International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182 ISSN Print: 2349-5979
Received: 06-01-2023, Accepted: 23-01-2023, Published: 09-02-2023
Volume 10, Issue 2, 2023, Page No. 3-6

A study on energy use pattern and its efficiency in paddy cultivation in Warangal district of Telangana state

Devakka Jannarapu
Research Scholar, Department of Economics, Kakatiya University, Warangal, Telangana State, India

Abstract
Agriculture is a biological industry, and in India, even after six decades of planned economic development, it is still a way of life for the country's people. One of the requirements for sustainable agricultural output is the effective use of energy resources in agriculture. The Indian energy-intensive paddy production is to blame for several environmental issues. The current study was conducted in this context to analyse the energy consumption pattern in paddy cultivation across various farm categories and calculate energy use efficiency (EUE) in Telangana. The amount of energy used to cultivate paddy was 47014.69 MJ/ha, and the average energy use was inversely correlated with farm size. Chemical fertilisers were the primary source of energy (42%) and were followed by the use of power for irrigation (36.05%), machine energy (18%), diesel fuel (17%), human labour (1.36%), and FYM (1.11%). The use of chemical, mechanical and electrical energy varied positively with the farm size, while it varied negatively for human and animal labour, seed and FYM.

Keywords: energy use efficiency, farm category, inputs, paddy, renewable

Introduction

Agriculture is India's leading economic sector and continues to be one of the most energy-intensive. Crop production is determined by the amount of energy used during various farming operations. The utilisation of energy and agricultural output are inextricably linked. Agriculture's expansion will be hampered by energy shortages and cost increases, which will significantly impact crop production in the short term. In this setting, efficient management of limited energy resources can be critical to agriculture's continued growth. This calls for energy conservation, intending to minimise energy use without affecting crop production.

In the agricultural sector, energy is necessary for land preparation, planting, cultivation, intercultural operations, harvesting, and post-harvest practices, among other things. Therefore, energy, as well as power, is required in the agricultural sector. There is a relative share of power generated by animal and human labour on the one hand and commercial energy in the form of gasoline, diesel, and kerosene on the other. The proportion of human and animal labour varies significantly. On the other hand, animal power plays a critical role in Indian agricultural practice. Therefore, fertiliser energy content must be factored into the total energy budgeting of agricultural production. Fertilisers are the backbone of agriculture.

Rural villages are the backbone of the Indian economy, as they are home to most of the population and are heavily involved in agriculture. As the people of India's way of life, agriculture relies on commercial and non-commercial energy, and agricultural output is proportional to energy consumption. The sector has become a growing direct and indirect energy consumer. Farmers use many types of energy to increase agricultural output by employing intensive agricultural methods that are in step with technological advances. It has significantly raised the demand for commercial energy, reducing the importance of non-commercial energy. The pattern and drivers of energy use in agriculture are influenced by the style and method of agricultural operations.

Energy is an evident input in all sorts of food and physical comforts required for humanity's survival. The energy a living being has is determined by the food they ingest. If it is an apple, eating it will allow you to work while also keeping your body warm. As a result, an apple has some energy, and man needs to find something to work with. As a result, energy usage is an inextricable aspect of human life and agriculture. Energy is a concept created to account for the fact that when heat or work is given into or removed from a system and the system ends up in a different state, some system features must account for the change. As a result, a particular system under a certain set of circumstances has a specific energy content.

Classification of energy

Direct energy sources include electricity, diesel, and human and animal labour, whereas indirect energy sources include fertiliser, chemicals, machinery, etc. The conversion factors were created by the Indian Council of Agricultural Research (ICAR). Commercial and non-commercial energy sources are categorised based on their comparative economic value. Purchased seeds, fertilisers, insecticides, power, diesel, machinery, and other commercial energy sources are readily available, whereas non-commercial energy sources include homegrown seeds, human animals, farmyard manure, and so on.

Physical energy inputs

1. Human Labour
2. Draft Animal
3. Mechanical Power Sources

a. Direct Energy
b. Indirect Energy Input for Energy Sequestered

Review of literature

Agriculture is a biological industry, and in India, even after six decades of planned economic development, it is still a way of life for the country's people. Agriculture accounted for 17.8 per cent of the GDP (at constant prices in 2007-08), Lal (2011) [6].

Shen Yuan (2017) [15]. In order to ensure energy security and the long-term sustainability of rice production in central China, it is essential to reduce energy inputs and improve energy use efficiency (EUE). Central China accounts for 52% of the country's total rice-farming land and output. We used an input-output energy analysis to determine energy input and EUE in farmers' practice (FP) and simplified and reduced-input practice (SRIP) for these analyses. Energy input, energy output, and rice grain yield were estimated to be 34544.4 and 25241.5 MJ ha1, 264744.9 and 232393.0 MJ ha 1, and 9171.3 and 8449.9 kg ha1 in FP and SRIP, respectively.

Powar (2017) [11], The energy consumption trend of paddy growing practices in Maharashtra's Konkan region is highlighted in this study. 61538.52 MJ/ha, 0.76 MJ/kg, 2.12, 1.16 kg/MJ, and 9.13 kg/m3 were found to represent the net energy, specific energy, energy output-input ratio, energy productivity, and water productivity for paddy agriculture. The indirect energy contribution (53.64 per cent) was higher than the direct energy contribution (46.16 per cent). Diesel fuel (82 per cent) and chemical fertilisers (49 per cent) provided the most direct and indirect energy, respectively.

Prasannakumar (2011) [10]. The study examined how much energy is used in paddy cultivation in Raichur's irrigated areas. The fertiliser was discovered to be the most energy-dense source, accounting for 3,054 megajoules (MJ) per acre or 54.53 per cent of the total energy used in paddy production. Small farmers (6,137MJ/acre) used much more Medium (5,401MJ/acre), and large (5,303MJ/acre) farmers used total energy for paddy farming. The operation-by-operation energy consumption pattern in rice cultivation revealed that ploughing consumed the most energy (308 MJ/acre), accounting for 20.58 per cent of the total energy used for all paddy cultivation operations. The total cost incurred per unit of input energy was 2.88 per MJ in paddy cultivation.

Landholdings are fragmented without minimum facilities such as irrigation, transportation, marketing, etc. Moreover, these holdings are unfertile too. As a result, Banjaras could not have adequate income to lead a dignified life by cultivating these lands. Therefore, they are forced to depend on other alternative sources of income. In this way, they were forced to migrate to urban areas for livelihood, Lal (2015) [4].

Lal (2018) [5] explains that inadequacy and uncertainty of rainfall often cause partial or complete failure of crops leading to recurring scarcity and drought crises. The total area under drip and sprinkler irrigation is used hugely for growing horticultural crops in the Rayalaseema region of Andhra Pradesh. The yields have been economically rewarding, and farmers also extended up to vegetables and fruit cultivation in drought-prone areas of Andhra Pradesh.

They were expected to plan and formulate rural development programs, transfer appropriate technology supported by technical services, undertake workforce development, provide training and disseminate information to the rural population, Lal (2004) [7].

Objectives of the study

The overarching goal of this research is better to understand current patterns of energy use in agriculture and to make policy recommendations for a brighter future. As a result, the study's precise objectives are as follows:

1. To study the particulars of paddy farmers in the study area.
2. To investigate the energy requirements for paddy cultivation.
3. To identify the constraints perceived by the farmers in the study area.

Methodology

For the study area selection, the Warangal district of Telangana State was selected purposively for the study. From the district, two villages from Nadikuda and Dharmaram were selected. From each village, 25 farmers were selected for the study, and 50 samples were.

Results and discussion

Table 1: Average Energy Input and Output for Paddy Cultivation (Per Acre) (in MJ)

Particulars of Input/ Output	Small Farmer	Large Farmer
Total Energy Input	2390.74	2391.56
Total Energy Output	2184.34	2896.01
Net Energy Output	433.60	524.45
Energy Output/ Energy Input	2.08	1.12
Net Energy output/ Energy Input	1.09	0.29

Source: Field study

In the paddy production process, the energy output-input ratio was more than one. This implies that both small and large farmers were utilising energy inputs effectively. However, it means that paddy crop production technology needs to be improved in order for large farmers' energy inputs to be more efficient. Small farmers received 1.09 mj for every megajoule spent on paddy production, whereas large farmers received 0.29 megajoules.

Table 2: Distribution of Sample Respondents based on Size of Land Holding

S. No.	Size of Land	No. of Respondents	Percentage
1.	Below 2 acres	22	44.0
2	3 to 4 acres	16	32.0
3.	5 acres & above	12	24.0
	Total	50	100

Source: Field study

Table 3 indicates the magnitude of the prevailing inequality in land ownership by distributing village households based on their held land area. While the bottom 44.0 per cent of households in the study area are landless or possess less than two acres of land, the top 24.0 per cent own more than five acres, and the remaining 32.0 per cent own 3 to 4 acres. The distribution of land ownership among households shows significant inequalities.

Table 3: Distribution of Respondents based on Irrigation

S. No.	Basis of Irrigation	No. of Respondents	Percentage
1.	Irrigated	40	80.0
2.	Un irrigated	10	20.0
	Total	50	100

Source: Field study

The table reveals that out of the 50 households in our pilot survey, 80.0 per cent have irrigation infrastructure on their lands, which range in size from a few acres to several acres. However, 20.0 per cent of the households need more irrigation access to their paddy fields, according to the owners of paddy fields. Because the research region is located on the banks of the Godavari and Krishna Rivers, most of the study area's land has water all of the time.

Table 4: Sources of Irrigation for Paddy Cultivation

S. No.	Sources	No. of Respondents	Percentage
1.	Pond	7	14.0
2.	Canal	30	60.0
3.	Well	5	10.0
4.	Pump set	8	16.0
	Total	50	100

Source: Field study

The cultivators' irrigation sources are listed in Table 5. Canal irrigation is the most common type in the study region, with roughly 60.0 per cent of the respondents using it. Pump irrigation is used by about 16.0 per cent of the respondents as a substitute for canal irrigation. However, only a few of the respondents use ponds and wells, with 14.0 per cent and 10.0 per cent. Because the study region is primarily located solely on canal irrigation. The residents in this area have been cultivating rice, a primary food item.

Table 5: Types of Seeds Used by Sample Respondents

S. No.	Particulars	No. of Respondents	Percentage
1.	Traditional Seeds	7	14
2.	High Yielding Varieties (HYV)	43	86
	Total	50	100

Source: Field study

The types of seeds used in the study area are listed in Table 7. Traditional seeds and High Yielding Varieties are the two types of seeds used by farmers. The bulk of the 43 (86 per cent) farmers employed High Yielding variety, while only 7 (14 per cent) farmers used traditional seeds.

Table 6: Yield of Crop of Paddy Per Acre

S. No.	Yield (peracre)	No. of Respondents	Percentage
1.	20 to 25 bags	2	4
2.	25 to 30	8	16
3.	30 to 35	13	26
4.	35 and above	27	54
	Total	50	100

Source: Field study

The yield per acre of paddy farming in the research area is shown in Table 7. Out of the 50 respondents, 27 (54 per cent) have a high yield per acre, i.e. 35 bags or more, and 13 (26 per cent) have a high yield per acre, i.e. 31 to 35 bags in their cultivations. However, only 2 (4 per cent) of farmers achieve yields of 20 to 25 bags per acre, whereas 8 (16 per cent) get yields of 25 to 30 bags per acre. The production disparity is attributed to variances in the farmers' agronomic methods in the study area.

Table 7: Classification of Sample Farmers based on Crops and Season of Cultivation

S. No.	Season	No. of Respondents	Percentage
1.	Rainy	22	44.0
2.	Winter	16	32.0
3.	Summer	12	24.0
	Total	50	100
	Cropping Pattern		
1.	BPT	16	32.0
2.	MTU	17	34.0
3.	Swarna	7	14.0
4.	Sona Masuri	10	20.0
	Total	50	100

Source: Field study

The above Table 8 classifies the nature of the season of crops in the study area. Generally, farmers in the Warangal district take three-time cultivation in the Rainy, Winter and Summer seasons for paddy crops. In the survey, nearly 44.0 per cent followed Rainy, and 32.0 per cent relied on winter, but 24.0 per cent of farmers could cultivate summer crops due to water scarcity. In the cropping pattern, BPT and MTU have been covered by many farmers, reaching around 34.0 per cent. The rest cultivated Swarna and Sona Masuri, which comes to around 20.0 per cent.

Table 8: Main Problems of paddy cultivation

S. No.	Problems of Cultivation	No. of Respondents	Percentage
1.	Irrigation (Electricity)	12	24.0
2.	Fertility soil	4	8.0
3.	Labor problem	15	30.0
4.	Money problem	6	12.0
5.	Marketing	4	8
6.	Availability of inputs	6	12
7.	Others problem	3	6
	Total	50	100

Source: Field study

The main issues with paddy agriculture in the research area are summarised in Table 9. During peak harvesting seasons, 30.0 per cent of responders (out of 50) face labour shortages. 24.0 per cent of respondents need help with irrigation, 12.0 per cent have a problem with money, and 12.0 per cent have a problem with sufficient inputs. Soil fertility and marketing are two of the most common problems, accounting for 6.0 and 8.0 per cent of the total. In recent years, farmers have primarily faced labour shortages and power outages.

Conclusion and Suggestions

With net energy gain, paddy cultivation is energy efficient in Telangana, but over-whelming consumption of electric and chemical fertiliser energy underpins the opportunities for energy saving. Paddy cultivation primarily depends on commercial, non-renewable and indirect energy forms, which need to improve the sustainability of paddy production and soil ecology of agricultural lands in the state. Energy management at the farm level needs serious attention for efficient and economical use of energy and safeguarding the agroecosystem. Lack of knowledge of scientific recommendations, improper use of modern means of energy, subsidisation of commercial energy and prevailing myth and mindset of the farmers are the most likely obstacles to efficient energy utilisation which need to be addressed. Strengthening extension services can encourage the judicious use of energy-intensive inputs by replacing these with alternative organic sources and by adopting recommended farming practices. Farm-level adoption of environment-friendly technology of paddy cultivation, *viz*. direct seeded technology (DSR), may also help in saving energy without compromising output level.

- Canal irrigation is the most common type in the study region, with 57.5 per cent of farmers using it. Because the research area is primarily located along the banks of the Cauvery River, most farmers rely solely on canal irrigation.
- Most farmers (88%) use High Yielding variety, while only 12% use traditional seeds. Most farmers favour high-yielding variety seeds since they produce a higher yield and are less expensive to cultivate than traditional methods.
- Generally, both male and female members participate in all farm operations and depending on the availability of labour in the study area, family or hired labour is used.
- Telecommunications and television in India can help actively increase food production, achieve social and economic development and provide access to education. Many people with disabilities can work and support themselves, leading lives as they choose because of support from computers, Lal (2004) [7].
- Farming technology mechanisation and ongoing land improvement activities necessitate significant financial investments. Therefore, sincere efforts will be made to attract agricultural entrepreneurs to the area to boost private investment. Temporary measures include increased and timely disbursement of cultivation needs, reduced power tariffs and power cuts.

References

1. Bhatnagar AP, Panesar BS. Energy Conservation in Agricultural Production and Agro-based Industries, Energy Management, 1989, 48-57.
2. Dhawan KC, Mittal JP. Role of Fertilisers in Increasing Yield of Various Crops in India, Economic Affairs,1990:39(2):95.
3. Dhulasi Birundha Varadarajan. Energy Economics, New Delhi: Sterling Publishers Private Limited, 1993, 1.
4. Lal B. Suresh. Socio-Economic and Health Issues of Banjaras in the Era of Globalization: A Study in Telangana Tribal Villages, International Journal of Physical and Social Sciences (IJPSS), Vol-5, Issue-6, June, 2015, 195-211. https://www.researchgate.net/publication/277534999
5. Lal B. Suresh (ed) Transformation of Agrarian Economy, Adhyayan Publishers & Distributors, New Delhi, 2018. https://www.researchgate.net/publication/368283341
6. Lal B Suresh. Impact of Globalisation on Indian Agriculture and farmers' Suicides: Issues and Challenges, 2011. DOI:10.13140/RG.2.2.14546.40642. https://www.researchgate.net/publication/333718678
7. Lal B Suresh, Rama B, AS Hussain. Information Technology For Rural Development: An Overview, The Economic Challenger, 2004:6(23):34-37. https://www.researchgate.net/publication/353902977
8. Malcolm Slesser. Energy in the Economy, London: The Macmillan Press Ltd, 1978, 13.
9. Pachauri RK. Economics of Energy use in Agriculture, Indian Journal of Agricultural Economics,1998:53(3):213-222.
10. Prasannakumar PS, Hugar LB. Economic analysis of energy use in paddy cultivation under irrigated situations—Karnataka Journal of Agricultural Sciences,2011:24 (4): 467470.
11. Powar RV Shahare PU, Aware VV, Deogirikar AA. Energy audit of paddy cultivation practices in Konkan region of Maharashtra, International Journal of Agricultural Engineering, 2017:10(2):647-654.
12. Ramasamy S., and Tamizh Chelvam T., (2001). Energy Scenario of an Indian Village in 2001 AD, Energy Options for 21st century, 2017, 103-125.
13. Reshma Chengappa, Indumati S, Jeyaraj H. Energy Budgeting for Paddy and Ginger: A Comparative Study, Southern Economist,2009:47(19):31-32.
14. Shahan S, Jafari A, Mobli H, Rafiee S, Karimi M. Energy Use and Economical Analysis of Wheat Production in Iron: A Case Study from Ardabil Province, Journal of Agricultural Technology,2008:4(1):77-88.
15. Shen Yuan, Shaobing Peng. Input-output energy analysis of rice production in different crop management practices in central China, j. energy, Energy,2017:141:1124e1132.