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Assessment of Mechanization Index of Sugarcane Cultivation in Mandya District, Karnataka, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Farm mechanization is the development and introduction of mechanized assistance of all forms and at any level of sophistication in agricultural production to improve the efficiency of human time and labour. Mandya District is one of the most agriculturally prosperous districts in Karnataka. Sugarcane is the major commercial crop in the district. Farmers used to grow in all seasons. This study was carried out to assess the mechanization index in sugarcane cultivation in selected regions. Respondents from the selected region were selected randomly and collected information regarding types of machinery availability and usage in sugarcane cultivation. The overall mechanization index found 50.5 per cent in sugarcane cultivation in selected regions. The findings

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indicate that the process of laying seed beds had the highest mechanisation index (98.46 per cent), followed by irrigation (97.37 per cent) and weeding/spraying operations (57.81 per cent). Semi medium farmers found high mechanization index followed by medium, small and marginal farmers. The mechanization index was not uniform in selected region for all operations in sugarcane cultivation. Seedbed preparation found higher mechanization index followed by irrigation and weeding operation and zero per cent mechanization index for planting and harvesting operations of sugarcane. The results clearly depicted the importance of the farm mechanization in realizing additional profit to the farmers.

Keywords: Sugarcane; farm mechanization; Mandya; Karnataka; mechanization index.

1. INTRODUCTION

"Agricultural mechanization is enabled by technologies that create value in agricultural production practices through the more efficient use of labour, the timeliness of operations, and more efficient input management with a focus on sustainable, high-productivity systems" (Reid, 2011) and [1].

"Mandya District is one of the most agriculturally prosperous districts in Karnataka. With the advent of irrigation from the K.R. Sagar reservoir (During the 1930s), there was a substantially marked transformation in cropping pattern, the composition of crops, better growth yield level, ultimately leading to better economic conditions for the people" [2].

"The total geographical area of the district is 4,98,244 ha, out of which 2,48,825 ha forms the cultivated area. More than half of the total land area in the district is put to agricultural use. The total irrigated area is 1,16,901 ha out of which around 88,000 ha is being irrigated by K.R. Sagar and around 16,000 ha by Hemavathi reservoir. The rest of the land is irrigated by other sources like tanks, wells and bore wells" [2].

Agriculture is the main activity in the district. The major crops of the district are sugarcane, ragi, rice, pulses and oilseeds. Sugarcane is the major commercial crop in the district. Farmers used to grow in all seasons. In the kharif season, farmers cultivate sugarcane around 31800 ha with a production of 35,24,500 tonnes and a productivity rate of 111 tons/ha and also in the rabi/summer season cultivate around 4860ha with a production of 5,34,600 tons and a productivity rate of 111ton/ha [2].

"Mechanization may be defined as the process of injecting power and machinery between man and materials in a production system" [3]. Verma [4] reported that "agricultural mechanization implies the use of various power sources and improved farm tools and equipment, with a view to reduce the drudgery of human beings and draught animals, enhance the cropping intensity, precision and timelines of efficient utilisation of various crop inputs and reduce the losses at different stages of crop production". Starkey [5] defined "farm mechanization as the development and introduction of mechanized assistance of all forms and at any level of sophistication in agricultural production to improve the efficiency of human time and labour".

Joppich [6] in his study reported that "mechanization affects the cost structure of agricultural production by (i) Saving labour (manual and bullock) (ii) Easing jobs (iii) Increasing yield and (iv) Facilitating the opening up of new land". "The problem of labour shortage put the farmers to increased use of machine power in operations like field preparation, harvesting, winnowing and transportation. The use of efficient machines in agricultural mechanization improves the utilization efficiency of inputs like fertilizers and agrochemicals and reduces the negative impact on the environment" [7]. Mohanaselvan et al. [8] was worked on "the Mechanization Level and Occupational Health Hazards in Sugarcane Cultivation in India where he suggests that cost-effective, simple interventions to prevent these injuries, like face shields, hand gloves and footwear". "The suggestions of this study are implementable in developing nations to protect sugarcane workers who perform various activities manually. In India, farm mechanization is growing at less than five per cent in the last two decades. Achieving/ attaining of the government's target of doubling farmers' income in upcoming years is possible through large-scale mechanization as it will bring down the cost of cultivation" [9]. "Further, the use of agri-machineries will help increase production by 20 per cent and bring down the cost of cultivation by 20-25 per cent. Farm

mechanization is key for modernizing the agriculture sector" [10], With this background, this study mainly focused on assessing the mechanization index in sugarcane cultivation in Mandya district, Southern Dry Zones of Karnataka.

2. METHODOLOGY

Based on the population of farmers, samples of 50 farmer respondents from the Thaggahalli village in Mandya district were selected randomly. Thaggahalli is one of the major sugarcane production villages in Mandya district. Respondents were categorised into marginal, small, semi-medium, medium and medium farmers based on land holdings. General information regarding the use of different types of machinery and types of equipment, cultivable land availability, different farm operations they followed to cultivate sugarcane, labours and time consumed for different operations, machines used, energy/fuel/power required for different operations, costs and returns of different crops and also the relevant data on variables related to the study etc., were collected from the sample respondents. The data collected were purely based on the memory of the respondents. Therefore, the sample respondents were convinced genuinely about the purpose for which the data was collected at the time of the interview in order to minimize personal bias.

a. Mechanization Index

The mechanization index was calculated by following the formula

$$\text{Mechanization Index} = \frac{MP}{MP+Ap+HP} \times 100$$

Where,

MP - Mechanical power
AP – Animal Power
HP – Human Power

3. RESULTS AND DISCUSSION

The respondents were categorised into marginal (< 1ha), small (1-2 ha), semi medium (2-4 ha), medium (4-10ha) and large farmers (>10 ha) based on land holdings. There were 30 per cent of marginal farmers, 40 per cent of small farmers, 26 per cent of semi-medium farmers and 4 per cent of medium farmers present in the selected region.

3.1 Energy consumption for the Sugarcane Crop Production Operations

The energy requirement for the sugarcane crop cultivation was elaborated in the Table 1 and also provided information based on the different operations. These information also an important for the machinery index estimation.

3.2 Mechanization index in sugarcane cultivation based on type of farmers

The mechanization index in sugarcane cultivation in the selected region based on the type of farmers is shown in Table 2. The total mechanization in sugarcane cultivation in the selected region was about 50.5 per cent. The mechanization index was high in semi-medium farmers followed by medium, small and marginal farmers. The mechanization index in sugarcane cultivation of semi-medium farmers was about

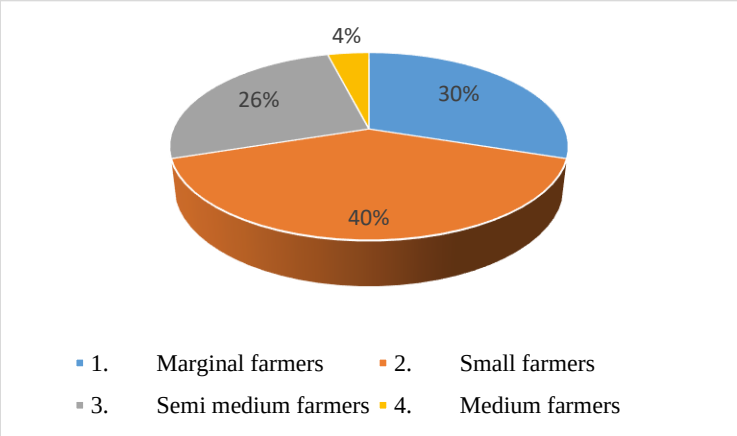

Fig. 1. Type of farmers based on land holdings

51.85 per cent, for medium farmers it was about 50.62 per cent, for small farmers 50.19 per cent and for marginal farmers it was about 49.34 per cent.

The results show the mechanization index of marginal farmers in sugarcane cultivation was minimal in selected regions, this may be due to small land holdings farmers preferring animal and human labours rather than mechanical power. As per the previous and present studies the mechanization index was increased like some of researchers mentioned in their works Felix et al. [11], Ashraf et al. [12].

Table 1. Energy consumption by various machineries in paddy cultivation

	Machinery used	Human	Fuel	Machinery	Total
Initial Tillage	Tractor + rotovator(2)	7.3	1208.4	68.4	1284
	Power tiller+ rotovator(2)	26.3	943.2	35.4	1004.9
	Tractor + cultivator(2)	9.8	854.5	79.6	943.9
Sowing	Manual line sowing	203.6	882(seed)	-	1085.62
Transplanting	Transplanter	1292.2	573.0	65.8	1931
	Manual Random Transplanting	3441.1	-	-	3441.1
	Manual Line transplanting	3605.4	-	-	3605.4
Weeding	Power weeder	627.2	262.9	4.6	894.7
	Manual weeding	881	-	-	881
	Manual single row weeder	835.2	-	40.0	875.3
Spraying	Power operated knapsack sprayer	412.4	127.1	1.4	540.9
	Battery operated knapsack sprayer	490	14.3	3.7	508.0
	Hand held sprayer	559	-	1.9	560.9
Fertilizer broad casting	Fertilizer Broadcaster	53.4	-	17.1	70.4
	Manual	65.3	-	0.0	65.3
Harvesting (Combine) 0	standard- 60 hp, 7 feet	6.7	813.7	319.4	1139.8
	claas, 60 hp, 12 feet	9.8	1055.8	363.7	1429.3
	Johndeere- 75 hp, 12 feet	5.8	827.8	276.2	1109.7
Straw baling	Tractor operated baler	4.9	492.7	53.4	551.0
	Manual	235.5	-	-	235.5
	Tractor operated baler	3.4	526.5	36.4	566.3

Table 2. Mechanization index in sugarcane cultivation based on type of farmers

Sl.no	Type of farmers	Mechanization index, %
1.	Marginal farmers	49.34
2.	Small farmers	50.19
3.	Semi medium farmers	51.85
4.	Medium farmers	50.62
5.	Large farmers	-
	Total	**50.5**

Table 3. Mechanization index in sugarcane cultivation based on operation

Sl.no	Type of farmers	Seedbed preparation	Planting	Weeding/spraying	irrigation	Harvesting	Total
	Marginal	95.3	-	57.69	93.7	-	49.338
	Small	99.16	-	54.102	97.665	-	50.1854
	Semi medium	99.64	-	60.66	98.94	-	51.85
	medium	99.725	-	58.76	99.15	-	50.62
	Large	-	-	-	-	-	-
	Total	**98.46**	**-**	**57.81**	**97.37**	**-**	**50.5**

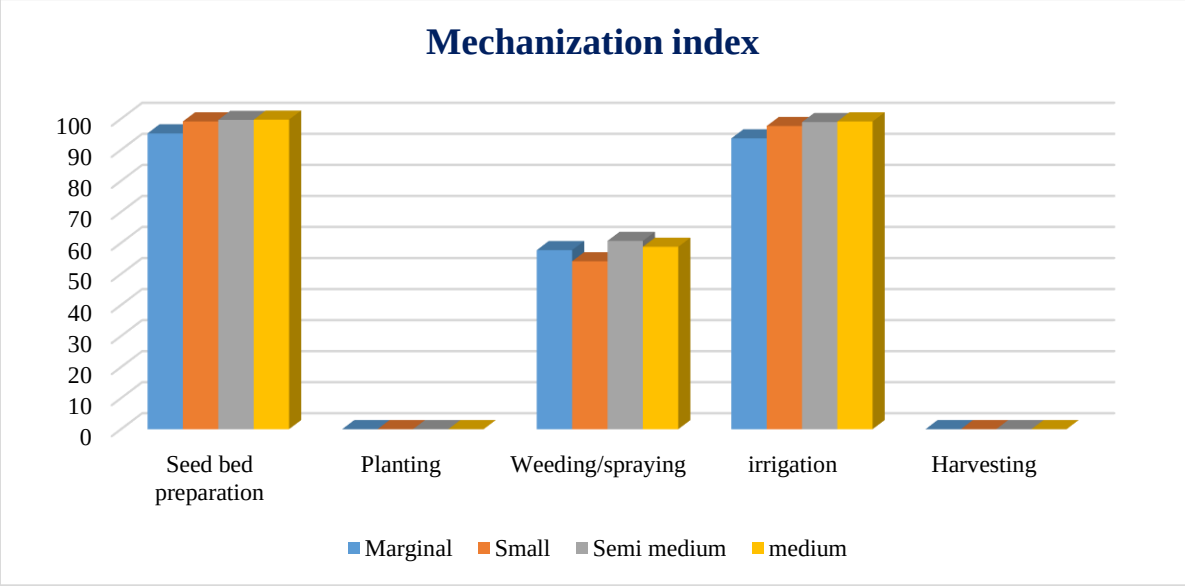

Fig. 2. Mechanization index in sugarcane cultivation based on operation

3.2 Mechanization index in Sugarcane Cultivation Based on Type of Operation

The mechanization index based on the operation in sugarcane cultivation of all types of farmers is shown in Table 3. The results show that the mechanization index was high in seedbed preparation (98.46 per cent) followed by irrigation (97.37 per cent) and weeding/spraying operation (57.81 per cent) Fig. 2. The mechanization index was zero for planting and harvesting operations since the majority of farmers were performing operation manually and also unaware and unavailability of equipments for the particular operation [13].

4. CONCLUSION

Farm mechanization helps in the timely performing of operations in the field. Seedbed preparation had a high level of mechanization followed by irrigation and weeding operations compared to planting and harvesting had zero mechanization index. Deficit or non-availability of sufficient farm machinery/ implements with the farmers was observed. Therefore, to enhance the mechanization level in the study areas, the Government should create awareness among the farmers about the existence of custom hiring centres and adequate measures should be taken to promote mechanization by providing financial incentives to the farmers for the purchase of specialized machinery (planters, harvesters *etc*.).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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