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DIFFERENT ENERGY USED IN COTTON CULTIVATIONIN THOOTHUKUDI DISTRICT- A CASE STUDY

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Abstract

The level of productivity of crops depends upon the energy input during various farming operations. There is a direct relationship between energy use and agricultural production. Energy shortage and cost escalations will impede the growth of agriculture and its impact will be severe on crop production in the short-run. In this study, efficient management of scarce energy resources can play an important role in maintaining the growth in agriculture. This calls for energy conservation with a view to minimize energy use without affecting the crop production. To analysis the data on energy use pattern in the study area statistical tools such as multiple regression, chow's test, input output analysis, Marginal value productivity (MVP) and factor analysis are used. This study concluded from the analysis that the largest share in the production of cotton was recorded by the bullock energy and the least share went to mechanical energy. It is understood that there is a need to improve cotton cultivation technology in order to increase the efficiency of energy inputs, used in the study area. Further, there is a scope for increasing the use of energy inputs so as to earn the maximum returns, Energy use efficiency can also be improved by practicing good husbandry, as there is scope for increasing yield through the use of higher inputs efficiently. There is a direct relationship between the energy use and agricultural production of cotton.

Keywords: Energy use, Cotton Production, Productivity, inputs, efficiency, yield, marginal farmers, small farmers.

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Introduction

Agriculture is the primary sector of Indian economy and one of the major consumers of energy. The level of productivity of crops depends upon the energy input during various farming operations. There is a direct relationship between energy use and agricultural production. Energy shortage and cost escalations will impede the growth of agriculture and its impact will be severe on crop production in the short-run. In this context, efficient management of scarce energy resources can play an important role in maintaining the growth in agriculture. This calls for energy conservation with a view to minimize energy use without affecting the crop production.

Indian agriculture has witnessed four-fold increase in food grains production during the last fifty years by adopting concepts like seed technology, fertilizer application, irrigation methods and pesticide usage. Subsequently, many HYVs (High Yield Varieties) were introduced in India. They were found highly fertilizer responsive and hence increased the use of chemical fertilizers. Ultimately, the increased use of agro -chemicals in agriculture led to pollution in land, water, air and food materials.

Energy is required in agricultural sector in terms of land preparation. Intercultural sowing cultivation, operation, harvest, post harvest practice etc, In agricultural sector energy along with power is needed, It can be seen that there is relative shares of power through animal and human labour on the one hand and commercial energy on the other hand in terms of petrol, diesel, kerosene etc. The share of human and animal labour also varies widely. However, there is a crucial role of animal power in Indian agricultural practice. Energy content of fertilizers, which becomes the backbone of agriculture, must also be included in overall energy budgeting of agricultural production.

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There is a direct relationship between the energy use and agricultural production. It is evidenced from works done on comparison of energy usage in a developed country like USA and a developing country like India. For instance, in USA where the yield of cotton is 1.62 times higher than that in India, the energy consumed in cotton production is 1.88 times.In the case of maize. the corresponding multiplying factors are 2.45 and 6.69

In India. the shortage of commercial energy has created new problems in agricultural sector and which posses a serious threat to our objective of producing 200 million tonnes of food grains by the turn of the centuary. We have to bridge the gap of energy demand and supply gap of energy for producing enough food grains for the ever -increasing population.

In the present study, an attempt is made to study the possibilities and scope of using commercial energy sources efficiently as the renewable energy sources in agriculture.

Problems

With the spread of new agricultural technology requiring increased use of mechanical power and high-pay off inputs. the demand for the use of non-conventional energy sources such as diesel. petrol and electricity is steadily increasing in rural areas. Paradoxically, at the same time. the supply of these sources of energy is becoming scarce and it threatens to grow into a critical proportion. This has resulted in the high cost of production of crops with its chain of reactions ultimately affecting the consumers. A solution to this problem is to renew the sources of supply of the energy at a faster rate. Another way out is to discover and to put to use other possible substitutes such as solar energy. wind energy. atomic power and thermal power.

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However, planning for the development of these resources and developing infrastructure to facilitate their use by the farmers is a long-term process. Therefore. it becomes an important and urgent need to find a way out for the problems of cotton cultivation in their energy use. In agriculture. This need is analysed in this study by evaluating the present status of energy use by agricultural sector especially cotton cultivation and by giving useful for resources management and plan for the farmers, Therefore, a further attempt in the present study made in future pertinent to energy usage in the study area.

Objectives of the Study

The specific objectives of the study are:

1. to understand the use of energy in cotton cultivation,
2. to identify the determinant factors of energy consumption in cotton cultivation,
3. to analyse the specific problems of the agricultural sector in the use of energy,
4. to offer policy suggestions to improve the existing energy usage pattern

Methodology

The study depends upon both secondary and primary data. For the purpose of collecting the primary data. the major techniques such as observation, informal talks and interview schedule may be the best ones. The survey method is to be used as a tool for data collection and to study the energy consumption pattern of the agricultural sector of the selected villages. To analysis the data on energy use pattern in the study area statistical tools such as log-linear multiple regression, Chow's test, input Output analysis, Marginal Value Productivity (MVP) and factor analysis are to be employed.

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Review of the Study:

Deepak Shah (2012) in his study reveals that Bt cotton is the first agricultural biotech crop that has been commercialised in India. The introduction of Bt cotton has brought in its wake impressive increases in the incomes to farmers as well as profits to biotechnology companies and seed companies. The largescale adoption of Bt cotton has dramatically changed the cotton scenario of India. The impact of Bt cotton on Indian agriculture can be seen through replacement of large tracts of varietal areas of north, west and south India with Bt hybrids. These hybrids are instrumental in reducing the overall quantity of insecticides, apart from showing spectacular yield levels for cotton crop. The use of Bt cotton is visualised as a positive step towards environmental protection since it makes possible to reduce insecticide load in the environment, which leads to enhance the effectiveness of biological controls and implementation of pest management programmes. The benefits emanating from Bt cotton cultivation have increased substantially ever since government regulation in terms of price control of Bt cotton seed came into force. However, while imposition of price control in 2006 has benefited the farmers, the margins of profits for biotech providers and seed companies declined. This raises concern since price control may have adverse affect on investments made by private companies in R&D and innovation, and also on sale of new technology. Since seed price controls might reduce the incentive of the company to innovate in the future, such controls should be exercised with caution, especially in view of the long run implication of the policy on agricultural development and innovation.

Refik Polat et al., (2006) conducted a survey to determine the energy use pattern and economic analysis of cotton farming in the Southeastern Anatolia Project (SEAP) areas in Turkey. Data were obtained through a questionnaire sent to 40 cotton producers from the different villages of Sanliurfa, Turkey which is the most important cotton province of the SEAP. Basic operational data were measured by using a computer- based data acquisition system. Total energy input, total energy output,

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output/input ratio and net energy ratio were 37.910, 95.800, 2.52 and 1.532 MJ ha–1, respectively. The highest contribution to the total energy consumption came from fuel and oil energy input at 10.417 MJ ha–1. However, the lowest contribution to total energy consumption came from bund making at 99,6 MJ ha–1.

Colin Poulton et al., (2009), in their study is a background paper prepared for the comparative analysis of organization and performance of cotton sectors in Sub-Saharan Africa, a study carried out by the World Bank, with the objective of analyzing the links between sector structure and observed performance outcomes and drawing lessons from reform experience, in order to provide useful guidance to policy-makers, other local stakeholders, and interested donor agencies. It describes and reviews the cotton sector situationin Zimbabwe, where a major change in the structure of the sector occurred around 2001-03. Zimbabwe thus provides a natural experiment in increasing the degree of competition in an already liberalized sector, that holds lessons for the structuring of cotton sectors across Africa in the future.

Mohanasundaram (2015) in his paper reveals that, cotton is one of the most important commercial cash crops in India and plays a dominant role in the industrial and agricultural economy of the country. India is one of the major producers of cotton in the world with the largest acreage, almost one- fourth of the world's area. The production share is, however, only 13.5 per cent ranking third after China and USA. India is an agrarian economy with 70 per cent of its population living in villageswith agriculture as the main source of livelihood. Agriculture accounts for 22 per cent of the GDP and provides direct investment employment to 58 per cent of the country's population. Cotton crop is one of the principal crops in India and enjoys pride of place and unique position in our country. It is largely cultivated in rain fed conditions and 74 per cent of the area in our country is dependent on rainfall, while the remaining areas have access to supplementary irrigation. Against this background, this study is focused on factors influencing the cotton Cultivation and problems in cotton cultivation in Gobichettipalayam Taluk.

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Results and Discussion

Area Production and Yield of Cotton

Over the years, country has achieved significant quantitative increase in cotton production, Till 1970s, country used to import massive quantities of cotton in the range of 8.00 to 9.00 lakh bales) per annum. However, after Government launched special schemes like intensive cotton production programmes through successive five-year plans, that cotton production received the necessary impetus through increase in area and sowing of Hybrid varieties around mid 70s. Since then country has become self-sufficient in cotton production barring few years in the late 90s and early 20s when large quantities of cotton had to be imported due to lower crop production and increasing cotton requirements of the domestic textile industry.

Since launch of "Technology Mission on Cotton" by Government of India in February 2000 significant achievements have been made in and production increasing yield through development of high yielding varieties, appropriate transfer of technology, better farm management practices. increased area under cultivation of Bt cotton hybrids etc. All these developments have resulted into a turn around in cotton production in the country since last 6/7 years. The yield per hectare which was stagnant at about 300 kg/ha for more than 10 years. has increased substantially and reached a level of 554 kg/ha in cotton season 2007-08.

The fundamental changes that taking place in the realm of cotton cultivation in the country, are having the potential to take the current productivity level near to the world average cotton production per hectare in the near future. Apart from meeting the increased cotton consumption by domestic textile industry, country may have sufficient surplus cotton to meet the cotton requirements of importing countries.

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Progress with regard to area, production and yield in the country over the last ten years is enumerated as under:

Table: 1 - Area, Production and Yield for lastTwelve years

Year	Area in lakh hectares	Production in lakh bales	Yield kgs per hectare
2000-01	85.76	140	278
2001-02	87.30	158	308
2002-03	76.67	136	302
2003-04	76.30	179	399
2004-05	87.86	243	470
2005-06	86.77	241	472
2006-07	91.44	280	521
2007-08	94.14	307	554
2008-09	94.06	290	524
2009-10	103.10	305	503
2010-11	111.42	325	496
2011-12	121.78	353	493
2012-13*	116.14	334	489

Source: Cotton Advisory Board, 2012-13.
Note: *Projected

Input-Output Structure of Cotton

The input-output structure of cotton cultivation per acre between un-irrigated and irrigated area farmers is given in Table 2.

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Table: 2 - Input-Output Structure of Cotton Cultivation per acre by Un-irrigated and Irrigated Area Farmers of the Study Area

particulars	Un irrigated Area Farmers	Irrigated Area Farmers	t-value
Human Labour in man days per acre	10750	10794	0.9981
Chemical Fertilizers in kgs. per acre	910	1170	4.1121*
Farm manure in kgs. Per acre	450	480	1.4265
Pesticide cost in Rs. per acre	1525	2200	1.6975
Irrigation Cost in Rs. Per acre	890	1690	3.1599*
Bullock labour cost in Rs. Per acre	11200	10670	2.7416*
Cost of seeds in Rs. per acre	1590	1800	1.0621
Yield in tonne per acre	1.212	1.324	2.6624*
Sample Size	50	50	

Source: field Survey
*Statistically significant at 5 per cent level

Table 2 indicates the average input used and output produced by the unirrigated and the irrigated area farmers cultivating cotton in the study area. The average yield is 1.212 tonnes per acre for the unirrigated area farmers and 1.324 tonnes per acre for the irrigated area farmers.

The difference in average requirement of human labour per acre is significant and it is 81.25man days in the case of unirrigated area farmers and 86.75man days in the case of irrigated area farmers. The utilisation of fertilizer and irrigation cost is also statistically significant between the unirrigated and irrigated area farmers. The irrigated area farmers utilise more propping cost per acre than the unirrigated area farmers.

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The irrigated area farmers use Rs.13,935.26 as propping cost and unirrigated area farmers use only Rs.13.875.25 per acre of propping cost in the study area.

The other inputs, namely farm manure, pesticides and suckers are not significant between unirrigated and irrigated area farmers.

Thus, it is observed that the level of input application was greater for irrigated area farmers compared to the unirrigated area farmers. The use of chemical fertilizers, irrigation cost, propping and yield differs significantly between the two groups cost of farmers. When more intensive use of input is made by the irrigated area observed. Therefore. the hypothesis that "there is farmers, more yield is no significant difference exists between the cotton cultivation of unirrigated and irrigated area farmers" is not proved.

Cost and Return Structure of Cotton

Per acre cost and return structure of unirrigated and irrigated area farmers cultivating cotton is explained.

It is explained that the net income of Rs.34,063 earned by the unirrigated area farmers Among the different types of inputs, human labour constitutes the major cost component which is 21.34 per is lesser than that of Rs.53,534 earned cent that is 22.28 per cent of the total by the irrigated area farmers. The total cost, for the un irrigated and irrigated cost incurred by the unirrigated area farmers is Rs.69,105 which is lesser than the cost of Rs.75,375 incurred by the irrigated area farmers. Variable cost is 86.98 per cent for the unirrigated area farmers and 88.32 per cent for the irrigated area farmers. farmers respectively. Marketing cost is the next important cost component which accounts for 10.98 per cent for the unirrigated area farmer sand 16.19 per cent for the irrigated area farmers.

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Expenditure made on chemical fertilizers is greater in the case of unirrigated area farmers. It is 2.97 per cent for unirrigated farmers and 2.81 per cent for irrigated area farmers. Rent paid is 10.13 per cent for the unirrigated area farmers and 10.15 per cent for the irrigated area farmers. Other costs made on seeds, irrigation and interest on working capital are found to be lesser than eight per cent for both the groups.

Resource -Use Efficiency

The Marginal Value Productivity (MVP) of a factor input is defined as the change in value of output energy resulting from a change of one factor, keeping all other factors constam. In order to examine the resource-use efficiency in producing Output energy of cotton crop by unirrigated and irrigated area farmers. Marginal Value Productivity (MVP) of different energy inputs was computed and compared with their respective Marginal Factor Cost (MFC). The basic condition to be satisfied was to obtain efficient resource use in the equality of marginal value productivity to factor cost. In order to compare Marginal Value Productivity (MVP), with respective cost input factor, MVP has been converted into monetary terms by multiplying price of per unit output energy.

Resource-use efficiency was examined by estimating the ratio of value of MVP of different factor ‘inputs such as human energy, bullock energy, fertilizer energy, pesticides energy. irrigation energy, mechanical! Energy and seed energy to the respective price of factor input, namely marginal factor cost. Equality of MVP and factor cost (i.e. MVP/MFC=1) indicates optimum resource-use efficiency of a particular input. cost (i.e. MVP/MFC¥1) indicates the Inequality of MVP and factor degree of resource-use inefficiency. If the ratio was more than one and the regression co-efficient was significant. the resource is said to be under used. Simillarly where the ratio was less than one and the regression coefficient was significant, the resource is said to be over used.

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The marginal value productivity of factor inputs and the ratio of marginal value product to the respective cost of the factor inputs for unirrigated and unirrigated area farmers producing cotton are presented inTables.3

Figure :- Per Acre Energy Consumption of Various Energy Inputs for Smalland Marginal Farmers Cultivating Cotton in Un-irrigated Area

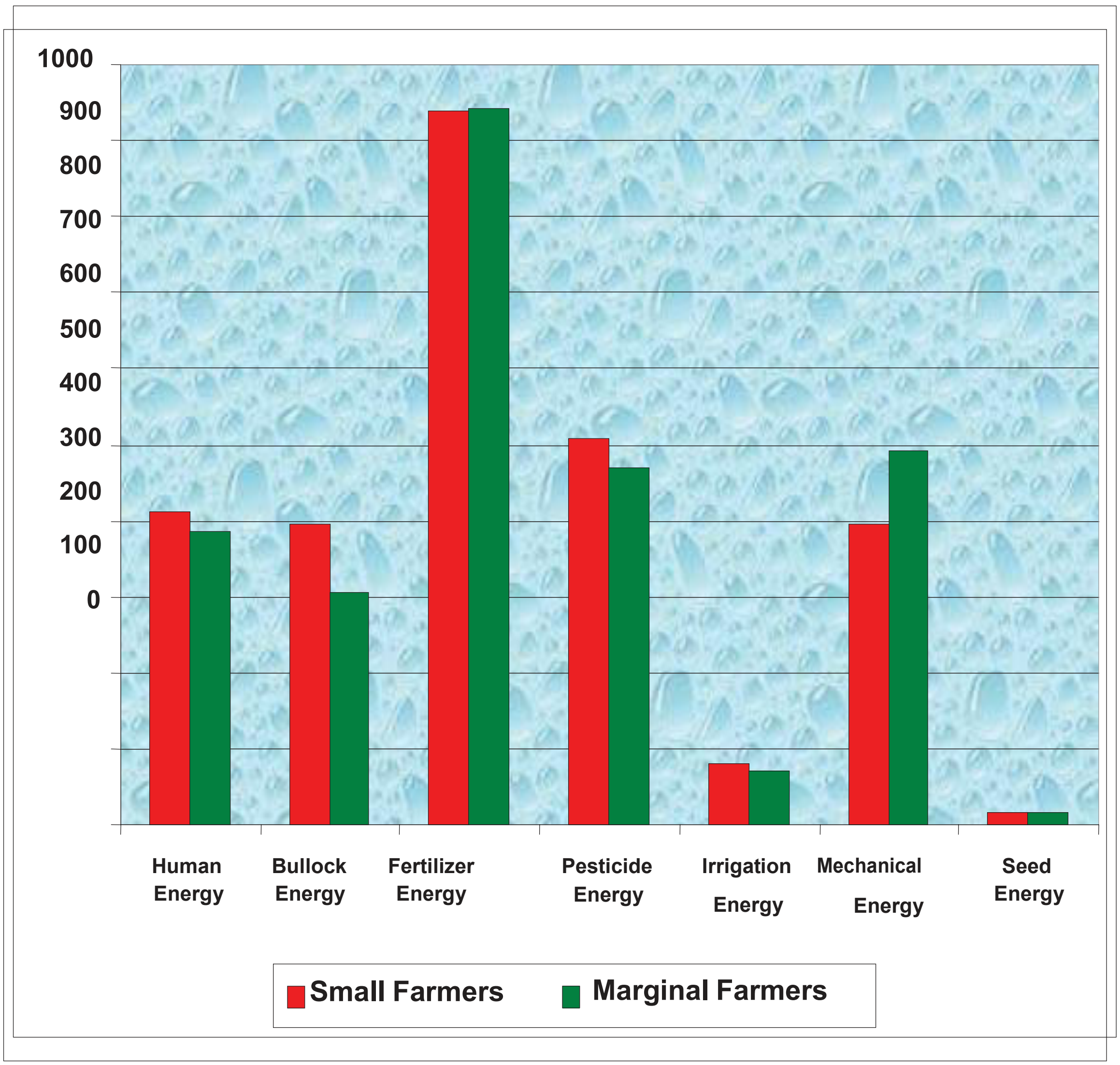

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Table: 3 - Resource-Use Efficiency of Different Energy Inputs for Un irrigated and Irrigated area Farmers

Variable	Mean Level	Elasticity	M.V.P (in Rs)	M.F.C (in Rs)	Ratio of MVP to MFC
Human Energy	389.35	0.719*	1.28	12.36	0.10
Bullock energy	350.93	0.1042*	0.84	0.99	0.85
Fertilizer energy	879.82	0.2267*	0.74	1.53	0.48
Pesticide Energy	298.51	0.0792	0.75	4.07	0.18
Irrigation energy	94.86	0.1168*	3.47	5.19	0.67
Mechanical Energy	381.00	0.0417*	0.32	2.81	0.02
Seed Energy	16.27	0.0782	13.52	15.73	0.86

Source: Field Survey

Note: * Indicates the coefficients are statistically significant at 5 Percent level.

It is observed from table 3 that the ratio of MVP to MFC in respect of Significant inputs namely human energy. bullock energy fertilizer energy and irrigation energy for small farmers producing paddy was0.10, 0.85, 0.48 and 0.67 respectively. This indicates that for every additional rupee spent on these variables. Gross revenue of cotton could be increased by Rs.0.10, Rs.0.85, Rs.0.48 and Rs.0.67 rupees respectively. Among the significant variables. Bullock energy was found to be the most important factor input' in the production of cotton. The ratios of all other variables namely pesticide energy. mechanical energy and seed energy were more than unity but they were found to be non-significant.

Thus, it may be inferred from the analysis that the inputs like human statistically significant at 5 per cent level. energy, fertilizer energy and irrigation energy were under utilised in cotton production in the study area in the both the groups of farmers, In the case of unirrigated area farmers, mechanical energy was found to be underutilised. Hence, it could be concluded that there is scope for increasing the use of resource inputs for cottonproduction by both the groups of farmers to maximise the return.

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Conclusion

The study reveals that main reason for this is uneven rainfall conditions, high usage of traditional (or) old methods, financial assistance, lack of degradation of natural resources, failure in conservation and improvement of rained land. knowledge gap with existing technology. low market, too much regulations for marginal farmers and small farmers. The study observed that the level of input application was greater for irrigated area farmers compared to the unirrigated area farmers, The use of chemical fertilizers, irrigation cost, propping cost and yield differs significantly between the two groups of farmers. When more intensive use of input is made by the irrigated area farmers, more yield is observed. It is concluded from the above analysis that the largest share in the production of cotton was recorded by the bullock energy and the least share went to mechanical energy. It is understood that there is a need to improve cotton cultivation technology in order to increase the efficiency of energy inputs, used in the study area. Further, there is a scope for increasing the use of energy inputs so as to earn the maximum returns.

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