micronaire value more or less evenly distributed. White colour and silky feel are dominating characteristics among all the varieties. DCH-32 cotton variety possess very low to very high trash content. This was because DCH-32 cotton variety is more susceptible to pests and diseases which adds to the trash content. As far as grade was concerned Hybrid 4 cotton was more uniformly graded than any other variety. Highest price was paid to DCH-32 and MCU-5 cotton varieties during the survey period.

Cotton at present is marketed on the basis of eye-sight grades evaluated by graders appointed by the market committees for the purpose:

The eye-sight grades are based on colour, feel of *kapas* and trash content. The study revealed that the present eye-sight grading is not taking several qualitative and non-qualitative factors into account in determining the grades and the prices paid to the producers. On the other hand, scientific grading measuring the fibre quality would determine the premium and discounts more accurately.

Several important implications can be drawn from this analysis with respect to those factors which are influential in the establishment of price at the producer level. First, many of the marketing problems which presently exist within the cotton marketing channel would be resolved by grading of cotton on those quality characteristics which are directly related to the use value of cotton. This would allow the marketing channel to function as it was intended by reflecting those cotton quality characteristics desired by mills directly back to producers through the pricing system. Therefore, it is recommended that the complete grading of cotton be reorganised in relation to cotton's use value. Secondly, during the recent past the share of cotton in fibre market has been declining while that of synthetic fibres have been increasing. This trend would naturally cause cotton fibre processors to be less concerned with cotton quality characteristics than with those of synthetics. Therefore, less emphasis has been placed on cotton quality by the textile industry. However, high cost of synthetic fibres would arrest this trend for some more time to come. Thus the spinning potential of cotton will become more crucial as an economic evaluation of raw cotton material costs, especially where cotton accounts for a larger share of the variable costs, of the textile industry.

David, Alvaris. 1993. Impact of Technology on Foodgrains Production in Sub-montane Zone of Maharashtra. Indian Agricultural Research Institute, New Delhi. *Major Advisor* : R.K. Pandey.

This work was undertaken in the Sub-montane Zone of Maharashtra to study the level of application of technology and to develop a technological index for foodgrains production; to examine the input-output relationship and allocative efficiency at different levels of technology adoption; to study the effect of technological change on functional income distribution and to suggest appropriate direction of technological change in foodgrains production. Both primary and secondary data relating to the years 1990-91 and 1983-84, respectively, were collected. Besides simple statistical tools, the indexing technique and multiple regression analysis were the analytical techniques used. Nine types of indices, one

simple, four weighted with cost and four with the area under the component, were developed for both the time periods. HYVs seed, N, P, K, pesticides and other chemicals, irrigation and machinery were the components of new technology considered for computing the index. In case of all the crops, viz., paddy, jowar and wheat, under the present study, (except gram, for which it was lower), the technological adoption level was found to be higher during 1990-91 when compared to 1983-84, but the rate of technology acceptance was very slow. Higher levels of technology resulted in higher productivity in all the crops. With increased technology levels, the consumption of HYV seeds, irrigation, fertilizers, human labour and machinery in case of paddy, HYV seeds, fertilizers, human labour in case of jowar, fertilizers in case of wheat, were found to increase. The analysis of resource use efficiency depicted that only human labour at low level of adoption in paddy was optimally allocated. At different levels of adoption, seed, fertilizers, human labour and bullock labour in case of paddy, fertilizer and human labour in case of jowar, human labour in case of wheat and bullock labour in case of gram, were underutilized, while irrigation and bullock labour at high adoption level in paddy, human labour at high adoption level in case of jowar and bullock labour at low adoption level in case of wheat were overutilized. The functional income distribution analysis depicted that at higher adoption levels, the technological change was biased in favour of land (residual) and capital but against labour in case of paddy and gram; in favour of land (residual), neutral to labour and against capital in case of jowar and in favour of land but against labour and capital in case of wheat. The absolute share, however, increased for all the factors, except capital, in case of jowar, though the magnitude of gain varied. The personal income distribution in the study area was observed to become more unequal but the gains of absolute increase in factor shares were distributed among all the sections.