Abstract

This paper surveys and critically reviews the major research works on resource use efficiency in agriculture. These papers analyse resource use efficiency, total economic efficiency and technical efficiency in various crops and various agricultural regions. The studies cover major farm inputs such as human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure and irrigation. The studies fail to incorporate the ideologies of resource use efficiency in the context of head, mid and tail reaches of the channel irrigation. This research gap opens the new avenue of research for the study on economics of resource use efficiency in head, mid and tail reaches in cannel irrigation based agriculture.

Key Words: Resource use efficiency; Survey of Literature

Introduction

Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. Agriculture and allied sectors like forestry and fisheries
accounted more or less 16 per cent to the GDP, about 50 per cent of the total workforce. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. The development of agriculture sector has direct impact on level of farm income as well as national income of the country.

According to FAO world agriculture statistics, India is the world's largest producer of many fresh fruits and vegetables, milk, major spices, select fresh meats, select fibrous crops such as jute, several staples such as millets and castor oil seed. India is the second largest producer of wheat and rice, the world's major food staples. India is also the world's second or third largest producer of several dry fruits, agriculture-based textile raw materials, roots and tuber crops, pulses, farmed fish, eggs, coconut, sugarcane and numerous vegetables. India ranked within the world's five largest producers of over 80 per cent of agricultural produce items, including many cash crops such as coffee and cotton, in 2010. India is also one the world's five largest producers of livestock and poultry meat, with one of the fastest growth rates, as of 2011 (FAO, 2011; World Bank, 2011).

Therefore, the economist gives more importance to study the production and productivity trend in Indian agriculture from the independence onwards. Among the studies on Indian agriculture, the studies on Indian Farm Management explored various dimensions of Indian agriculture. In particularly, the studies mainly explored the resource use efficiency in Indian agriculture. Since, the resource efficiency in agriculture places
an important role to determine the farm production and income of the farm household. The agricultural sector uses various resources such as manure and fertilizers, irrigation facilities, manpower, seeds, bullock labour, working capital, farm implements and machinery and crop protection measures etc. The farm income is determined by the efficiency with which farmers are able to utilize the resources at their command. If the farmers are efficient in the use of scarce resources then farmers can increase their household income. In Indian agriculture, the availability of resources is not the same all over the country.

In this context, the present paper surveyed and reviewed the major research works on resource use efficiency in agriculture and tries to identify the important research gap for scope for further research in the discipline of resource use efficiency in agriculture. The major works of the resource use efficiency are listed below.

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Saini (1969) To explore the resource-use efficiency in different category of farmers in the states of UP and Punjab. Human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure and irrigation Secondary data obtained from Farm Management Studies of UP and Punjab States. The allocation of various input factors depend upon the expected return on the particular crop. Thus, it concludes that the farmers are very rational in the use of their resources.

Author(s) Objective Use-Efficiency

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Bhise et.al (1992) To examine the input use efficiency in energized farms. Various input factors for paddy and sugarcane 120 agricultural households covered from paddy (60) and sugarcane (60) through the random sampling method in Nizamabad district of AP. The analysis revealed that the marginal value productivity to opportunity cost ratios for the entire input variable in both crops indicated a high degree of resource-use efficiency.

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Chandra Dinesh (1992) To analyse the resource-use efficiency in different irrigated systems. Human labour, bullock labour, seeds, fertilizer and manure and tractor power 100 farmers were surveyed by multi-stage random sampling in Ghaziabad district of UP. The study observed that human labour, bullock labour and tractor power were used in excess on all the irrigation system.

Raja (1992) To examine the farm size, resource use pattern and productivity in Indian agriculture. Various input factors for paddy cultivation 160 farmers were surveyed by random sampling method from two main blocks of Periyar district, Tamil Nadu.

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Singh et.al. (1992) To explore the input use efficiency in wheat crop.

Various input factors for wheat cultivation 200 sample agricultural households (small, medium and large) selected from the data set of cost of cultivation survey, Haryana State 1980-82. The study identified that there was more use of human labour on small farms. On medium and large farmers, more use of machine labour and less use of human labour has resulted in higher marginal value productivity of human labour.

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Objective Efficiency

Measured Resources Methodology Major Findings
Chhotan Singh et al.

(1994) To explore the resource allocative efficiency on various size of farms.

Various input factors for paddy cultivation. The data set of “Economics of Farm Mechanization and Agricultural Inputs in Salem District, Tamil Nadu” project used for analysis. The study revealed that expenditure on fertilizer, irrigation and bullock labour significantly increased the farm return on all size of farms.

Krishna Rao et al. (1994) To study the resource use efficiency in paddy. Various input for paddy cultivation. 240 agricultural households selected from watershed and non-watershed areas in Rangareddy district of AP. The study found that the utilization of human labour, cattle labour and fertilizers were not at optimum level in the case of adopters.

Chandrashekar et al. (1996) To examine the resource-use efficiency in groundnut.

Land, farm yard manure and seed. 100 groundnut farmers were selected from Challakere Taluk of Karnataka state during 1991 agricultural year. The production function analysis revealed that land, farm yard manure and seed in the case of small farmers contributed significantly to the production.

Panda (1996) To explore the relationship between various input use and various tenurial categories. Human labour, bullock labour, fixed capital, land, seeds, fertilizers and
manure and irrigation 165 various categories of tenurial households surveyed from Puri district of Orissa. The study indicates that the land ownership has a limited impact on use and crop productivity.

Raja (1996) To analyse the resource efficiency in the context of technology change.

Various input for tobacco cultivation 150 tobacco farmers surveyed from four villages in Edapadi panchaya of Salem district. The excessive or indiscriminate use of pesticides in turn leads to a decline in productivity of tobacco in most of the farmers.

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Malaprabha Command Area of Karnataka. The study concludes that the land, manures and fertilizers were over utilized in head reach and underutilized in mid and tail reach.

Velavan et.al. (2000) To examine the resource-use efficiency in groundnut.

Various input for groundnut cultivation 120 farmers selected from irrigated and un-irrigated regions in Salem district of Tamil Nadu. The study indentified that there is large scope for adding more farm inputs in both irrigated and un-irrigated groundnut cultivation.

Rama Rao et.al. (2003) To examine the technical efficiency of crop production.

Technical efficiency of various farm inputs From the Anhdra Pradesh farm management survey three representative districts were chosen for study. The study found that the technical efficiency of production is determined by farmer’s education. Therefore, it suggests that motivation of formal and informal education for farmers.

Senthil Kumar et.al (2005) To explore the resource use efficiency in paddy cultivation.

Various input factors for paddy cultivation 90 farmers surveyed from head, mid and tail reach of the Lower Bhavani Basin Project (LBP) Command Area of Tamil Nadu.

The study suggests that there is scope for further use of various input factors for enhancing the productivity.

Koshta et.al (2005) To analyse the economic efficiency of paddy production.

Various input factors for paddy cultivation 202 farm households selected from

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irrigated and rainfed regions of Chattisgarh. The cost of cultivation is much higher in irrigated area as compared to rainfed region.

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Rangappa et.al. (2005)  | To examine the resource use efficiency between canal and tank irrigation in paddy cultivation. Various input factors for paddy cultivation. The data were collected 48 respondents each from canal irrigated and tank irrigated in Shimoga district of Karnataka. Low productivity 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.

Shanmugam et.al. (2006)  | To explore the technical efficiency in agriculture production in India. Technical efficiency of various farm inputs. Secondary data used from Indian Agricultural Institute during the period of 1990-91. The technical efficiency greatly depends on agro-climatic zones, technological factors and crop mix.

Bhende et. al. (2007)  | To analyse the technical efficiency of major food and cash crops in Karnataka. Technical efficiency of various farm inputs. Secondary data used from University of Agricultural Sciences during the period of 1993-94. Educational achievements of the farm household determine technical efficiency in both food and cash
crops in Karnataka. In addition to that the farm size and technical efficiency are inverse relationship.

Fernandez I and Peter (2009) To identify the sources of input use inefficiency in sugar cane production. Technical efficiency of various farm inputs A total of 140 respondents were interviewed in Negros Island by using random sampling method.

The overall technical efficiency of sugar cane farmers in Central Negros is positively related to farmers’ age and experience, access to credit, nitrogen fertilizer application, and soil type and farm size.

Rai et.al. (2011) To measure water use efficiency in Godavari river basin in India.

Godavari Water The Chinna Ghanapur and Machavaram important river basin villages were selected for the study and Census method was adopted. Due to the frequent availability and free of cost farmers are inefficiently use the irrigation water for paddy cultivation.

Taiwo et.al. (2011) To study the resource use efficiency in hybrid and traditional maize. Various input factors for maize cultivation 100 farmers in Giwa Local Government Area of Kaduna state was surveyed by random sampling method. There is large scope for increase the resource use in both hybrid and traditional maize cultivation.
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<td>Various input factors</td>
<td>The sampling design adopted for the study was two-stage stratified random sampling method. There were 120 households selected in 12 villages of Ahmednagar district of Maharashtra.</td>
<td>The study found that the use of all resources was higher on mixed farmers compared to arable farmers in both the irrigated and un-irrigated regions.</td>
</tr>
<tr>
<td>Singh et al. (1992)</td>
<td>To explore the input use efficiency in wheat crop.</td>
<td>Various input factors for wheat cultivation</td>
<td>200 sample agricultural households (small, medium and large) selected from the data set of cost of cultivation</td>
<td>The study identified that there was more use of human labour on small farms. On medium and large farmers, more use of machine labour and less</td>
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<tr>
<td>Survey</td>
<td>Use of human labour has resulted in higher marginal value productivity of human labour.</td>
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<tr>
<td>Chhotan Singh et.al. (1994)</td>
<td>To explore the resource allocative efficiency on various size of farms.</td>
<td>Various input factors for paddy cultivation</td>
<td>The data set of “Economics of Farm Mechanization and Agricultural Inputs in Salem District, Tamil Nadu” project used for analysis.</td>
<td>The study revealed that expenditure on fertilizer, irrigation and bullock labour significantly increased the farm return on all size of farms.</td>
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<tr>
<td>Krishna Rao et.al. (1994)</td>
<td>To study the resource use efficiency in paddy.</td>
<td>Various input for paddy cultivation</td>
<td>240 agricultural households selected from watershed and non-watershed areas in Rangareddy district of AP.</td>
<td>The study found that the utilization of human labour, cattle labour and fertilizers were not at optimum level in the case of adopters.</td>
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<tr>
<td>Chandrashekhar et.al. (1996)</td>
<td>To examine the resource-use efficiency in groundnut.</td>
<td>Land, farm yard manure and seed</td>
<td>100 groundnut farmers were selected from Chawkere Taluk of Karnataka state during 1991 agricultural year.</td>
<td>The production function analysis revealed that land, farm yard manure and seed in the case of small farmers contributed significantly to the production.</td>
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<td>Panda (1996)</td>
<td>To explore the relationship between various input use and various tenurial categories.</td>
<td>Human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure and irrigation</td>
<td>165 various categories of tenurial households surveyed from Puri district of Orissa.</td>
<td>The study indicates that the land ownership has a limited impact on use and crop productivity.</td>
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<tr>
<td>Raja (1996)</td>
<td>To analyse the resource efficiency in the context of technology change.</td>
<td>Various input for tobacco cultivation</td>
<td>150 tobacco farmers surveyed from four villages in Edapadi panchayat of Salem district.</td>
<td>The excessive or indiscriminate use of pesticides in turn leads to a decline in productivity of tobacco in most of the farmers.</td>
</tr>
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<tr>
<td>Venketaraman et.al. (1996)</td>
<td>To examine the resource efficiency in tomato cultivation.</td>
<td>Various input for tomato cultivation</td>
<td>150 tomato farmers surveyed from Kolar district of Karnataka State.</td>
<td>The study pointed out that the large farmers are underutilized the fertilizers, human labour and animal labour.</td>
</tr>
<tr>
<td>Koppad et.al. (1997)</td>
<td>To analyse the resource efficiency in maize cultivation.</td>
<td>Various input for maize cultivation</td>
<td>120 farmers surveyed from head, mid and tail reach of the Malaprabha Command Area of Karnataka.</td>
<td>The study concludes that the land, manures and fertilizers were over utilized in head reach and underutilized in mid and tail reach.</td>
</tr>
<tr>
<td>Velavan et.al. (2000)</td>
<td>To examine the resource-use efficiency in groundnut.</td>
<td>Various input for groundnut cultivation</td>
<td>120 farmers selected from irrigated and un-irrigated regions in Salem district of Tamil Nadu.</td>
<td>The study indentified that there is large scope for adding more farm inputs in both irrigated and un-irrigated groundnut cultivation.</td>
</tr>
<tr>
<td>Rama Rao et.al. (2003)</td>
<td>To examine the technical efficiency of crop production.</td>
<td>Technical efficiency of various farm inputs</td>
<td>From the Anhdra Pradesh farm management survey three representative districts were chosen for study.</td>
<td>The study found that the technical efficiency of production is determined by farmer’s education. Therefore, it suggests that motivation of formal and informal education for farmers.</td>
</tr>
<tr>
<td>Senthil Kumar et.al (2005)</td>
<td>To explore the resource use efficiency in paddy cultivation.</td>
<td>Various input factors for paddy cultivation</td>
<td>90 farmers surveyed from head, mid and tail reach of the Lower Bhavani Basin Project (LBP) Command Area of Tamil Nadu.</td>
<td>The study suggests that there is scope for further use of various input factors for enhancing the productivity.</td>
</tr>
<tr>
<td>Koshta et.al (2005)</td>
<td>To analyse the economic efficiency of</td>
<td>Various input factors for paddy cultivation</td>
<td>202 farm households selected from irrigated and rainfed</td>
<td>The cost of cultivation is much higher in irrigated area as compared to</td>
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<td>paddy production.</td>
<td>regions of Chattisgarh.</td>
<td>rainfed region.</td>
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<td>Rangappa et.al. (2005)</td>
<td>To examine the resource use efficiency between canal and tank irrigation in paddy cultivation.</td>
<td>Various input factors for paddy cultivation</td>
<td>The data were collected 48 respondents each from canal irrigated and tank irrigated in Shimoga district of Karnataka.</td>
<td>Low productivity 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.</td>
</tr>
<tr>
<td>Shanmugam et.al. (2006)</td>
<td>To explore the technical efficiency in agriculture production in India.</td>
<td>Technical efficiency of various farm inputs</td>
<td>Secondary data used from Indian Agricultural Institute during the period of 1990-91.</td>
<td>The technical efficiency greatly depends on agro-climatic zones, technological factors and crop mix.</td>
</tr>
<tr>
<td>Bhende et. al. (2007)</td>
<td>To analyse the technical efficiency of major food and cash crops in Karnataka.</td>
<td>Technical efficiency of various farm inputs</td>
<td>Secondary data used from University of Agricultural Sciences during the period of 1993-94.</td>
<td>Educational achievements of the farm household determine technical efficiency in both food and cash crops in Karnataka. In addition to that the farm size and technical efficiency are inverse relationship.</td>
</tr>
<tr>
<td>Fernandez and Peter (2009)</td>
<td>To identify the sources of input use inefficiency in sugar cane production.</td>
<td>Technical efficiency of various farm inputs</td>
<td>A total of 140 respondents were interviewed in Negros Island by using random sampling method.</td>
<td>The overall technical efficiency of sugar cane farmers in Central Negros is positively related to farmers’ age and experience, access to credit, nitrogen fertilizer application, and soil type and farm size.</td>
</tr>
<tr>
<td>Rai et.al. (2011)</td>
<td>To measure water use efficiency in Godavari river basin in India.</td>
<td>Godavari Water</td>
<td>The Chinna Ghanapur and Machavaram important river basin villages were selected for the study and Census method was adopted.</td>
<td>Due to the frequent availability and free of cost farmers are inefficiently use the irrigation water for paddy cultivation.</td>
</tr>
<tr>
<td>Taiwo et.al. (2011)</td>
<td>To study the resource use efficiency in hybrid and traditional maize.</td>
<td>Various input factors for maize cultivation</td>
<td>100 farmers in Giwa Local Government Area of Kaduna state was surveyed by random sampling method.</td>
<td>There is large scope for increase the resource use in both hybrid and traditional maize cultivation.</td>
</tr>
</tbody>
</table>
Critical Review of the Literature

The studies on resource use efficiency in agriculture emerged from the 1950’s. In beginning period, the studies concentrating on resource return, production and return to scale (Heady et.al. 1954; Khusro, 1964; Desai, 1963). Later, the focuses of the study moved towards the allocative efficiency and income generation in agriculture (Raj Krishna, 1964; Schultz; 1964; Acharya, 1965; Hopper, 1965). Further, the studies reach its peak to study the resource use efficiency in agriculture.

In the case of resource use efficiency, few of the studies analyse the efficiency of farm resources such as human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure. The major crops are potato, maize, wheat and important classifications are tenure and farm size. They conclude that the scope for maximizing the efficiency of farm inputs and explained the role of tenure, farm size and other factors to enhance the recourse use efficiency in agriculture (Saini, 1969; Sankhyan et.al. 1971; Singh, 1975; Bhardwaj et.al; 1980; Chandra Dinesh, 1992; Panda, 1996).

On the other hand, some the scholars studies the resource use efficiency of various farm input of wheat, paddy, groundnut, maize, tomato and tobacco cultivation. These studies explore the role of farmer’s education for achieving resource use efficiency in agriculture. Further, they suggests that the implementation of formal and informal farm education in the surveyed agricultural regions. In addition, the gave a suggestions to improve the resource efficiency in various crops (Kuber Ram et.al. 1965; Singh Uma Shankar et.al. 1973; Muraleedharan, 1987; Thakur et.al. 1990; Bhise et.al. 1992; Shete...

The scholars like Desai, (1973), Rathore et.al. (1973), Chandrasekhar et.al. (1996) and Sampath (1979) studied the total economic efficiency of recourses like human labour, fertilizers and manure and other farm inputs. They explain the role of farm size and farmer’s economic background for enhancing the resource use efficiency. They concludes that the small farmers and economically well off farmers achieved greater efficiency in various farm inputs in the surveyed regions.

In addition to that some the studies on resource use efficiency specifically analyse the technical efficiency of various farm inputs (Rama Rao et.al. 2003; Shanmugam et.al. 2006; Bhende et. al. 2007; Fernandez1 and Peter, 2009). These studies explore that the role of farmer’s education, environmental factors and agro-climatic factor for the attainment of technical efficiency in farm inputs. Only few studies analyse the resource use efficiency in terms of various segments of the surface irrigation such as head, mid and tail reach.

**Conclusion**

In the critical review of the literature on resource use efficiency in agriculture, majority of the studies analyse the resource use efficiency in maize, paddy, groundnut, wheat, tomato, potato, tobacco and other crops. They analysed the resource use efficiency and total economic efficiency and technical efficiency in various crops and various...
agricultural regions. The studies covered major farm inputs such as human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure and irrigation. Though, the studies fail to incorporate the ideologies of resource use efficiency in the context of head, mid and tail reaches of the cannel irrigation. This research gap opens the new avenue of research to conduct the study on economics of resource use efficiency in head, mid and tail reaches.

References


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