CHAPTER - 2

REVIEW OF LITERATURE

2.1. INTRODUCTION

In this chapter an effort is made to review the studies pertaining to the resource use efficiency in agricultural production. The well being of a nation is judged in terms of per capita availability of food. It is determined by the amount of available resources and their productivity. It is the fact that the efficient use of various resources in crop production is essential of agricultural development and prosperity. The review of previous studies on resource-use efficiency and returns to scale in agricultural production is made in this chapter.

2.2. REVIEW OF LITERATURE

Suryanarayan\textsuperscript{1} fitted a Cobb-Douglas type production function to find out the relationship between the output and inputs like, land, labour and capital, for both district wise and land wise (wet, dry and mixed) for the data collecting from 196 sample farmers of three districts of Telangana region in Andhra Pradesh. The co-efficient of labour and capital were found to be positive, while it was negative for land. He attributed the negative returns to land to the stretching of the crucial management factors.

Venkareddy and Chennareddy\textsuperscript{2} have employed a Cobb-Douglas type of production function to measure the production efficiency in

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South Indian Agriculture. He considered the total value of all crops as the dependent variable and land, human labour, capital and production expenses as the independent variables. They pointed out that a rapid and mass development of agriculture can be achieved only by a break through in the introduction of modern technology in a package consisting of new inputs, agricultural education, special skills and techniques.

Heady and Russel\(^3\) have made inter regional comparisons of resource productivities. Cobb-Douglas production function was fitted to evaluate the productivity. Random samples were used in the four regions of the study area. Inputs and outputs were aggregated in all the regions. Factor inputs for crops land, labour and capital services measured in dollar value. The study was based on the four random samples covering the 1950 production year in the Alabama, Piedmont, Northern Iowa, Southern Iowa and Montana. They observed that the ratio of capital to labour was much higher in Northern Iowa and Montana than in Southern Iowa and Alabama. The study showed that marginal productivity of labour on crops and live stocks were significant in Iowa and Alabama and the quantity of resource used was not significantly low in Northern Iowa.

Schultz\(^4\) has studied the allocative efficiency of traditional agriculture. The study has advanced the hypothesis that the agriculture sector in a large class of poor countries is relatively

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efficient in using factors of production at its disposal. The rationality in the allocation of resources shown by the farmers in traditional Indian agriculture was pointed out for the first time.

Ramakrishna Rao\(^5\) has studied the inputs use on different groups of farms in the context of urbanization. The data collected a sample of 382 farms in 12 villages from two zones of North and South Arcot districts of Karnataka State. The result of the study showed that the value of per irrigated acre among urban cultivators was positive. The urban influence on efficiency was more noticeable among big and medium cultivators in an urban group.

Hopper\(^6\) studied the operations of 43 farms in a village in eastern Uttar Pradesh, India during peak rabi season of 1954 to measure the allocative efficiency in traditional agriculture and thereby test the hypothesis that Indian cultivators using traditional technology make rational profit maximizing allocation of factors. Cobb-Douglas production function was estimated and marginal revenue for products were equated to marginal costs to analyze whether a farmer has allocated his inputs among his production alternatives efficiently and if he was operating under conditions of competitive product factor market. It was found that farmers were efficient and successfully economized their resources.


Jha\textsuperscript{7} has analysed the relationship between farm size and resource use in Ahmednagar and Nasik districts of Maharastra. 320 sample farms were selected from two districts for the year 1956-65. The empirical results obtained indicated that small farms were not inefficient in comparison to large farms. Hence, the study suggested that there was no pressing economic need for big farmers. This study revealed more efficient allocation of resources for the development of Indian agriculture.

Sahota\textsuperscript{8} while studying the resource productivity and efficiency of resource allocation in Indian agriculture concluded that on the whole there were comparatively few significant inefficiencies in resource allocation. There was little evidence of inadequacy in investment in fixed capital in general and strong evidence of under investment in specific forms of capital like fertilizer and irrigation water.

Saini\textsuperscript{9} evaluated the resource use efficiency in crop production in the states of the U.P. and Punjab with different categories of farms like small, medium and large farms. He used log linear transformations of Cobb-Douglas production function to estimate the resource use efficiency, the results indicated that land and labour to be the important inputs to which output was highly responsive in agriculture for the study area. The elasticity of output with respect to human labour input was found not only positive but also fairly high.

\textsuperscript{8} Sahota G.S. (1968), Efficiency of Resource Allocation in Indian Agriculture, American Journal of Agricultural Economics, 50 (3), PP – 584-605.
and statistically significant which was practiced on traditional lines with near absence of modern inputs like chemical fertilizers. He observed constant returns to scale in the study area.

Sankhayan and Sirohi\textsuperscript{10} have studied the resource productivity and allocative efficiency on seed potato farms in Himachal Pradesh. A sample of 30 observations was selected of three villages of Theog tahsil in Mahasu district. Cobb-Douglas and quadratic production functions were used. The inputs like land, human labour, bullock labour, manures and fertilizers, seeds were selected for potato and maize crop. They concluded that constant returns to scale operated in case of seed potato farms. In case maize crop diminishing returns to scale was observed. The farm resources within each crop were optimally allocated in seed potato.

Desai\textsuperscript{11} has analysed the resource use on sample farms of Baroda district in Central Gujarat. The data collected from the Indian Institute of Management Ahmedabad during the agriculture year 1968-69 was used. The study found that the factor pervades so deeply that it also seems to have caused an economic use of hired labour and sub-optimum use of fertilizers and manures in the region. Irrigation resource was more adequate and reliable in the study area.

Rudra and Day\textsuperscript{12} studied the rational allocation of resources under Cobb-Douglas production technology. This study has tested the hypothesis that Indian farmers are rational in resource allocation. The


study rejected the hypothesis of profit maximization under Cobb-Douglas production function. Their main concern was the relative proportions in which labour and material inputs were used.

Patel and Singh\textsuperscript{13} observed the increasing returns to scale on the selected farms of Meerut District in Uttar Pradesh. It was found that there was no inverse relationship between per hectare productivity and farm size under the new agricultural technology in the area under study.

Rathore, et.al.\textsuperscript{14} have studied the resource-use efficiency and returns from some commercial crops of Himachal Pradesh. The data for five commercial crops, namely potato, ginger, tomato, French bean and chilly were collected for the year 1973-74 by survey method. The sample for the study included 25 farmers for each of the selected crops.

Uma Shankar Singh and Jha\textsuperscript{15} have examined resource-use efficiency in relation to resource endowments for a sample of farms in rural Delhi for the year 1967-68. High income and low income groups of farms were taken into account. A linear programming technique was used to derive optimal farm plans. The average farm situations indicated that the high income group farms were more efficient than the low income group farms.

\textsuperscript{14} Rathore M.S. Bhati J.P. and Swarup R. (1973), Resource-use Efficiency and Returns from some commercial crops of Himachal Pradesh, Agricultural Situation in India, Vol.30, No.7, PP-507-509.
Singh\textsuperscript{16} has studied resource use, farm size and returns to scale in a backward agriculture of Eastern Uttar Pradesh. The data were collected for the year 1967-68 pertaining to a sample of 150 farms spread over 15 villages in Deoria district of U.P. Cobb-Douglas production function was fitted to work out the elasticities of production of factor inputs. The marginal value product and its ratio to factor price for human labour, bullock labour, manures and fertilizers, fixed capital resources were not significantly different from unity and hence indicated that all the inputs except land have been used efficiently on the average farms. The elasticity co-efficient of manures and fertilizers for large farms was significant as compared to the small farms but the co-efficient of bullock labour was greater for the small farms as compared to the large farms.

Verma and Pareek\textsuperscript{17} studied resource use efficiency in Jaipur district and found higher marginal value productivity of land on small farms as compared to large farms. The explanation given was that increased effort to get more income by small farmers from their limited area motivated them to cultivate their land more intensively.

Phillip Le, et al\textsuperscript{18} have analysed the farm size and economic efficiency in the case of California. The data was collected from a sample of small fruit and vegetable farms in the year 1977. The study observed that the small farms required relatively more capital and

\textsuperscript{17} Verma R.C. and Pareek S.N (1975), Resource – Use Efficiency on Small Size Farm vis-à-vis Large Size Farm in Jaipur District of Rajasthan, Indian Journal of Agricultural Economics, Vol.30 P-235
\textsuperscript{18} Phillip Le., Veen E. and Hall Bruce F. (1978), Farm size and Economic Efficiency: The Case of California, American Journal of Agricultural Economics, Vol.60, No.4, PP-589-600.
labour to produce a dollar's worth of output than large farms. In cotton and sugar cane crops, yield on irrigated and fertilizers land was higher for large farms. The study also indicated that the fertilizer prices were constant in all sizes of farms. An analysis of the combined expenditures for fertilizer, pesticides, seed and fuel for farms in all size classes showed that the large farms have over all lower costs for these items.

Sampath\textsuperscript{19} has examined the nature and measurement of economic efficiency in Indian Agriculture. The data involved in calculating the input output co-efficient matrices and objective function co-efficient vectors for the farm size group were taken from Farm Management Survey Report for Deoria district of U.P. for the year 1967-68. The resources used by each member of the group. Linear programming model was used for the measurement of economic efficiency. The conclusion of this aggregate and disaggregate empirical study is that the inefficiency found in order of 36.53 percent. The study has analysed the difference between the small farmer and the large farmer in terms of the level of economic efficiency. Economic efficiency of small farmer is 35.27 percent and it is 37.83 percent for large farms.

Arun Kumar et al\textsuperscript{20} have studied the economic efficiency of large and small farms, using data from the hybrid sorghum and potato farms

in Karnataka state. The study compared the profit of a farm as a function of the normalized prices (unit prices of inputs divided by the unit prices of output) of variable inputs and of land. Cobb-Douglas production functions were fitted. Both the methods supported the hypothesis that there was no difference in the efficiency between the two farm size groups.

Bharadwaj et al\textsuperscript{21} have analysed the resource use efficiency in wheat and maize in Bilaspur district of Himachal Pradesh for the year 1976-77. The data was collected by survey method in 12 districts of H.P. A total of 84 cultivators were randomly selected from two villages namely Dabla and Bhadrog in Tehsil Ghumrwin for the study. Manures and fertilizers, human labour and bullock labour inputs were included in the study. The resource productivities of high yielding and local varieties separately for irrigated and un-irrigated area have been compared with the help of Cobb-Douglas type of production function. The study observed an excess use of bullock labour for the cultivation of wheat and maize in the study area as marginal value productivity was observed negative.

Subramanian and Selvarajan\textsuperscript{22} have observed the economic impact of resource use optimization in farms of Parambikulan Aliyar Project Region. The data were collected for the agricultural years 1973-74 and 1974-75. The data relates 360 holdings, 30 each from 12 villages selected by using random sampling in the project region. The profit maximization model of linear programming technique was used. The impact of resource


use optimization was evaluated in terms of cropping pattern, human and bullock labour utilisation and family labour income. The study indicated ample scope for increasing farm incomes and employment through resource-use optimization and water augmentation.

Mahajan and Sadhu\textsuperscript{23} have examined economic efficiency of agricultural resources in the state of Jammu and Kashmir and Punjab for the year 1977. The Cobb-Douglas type of production function was used to test the production efficiency of individual inputs. The number of farmers selected for the study was 150 by using the multi-stage random sampling method. Adult man-days, bullock labour days, tractor-hours, fertilizers and manures, seeds, irrigation, plant protection and fixed capital resources where selected for the study. Two blocks namely Batala and March from Punjab and Jammu and Kashmir states respectively were selected. The study found the regression co-efficient of estimated equation for March block turn out to be significant in case of land, fertilizers and manures and working capital, but for Batala block it was found to be significant for all variable inputs except bullock labour.

Pandey and Singh\textsuperscript{24} have analysed crop productivity and fertilizer use efficiency in the state of Haryana. Primary and secondary data were used for agricultural years 1978-79 and 1979-80 for the study. Primary data were collected from a random sample of farmers from Karnal, Jind and Mahendraghar districts. Cobb-Douglas production function was fitted to estimate fertilizer use efficiency for

\textsuperscript{24} Pandey R.N. and Singh I.J. (1981), Crop Productivity and Fertilizer Use Efficiency in Harayana, Agricultural Situation in India, Vol.36, No.9, PP-671-675.
each district, 20 small, 20 medium and 20 large farms were randomly selected. The study concluded that all categories of the farms in Karnal district use considerable high doses of fertilizers for paddy and wheat crops than the farmers of the Jind and Mahendraghar districts.

Bagi\textsuperscript{25} studied the economic contribution of irrigation to crop production in the Haryana state for the agricultural year 169-70. The data were collected from 119 individual farms. To estimate the returns to scale of various farm samples, Cobb-Douglas production function was fitted in the log liner form. The study observed under utilisation of fertilizer, irrigation and capital resources and higher technical efficiency on irrigated farms of the study area.

Subbarama Raju et al\textsuperscript{26} in their study on the resource productivity and returns to scale in groundnut production of Mehaboob Nagar district (A.P) indicated that organic manures and irrigation formed the most influencing factors under irrigated conditions while land, bullock labour and fertilizer have significantly contributed under un-irrigated farm situations. The returns to scale under irrigated conditions were found to be significantly different from unity (1.3426) at 5 percent level of probability indicating increasing returns, while in the un-irrigated farms constant returns to scale was noticed.

Murleedharan\textsuperscript{27} studied the resource-use efficiency in Kole lands in Trichur district of Kerala state. C-D production function was fitted to study the resource-use efficiency in the study area, and this resource-use efficiency in the study area, and this resource-use efficiency was tested by comparing the estimated marginal value product (MVP) of various inputs with their respective factor costs. He observed that the cultivators had not been able to allocative their inputs efficiently and there seems to be considerably scope for augmenting profit from Kole cultivation by optimum use of inputs.

Khan and Alam\textsuperscript{28} have observed the effect of land reforms on resource-use efficiency in Jammu and Kashmir. Cobb-Douglas production was fitted to evaluate resource-use efficiency. The data was collected from 15 villages in two districts of the state. The study explained the marginal value productivity of land, labour, fixed capital and variable capital were higher on owner operated farms.

Sen and Dubey\textsuperscript{29} have studied the resource - use planning in the Chiraigaon block of Varanasi, Eastern Uttar Pradesh. A sample of 37 household was drawn consisting 14 marginal farmers, 12 small farmers and 11 large farmers. The data were collected for the agricultural year 1984-85 by survey method. The study revealed that the existing resource-use pattern in the study area is not optimum.

Sharma et al.\textsuperscript{30} have examined resource-use, farm size and returns to scale on tribal farms of Himachal Pradesh state. The data were collected from the tribal district of Lahaul-Spiti for the agricultural year 1983-84. Cobb-Douglas production function was fitted to workout the elasticities of production of inputs. The study observed that the factors of production were not efficiently used. The elasticity co-efficients of inputs particularly that of labour did not differ significantly between marginal, small and large farm size. The farm size was an important factor to influence the productivity of inputs at farm level which can not be supported.

Reddy et al.\textsuperscript{31} analysed the resource-use efficiency on Betelvine cultivation in Cuddapah district of Andhra Pradesh. The major input costs were seed cost, labour cost, cost of manures and fertilizers, rental value of the land and miscellaneous costs in each year of crop period. 90 farmers at the rate of 30 in each year cultivation period, who were growing Betelvine in 1988-89, were selected for the study.

The labour cost and the rental value of the land constituted nearly 50 percent of total costs. The study revealed that there was a scope for further use of labour, manures and fertilizers upto its optimal level in the Betelvine cultivation. Further investment on seed and miscellaneous costs were not desirable.

\textsuperscript{30} Sharma H.R., Maroti T.V. and Thakur D.R. (1990), Resource - Use, Farm size and Returns to Scale on Tribal Farms of Himachal Pradesh, Agricultural Situation in India, Vol.44, No.11, PP - 885-891.

Koujalagi and Kunnal\textsuperscript{32} made an attempt to examine the resource use efficiency in Pomegranate cultivation. Cobb-Douglas type of production function model was used. The variables considered were land, number of plants per acre, labour, plant protection chemicals, irrigation, manures and fertilizers. The functional analysis revealed that 70 percent of the variation in gross returns was explained by six independent variables included in the model. The regression coefficient of number of plants per acre and plant protection chemicals were negative and non-significant. The marginal value productivities of inputs indicated that labour, irrigation and plant protection chemicals were used efficiently, while manures and fertilizers were used optimally.

Mahita and Hemachandrudu\textsuperscript{33} studied the resource-use efficiency in paddy cultivation using the secondary data for 15 years (1971-1986) from the cost of cultivation scheme, Agricultural Economics, Andhra Pradesh Agricultural University, Hyderabad. Authors noticed a very high degree of inefficiency in the use of farm resources in paddy cultivation. The study warranted the need for reorganization of farm resources because the ratio of marginal value product to marginal factor cost differed from unity for most of the resources.


Bhise and Balakistaiah\textsuperscript{34} have analysed input use efficiency on enterprised farms in Nizamabad district of Andhra Pradesh. The data was collected by personal investigation from 120 farmers pertained to the agricultural year 1988-89. The study covered two crops namely, paddy and sugarcane, 9 and 111 cultivators respectively. Cobb-Douglas production function model had been used to estimate the resource use efficiency. The study observed constant returns to scale prevailed in the case of paddy and increasing returns to scale in the case of sugarcane. The study also revealed the marginal value productivity to opportunity cost ratio for all the input variables in both the crops clearly included a high degree of resource use inefficiency. The analysis revealed good scope for reallocation of resources to improve the productivity in both paddy and sugarcane crops.

Bhat and Dhar\textsuperscript{35} studied resource-use efficiency of Apple cultivation in Baramula district of Jammu and Kashmir state. A sample of 85 apple growers were selected for the year 1983-84. Cobb-Douglas production function was fitted to estimate resource use efficiency of apple cultivation. The study revealed increasing returns to scale in apple cultivation in the study area.

Jaulkar\textsuperscript{36} has studied the input use efficiency in northern part of Madhya Pradesh and selected Bhin and Morena districts. 144 sample farms were selected from Bhind and Morena districts for the

agricultural year 1988-89. Cobb-Douglas production function was fitted to estimate inputs use efficiency. The study has shown that elasticity of production was more than one for wheat crop under tube wells and dry farms and for mustard crop under canal irrigated farms. The marginal value productivity was comparatively higher under tube wells for wheat and under canal farms for mustard, indicating the scope for further investment on crucial inputs for augmenting productivity.

Naidu and Tirupathaiah\(^37\) have made an attempt to examine the resource use efficiency and resource allocation on groundnut farms. The Vizianagaram district was purposively selected as groundnut was one of the important oil seed crops in the district. Three stage stratified random sampling was adopted to select three mandalas, nine villages and 120 groundnut farmer – respondents. Study was made for the agricultural year 1989-90. Cobb-Douglas production function was used to estimate resource use efficiency by developing functional relationship between output and inputs used in the production of the output. The functional analysis revealed the operation of constant returns to scale in groundnut cultivation. Inputs like land, human labour, seeds and plant protection exerted significant influence on gross returns. The results showed that there is scope for reorganization of resources so as to achieve higher profits. In terms of their marginal value products and opportunity costs, all the three size-groups of farms appeared to be

grossly inefficient. Nevertheless, on large and overall farms, the ratios for
human labour and plant protection were more than one, which
indicated that the utilisation of these inputs could be increased
sufficiently to enhance production and to earn higher profits.

Shukla et al.\textsuperscript{38} have examined the input use efficiency of seeds, land,
human labour and irrigation in the cultivation of gram an arhar in
Chiraigaon block of Varanasi district in Uttar Pradesh. Cobb-Douglas
production function was fitted to the field data in respect of pulse crops.
Input use efficiency is studied by estimating $b_i$ values and MVP/MC ratios.
The results indicated positive $b_i$ values for both the crops. MVP/MC ratios
also were found to be more than unity, indicating their optimum use. The
need is emphasized to ensure timely and adequate supply of the above
mentioned inputs with technical know-how at reasonable cost, within the
reach of the farmers.

Jadhav et al.\textsuperscript{39} made an attempt to study the resource
productivity in summer groundnut based on data collected from a
sample of 90 cultivators selected from three tahsils in the Sindhudurga
district of Maharastra, pertaining to the year 1989-90. The ratios of
MVPs to factor costs for land, seeds and phosphorus fertilizers were
positive and more than unity. This indicated that the crop area as well
as quantity of seeds and phosphorus fertilizers could be increased for
the optimum production of summer groundnut for higher profits.
Whereas the ratios of MVP to FC for other inputs, namely, farm yard

\textsuperscript{38} Shukla B.D., Bharati D.K. and Jha R.K. (1992), Input Use Efficiency in Indian Agriculture: A
\textsuperscript{39} Jadhav K.L. Thakare G.G. and Wadkar S.S. (1993), Resource Productivity in Summer Groundnut Production in
manure, nitrogenous fertilizer and irrigation were negative, indicating the excess use of these inputs. However, the profitability ratio for human labour was positive but less than unity. They concluded that, there is need to re-organise the various production inputs used on groundnut cultivation on for better returns.

Sunandini et al.\textsuperscript{40} evaluated the resource use and their productivity on paddy farms of West Godavari, Warangal and Nellore districts of Andhra Pradesh and opined that a high level of resource inefficiency existed in all the three districts. Tractor power, manures and fertilizers were under utilized as indicated by their profitability ratio in paddy production.

Zeaudeen and Velayutham\textsuperscript{41} have analysed the resource use efficiency in \textit{Sesamum} production in Sathiyam, Nariyur and Kothanur villages of Nellur block in Tamil Nadu for the year 1991. Data was collected by survey method for the study. Cobb-Douglas type production function was fitted to study the resource use efficiency in \textit{Sesamum} production. The study revealed that the share of human labour was the highest in the cost of production. Land, seed, manures, human labour and bullock labour, these five resources were studied for the analysis. Among the above five resources only land and human labour were found to influence the production of \textit{Sesamum} positively and significantly.


Ratna Reddy\textsuperscript{42} has studied the relationship between new technology and changing size productivity relationship in agriculture for the four years, 1971-72, 1972-73, 1976-77 and 1977-78. The data was drawn from the comprehensive scheme for studying the cost of cultivation of principal crops. The sample size of 400 households was covered under the scheme in A.P. The aim of the study was to examine the relationship between farm size and input use which included human labour, bullock labour, machine labour and material inputs. The study observed that small farmers use more labour per unit of land, whereas the use of family labour declines and the use of hired labour increases along with farm size. The use of non-labour inputs like material inputs and tractor was expected to be higher on large farms.

Mishra and Shahu\textsuperscript{43} applied the Cobb-Douglas type of production function to study the resource productivity in Bengalgram in Vindya plateau region of Madhya Pradesh. Only land input among the selected variables, influenced yield significantly. However, excessive use of seeds among the selected inputs was noticed as indicated by its negative value of regression co-efficient.

Kulkarni et al.\textsuperscript{44} have studied resource use efficiency in Easter (Paddy) farms of Rangareddi district in Andhra Pradesh. A

comparative study was made of 120 adopters and equal number of non-adopters. The data was collected by personal investigation method for the agricultural year 1988-89. Cobb-Douglas production function model was fitted to estimate resource use efficiency. The farmers were categorized into small, medium and large farms based on operational holdings. The study found that in the case of medium farms, human labour and seeds should be increased, while cattle labour component needs to be rationalized.

Hemakumari et al.45 studied allocative efficiency of resources used on Chrysanthemum flower crop in East Godavari District of Andhra Pradesh state by fitting Cobb-Douglas type production function and using marginal value product (MVP) to Opportunity Cost (OC) ratio. The results indicated that in case of large farms, MVP/OC ratios for all included variables except for plant protection chemicals were less than unity and negative implying excessive utilisation of inputs. However, MVP to OC ratio was found to be higher than unity for chemicals in small group and manures and fertilizers and human labour in medium group indicating scope to increase the use of these inputs to realize higher returns and profits.

Krishna Rao et al.46 examined allocative efficiency with respect to watershed and non-water shed villages by classifying the farmers into

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small, medium and large in the production of castor in Andhra Pradesh state. Marginal value products were calculated for each input for the three farm groups. Allocative Efficiency was then determined statistically by testing the equality between the marginal value product (MVP) and marginal factor cost (MFC) of the inputs. The result showed a considerable potential for increasing profit through reallocation of resources. Human labour was found to be under-utilised in all groups of farms while cattle labour was over-utilised by small and medium farms.

Sucharita et al.\(^47\) have studied the resource use and productivity of Turmeric crop in Nizamabad district of A.P. The total number of the samples selected for the study was 96 and Cobb-Douglas production function was used to estimate resource use efficiency. The resource use efficiency on turmeric farms revealed the operation of diminishing factor returns and constant returns to scale irrespective of size of the farm. The results showed that in large farms, there was excessive utilisation of seed and manures inputs. In the case of medium farms, fertilizers, manures and cattle labour expenditure was excess. The utilisation of the seed, manures and cattle labour were not at optimum level in the case of small farmers.

Singh et al.\(^48\) have studied the resource productivity and allocative efficiency in crop production in Mirzapur district of Eastern region of Uttar Pradesh for the agricultural year 1989-90. The data was collected


from a sample of 10 farmers in canal and tube well irrigation in the study area. Cobb-Douglas type of production function was fitted to study the resource use efficiency in crop production by least square method. The human labour, irrigation, bullock labour, tractor, manures, fertilizers and seed these seven resources were selected for the estimation of cost value. The study revealed that manure and fertilizers were the most important input affecting crop production. The study also revealed that inefficiency in the use of farm resources, both under the canal and tube well irrigation systems, the use of this farm resource needs to be reallocated and used optimally.

Chandrashekar et al.\textsuperscript{49} have examined resource use efficiency in groundnut production under rain conditions in Challakere taluka of Karnataka. A total number of 100 farmers were selected who cultivated groundnut crop during 1991 Kharif season. To test the resource use efficiency for groundnut, Cobb-Douglas production model was fitted. The production function analysis revealed that land, farm yard manure and seed in the case of small farmers contributed significantly to the production. The study also revealed that for all the categories of farmers the returns to scale were nearly constant.

Resource – use efficiency in Maize crop was studied by Koppad et al.\textsuperscript{50} in three locations of Right Bank Canal of Malaprabha Command Area using the field level data collected from 120 sample

farmers comprising 40 each from head reach, mid reach and tail reach farmers. The Cobb-Douglas type of production function fitted to the data revealed constant returns to scale in all the situations. The variables included in the model explained more than 96 percent of maize yield variation in all the locations. The resource productivity analysis examined through profitability analysis revealed that land, manure and fertilizer inputs were excessively used in head and tail reach locations. While human labour was over utilised in head and middle reach. Whereas, reverse trend was observed with respect to bullock labour use. Farmers used over dose of seeds in tail reach (-2.51) situation. It was concluded that in order to increase the gross returns, farmers have to re-organise the use of resources.

Adeolu and Isijola⁵¹ have studied resource use pattern on different farm sizes and ascertained the level of efficiency of the resources used on different farm sizes. The study was conducted in Osun state of Nigeria. Stratified sampling technique was used to select 50 farms each of small and large size. A large sized farm was defined as one with more than 10 hectares of holdings. Production functions were fixed to each category of farm sizes to determine the level of economic efficiency of resource use. The Marginal Value Productivity approach was used to estimate the efficiency of resource use when compared with their respective cost. Results obtained showed that disequilibria were prevalent in the use of farm resources by both small and large sized groups. While maize seeds, insecticides

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and fertilizer were being under-utilised on small farm size, these resources were being over used on large sized farms. However, both categories of farms need to expand their existing area of cultivable land to exploit the potential for increased farm income.

Sailaja et al.\textsuperscript{52} examined the resource productivity in vegetable farms in Guntur district of Andhra Pradesh. The data collected from 90 sample farms were analysed using Cobb-Douglas production function. The findings of the study indicated that five selected variables explained 82.5 percent variation in gross income on tomato, 86.61 percent on brinjal, 89.31 percent on cauliflower and 98.82 percent coccinia farms. The machine labour (-0.5087), plant protection chemicals (-1.2691) and seed (-0.8834) variable had negative regression co-efficients on tomato farms. Whereas, the regression co-efficients of machine labour (-0.5534) and manures and fertilizers (-0.0320) were found to be negative in the case of brinjal and coccinia farms, respectively. The co-efficient of human labour found to be positively significant on all the vegetable farms. The ratios of MVP to MFC showed that human labour on brinjal farms was the only input optimally used. Further, authors reported excessive use of seed material, machine labour and plant protection chemical on tomato farms; machine labour and plant protection chemical on brinjal farms and all the inputs except human labour on coccinia farms were excessively used. Therefore, use of these inputs needs to be reduced to optimize the

income level of farms. In case of cauliflower, farmers can realize better returns by using more of all inputs since they were under used.

Badal and Singh\textsuperscript{53} have studied resource productivity and allocative efficiency of maize crop in Bihar. The data was collected through a survey of 180 farmers from 12 villages spread across three districts of Bihar namely, Samastipur, Vaishali and Hazaribagh during the agricultural year 1996-97. The linear, quadratic and Cobb-Douglas functions were attempted to exhibit the relationship between input and outputs of sample farms for maize and its competing crops i.e. rice and wheat. The study concluded that resource use efficiency for different inputs varied widely across the crops and there was scope to reallocate the resource in order to achieve optimal allocation of inputs. High yielding varieties of rabi maize offered a greater scope for input use for enhanced productivity compared to any other crop of the season.

Sekar and Ramaswamy\textsuperscript{54} have examined resource use efficiency and factor share analysis for Mungbean in India. The study was conducted during 1998-99, in three states, namely Maharastra, Andhra Pradesh and Tamil Nadu. One district in each state and three villages in each district were selected based on likely adaptive research trial on Mungbean. A sample 50 farmers, in each state constituted the universe of the study. Different types of production functions such as linear, quadratic, square root, semi log and Cobb-


\textsuperscript{54} Sekar and Ramaswamy C. (2001), Resource - Use Efficiency and Factor Share Analysis in Mungbeen in India, Agricultural Situation in India, Vol.58, No.9, PP – 427-429.
Douglas functions were attempted to exhibit the relationship between inputs and output for the pooled data in the sample farms of India. The study indicates that even with the existing technology there is considerable scope for increasing the efficiency of resources use in Mungbean by readjustment of resources. The present MVP/MC ratio analysis implied that labour utilisation has been in excess use and needs to be curtailed. Nevertheless expenditure on Mungbean seeds may be increased to enhance Mungbean returns at farm level.

Uma Devi et al.\textsuperscript{55} have studied resource productivity and input efficiency of coffee in Visakapattnam district of Andhra Pradesh. The data was collected from 90 farmers, of two villages each from the three selected mandals viz. G.K. Veedhi, Chintapalli and Paderu district for the year 1999-2000. The Cobb-Douglas production function was used to estimate productivity and input efficiency of coffee. The study indicated the high degree of resource use inefficiencies with respect to various inputs and the productivity level in coffee can be raised by reorganizing the farms with proper adjustment of resources so as to increase profits of coffee plantations. Technical know-how must be provided to optimize the use of resources for maximizing returns.

Gaddi et al.\textsuperscript{56} have studied resource – use efficiency in Groundnut production in Karnataka. The data collected was in the form of personal interviews of 80 farmers, selected from two villages.


from two taluks of Raichur and Dharwad district each. The study had selected farmers at random, who were classified into small and large category based on the land holding. The Cobb-Douglas production function was used in this study. The study revealed that the average level of technical efficiency achieved by the sample farmers in Groundnut production was fairly high. There is a scope to pushup groundnut production in the study area, as most of the inputs were underutilized.

Senthil Kumar and Alagumani57 conducted a study in Lower Bhavani Project command area in Tamil Nadu with a view to assess the productivity, water use efficiency, equity and resource use efficiency in paddy cultivation. The command area was divided into three reaches such as Upper, Middle and Lower. From each reach 30 farmers were randomly selected; the reference year as 2000-01. Functional analysis in the form of Cobb-Douglas production function was used to determine the input-output relationship. The study has shown the existence of variation in productivity of paddy in different locations in the command area. This is due to availability of water. In upper and lower reaches manure, water and plant protection had significant influence on the income of paddy farmers where as in the middle – reach fertilizer, manure, water and plant protection were the significant variables. Resource – use efficiency analysis showed that marginal

value productivity for manure, water and plant protection were found to be greater than marginal input cost in all the reaches. This indicated that there is a possibility to increase the yield by increasing the use of these inputs in the command area.

Rangappa et al.\textsuperscript{58} made an attempt to analyse and compare the resource use efficiency in canal and tank irrigated paddy in southern transition zone of Shimoga district in Karnataka. The data were collected from 98 farmer respondents, 48 each from canal irrigated and tank irrigated paddy for the Kharif crop season 2000-01. The Cobb-Douglas production functions on per hectare basis were estimated. Similarly MVP of each rupee spent on the different inputs was also computed. The production elasticities of all the inputs except farm yard manure and bullock labour were relatively higher in the canal irrigated paddy compared to tank irrigated paddy. The yield in tank irrigated paddy was lower than the canal irrigated paddy by 10.82 quintals. Relatively lower geometric mean values were reported in tank irrigated paddy compared to canal irrigated paddy for all inputs except farm yard manure. MVP of all inputs except plant protection chemicals and bullock labour were relatively low in tank irrigated paddy. Relatively MVP of inputs was found with respect to human labour and fertilizer in tank irrigated paddy which might be due to the problems related to water management. Therefore, modernization of irrigation tanks could enable the farmers to adopt better

water management and ultimately to improve resource use efficiency as well as paddy yield.

Dibakar and Durga\textsuperscript{59} have studied the resource use efficiency on irrigated rice farms of Orissa particularly in respect to irrigation, fertilizer and area under high-yielding varieties and their impact on productivity. The required data were drawn from Orissa Agricultural statistics, Orissa for the period 1961-62 to 2003-04. Even with the expansion of area under irrigation, area under high yielding varieties and increase in application of fertilizer in the early years of 21\textsuperscript{st} century, the productivity of rice has declined even in the irrigated areas. The productivity of rice and food grains have declined by 6.97 percent and 5.77 percent during 1991-94 to 2001-04 inspite of 21 percent increase in area under irrigation, 89 percent increase in application of fertilizer and 23 percent increase in area under high yielding paddy during the period. It appears from the study that rice and other crops have not responded properly to the application of irrigation, fertilizers and high yielding varieties during the study period. Inspite of increase in area under high yielding varieties, fertilizer used and irrigation facilities, the productivity of rice and food grains have declined even to the extent of 13 to 20 percent in the irrigated areas. The yield potential of paddy crop can be exploited by resorting to increased levels of fertilizer consumption, seed

replacement and increased level of irrigation for yield and profit maximization.

Jyothirmai et al.\textsuperscript{60} A study was undertaken in Nagarjun Sagar left main canal to examine the resource use efficiency of paddy crop in the irrigated farms. The left main canal was divided into head, middle and tail regions considering the distance from the off-take point. The first division of canal (head region) with the maximum length and ayacut was considered and three distributors representing head, middle and tail based on the location with respect to distance from the main canal was selected. A total sample of 120 farmers distributed in head, middle and tail regions were selected using random sampling technique. Data were collected and analysed by employing Cobb-Douglas production function to study the resource use efficiency. The gross returns of crop was taken as dependent variable, while inputs like irrigation water, seed cost, labour cost, fertilizer cost and management index were identified as independent variables. Irrigation water was found non-significant in head and middle regions. Seed was found to be non-significant in the middle and tail regions. Fertilizer and labour were found non-significant in head the tail regions respectively. The Marginal Value Productivity of irrigation water was the highest in tail region when compared to other regions. The Marginal value productivity was less than one in head and middle regions indicating excessive use of this input.

Prakash et al. (2012)\textsuperscript{61} studied the input use pattern and production pattern in paddy cultivation. Cobb-Douglas production function has been employed to estimate the influence of factors on output change. The study has revealed that there is no significant difference in input use pattern and production pattern between owner-cultivated land and leased in land. The production estimates have revealed that the MVP to MFC ratios were greater than one for all the inputs used in both owner cultivated land and leased in land, except for plant protection, chemicals, human labour, machine labour. The ratio of MVP to MFC equal to one, indicated the optimum use of inputs.

The review of above mentioned studies on the Indian agriculture in connection of resource use efficiency indicate that resource utilisation has increased but resource productivity has not increased considerably in Indian agriculture. Some of the studies reviewed have also indicated it is wrong to assert that Indian farmers are traditional and not rational. It means farmers in traditional agriculture are generally efficient in the use of resources. Few studies observed resource use inefficiency in tribal and dry land areas. Land ownership has a limited impact on resource use and crop productivity. The evidence on extensive literature indicates that Indian agriculture is much a subject of constant returns to scale and less in favour of

increasing returns to scale and inverse relationship between farm size and quantity of output.

Resource – use efficiency assumes greater significance in Indian agriculture. There is a need for increasing agricultural production and productivity by achieving optimum utilisation of resources for the development of agriculture sector in the backward regions. Improvement in resource use efficiency makes agricultural sector more price efficient and also assures food security to the inhabitants of the country.

2.3. RESEARCH GAP

Only farm management and water resource management studies were conducted but no effort has so far been made for studying resource-use efficiency in Upper Krishna Project Command area in Karnataka. Hence due attention should be given to this issue. Therefore, the present study is an effort to examine the resource – use efficiency in the command area of Upper Krishna Project in Karnataka state.