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Status, Strategies and Challenges for Farm Mechanization in Narmada District, Gujarat

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ABSTRACT

Adoption of Farm Machines in a region depends greatly on socioeconomic condition of farmers. A survey was conducted in Dediapada taluka, Narmada District, Gujarat to assess their socio-economic status and their effect on mechanisation level. The maximum, minimum and average values of mechanization index are 78, 7 and 24, respectively. The mechanization tool level (MTL), which indicates percentage of mechanization used for particular farming operation in Dediapada region were 40% for tillage, 11 % for sowing, 18 % for intercultural, 35% for spraying, 22 % for weeding, 14 % for harvesting and 33 % for threshing. This paper also discusses future strategies for enhancement of mechanization in region.

KEYWORDS

Farm Mechanization index, Mechanization tool level, Narmada, Gujarat

INTRODUCTION

Agricultural mechanization is level of using the equipment, mechanical devices or technology in order to increase agricultural productivity to achieve sustainable development. Agriculture productivity is greatly influenced by power availability and its optimum use on the farms (Singh *et al.*, 2015). The use of modern technology during latter decades resulted in rapid growth of farm production. The quality of inputs of mechanization and consequently land and labour productivity in both situations may differ considerably (Singh *et al.*, 2002). Mechanization planning requires the quantitative assessment of mechanization index and its impact on agricultural production (yield) and economic and energy factors (cost of cultivation, deployment of animate and mechanical owner, economic advantage and energy ratio). Development and adoption of agricultural machine is related to economical-social conditions, technical knowledge of farmers as well as the industrial development of the country. The vision, cultural trends, economical and social livelihood conditions are different in different regions and therefore, it is not suitable to use a general model. Thus, any region needs a special strategy and mechanization pattern. In Dediapada region the status of mechanization is not known. So, any planning related to farm mechanization in this area will be difficult due to the lack of enough information. Therefore, it is essential to have a comprehensive analysis study in this field. This study evaluates the status of agricultural mechanization and its impacts on sustainable development. Furthermore, it would provide a solution to improve agricultural mechanization in Dediapada taluka in Narmada District.

MATERIALS AND METHODS

There are 214 villages in Dediapada taluka District Narmada, Gujarat. Six villages were selected randomly viz. Ghatoli, Motasukha-amba, Khokhar-amba, Timbapada, Relva and Rakas-kundi for survey. Total 450 farmers were selected for survey, 75 farmers from each village. The number of available traditional and improved implements was surveyed for their annual use. Annual usage of the man, animal and mechanical power was investigated through the operations performed by the farmer in the current cultivation practices.

Mechanization Index (MI)

The mechanization index (MI) was calculated on the basis of the total cost of farm operations performed by different mode of operations and the cost of the operations performed by the machinery (Tractor, diesel engine or electric motor). The mechanization index was calculated the formula (Eq. 1) derived by Nowacki 1978.

$$MI = \frac{C_M}{C_H + C_A + C_M} \quad \text{[Eq. 1]}$$

where, C_M= Cost of use of the machinery
C_H= Cost of human labour
C_A= Cost of use of animals

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Mechanization Tool Level (MTL)

The mechanization tool level is the indicator of percentage of mechanized being used for particular operation (Jonathan *et al.*, 2011). This is computed on the basis of total machinery being used and the mechanized machine for the same operation. The Mechanization tool level (MTL) was calculated from the relationship (Eq. 2):

$$MTL = \frac{Nmc}{(Nmc + Nht)} \qquad [Eq. 2]$$

where, N_{mc}= number of machines used for a particular farm operation

N_{ht}= number of hand tools used for the same

RESULTS AND DISCUSSION

The operations performed by farmers in traditional cultivation practices for different crops were surveyed, noted down in the questionnaire prepared in format and it included socio-economic details as well as technical details. The socio-economical details included education level, land holding, annual income, number of family members, subsidiary business. The technical details included inventory of livestock, source of irrigation, plant protection equipment, power sources, operations performed in current cultivation practices for different crops in terms of hours of application of different power sources, technical knowhow of farmer about improved implements & government schemes about the farm implements and farmers, view for boosting mechanization in their area, etc. The major crops grown in this region were paddy, tur, black gram, cotton and soybean in *Kharif* and wheat, pea and mung in *rabi*.

Socio-economic status of the farmers

The education level, economic status and land holding status of the farmers are given in Table 1, Table 2 and Table 3, respectively. It can be seen from Table 1 that most of the farmers in the area were illiterate (40 %) and very few were found graduate (6 %).

Table 1: Educational status of the farmers

Education level	No. of members	Percent
Illiterate	530	40.0
Primary education	367	27.5
Secondary education	215	16.0
Higher secondary education	140	10.5
Graduate	85	6.0
Total	**1337**	100

It is observed from Table 2 it can be seen that majority of the farmers were falling in the category of ₹ 10000-15000 annual income. Very few farmers having annual income above ₹ 30000 (14 %).

It is observed from Table 3, majority of the farmers were marginal and small, jointly comprised 63% and 25% in medium and large category.

Table 2: Economic status of the farmers

Annual income, Write	No. of farmers	Percent
<5000	16	3.50
5000-10000	70	15.50
10000-15000	103	23.00
15000-20000	85	19.00
20000-25000	61	13.50
25000-30000	52	11.50
>30000	63	14.00
Total	450	100

Table 3: Land holding status of farmers

Land holding	No. of farmers	Percent
Marginal	190	42
Small	95	21
Semi- medium	62	14
Medium	51	11
Large	52	12
Total	450	100

Use pattern of farm tools and implements among farmers

Inventory of available improved tools and implements revealed that most of the farmers having improved animal drawn tools viz iron plough (94%), blade harrow (83%), Knapsack sprayer (51%) etc. The tractor was owned by only 8 % farmers. Similarly, cultivator, leveller, rotavator and threshers were owned by 10, 6, 7 and 7 percent farmers. The

Table 4: Distribution pattern of farm tools and implements among farmers in selected villages of Dediapada Taluka (N=450)

Sl. No.	Improved Tools/ Implement	Number of tools	Percent
1	Serrated Sickle	98	23
2	Sprayer	215	51
3	Wheel Hoe	70	17
5	Iron Plough	393	94
6	Puddler	12	3
7	Blade harrow	350	83
8	Animal Trailer	180	43
9	Cultivator	43	10
10	Thresher	31	7
11	Leveller	26	6
12	Seed drill	38	9
13	Rotavator	25	5
14	Trailer	33	8
15	Diesel Engine/ Motor	212	50
16	Tractor	33	8

fewer adoption of the tractor and tractor drawn implement was due to higher initial costs and unaffordable to the small and marginal farmers. The diesel engine or motor for water lifting was owned by 50 % farmers (Table 4).

Mechanization index (MI) as affected by Land holding and educational status of farmers

The mechanization index was calculated on the basis of cost of different modes of energies (human, animal and power) engaged in different agricultural operations. The cost of the energy engaged was calculated on the basis of hours of energy engagement and prevailing wages. The maximum, minimum and average values of mechanization index was found as 78, 7 and 24, respectively. The trends of the mechanization index according to the land holding, literacy and economy of the farmers is given in Fig. 1, Table 5 and Fig. 2, respectively. It is revealed from Fig. 1 that the farmers of medium and large categories are having greater mechanization index as compared to smaller land holding categories. The maximum average MI was found as 18 % for marginal and 48 % for large farmers. This may be due to unaffordable costlier agricultural tools and implements for marginal and smaller farmers and very less working hours of the implements.

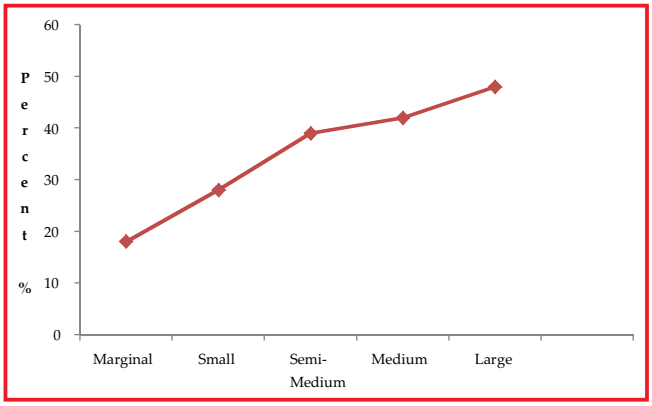

Fig. 1: Change in Mechanization Index with Land holding of farmers

Table 5: Trends of Mechanization Index with literacy level of farmers

Sl. No.	Literacy level	Average MI (%)
1	0	14
2	>10	26
3	10	35
4	12	44
5	Graduate	68

Mechanization tool level

The mechanization tool level is the indicator of percentage of machines being used for particular operation. This is computed on the basis of total machinery being used and the mechanized machine for the same operation and given in Fig. 3. The maximum value of the MTL was found as 40 percent for tillage operation, whereas, minimum for the transplanting as 0 percent. The higher MTL for tillage was found due to the

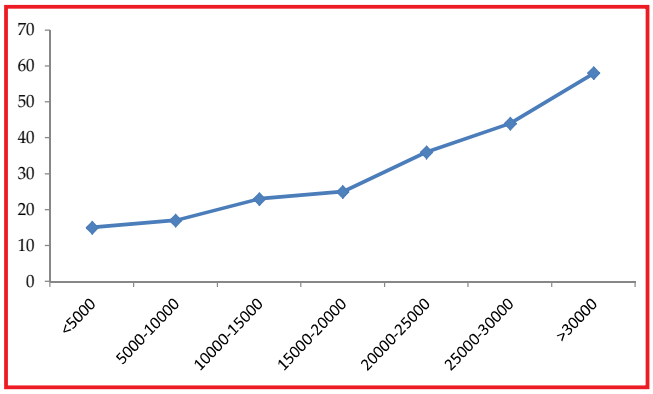

Fig 2: Change in Mechanization Index with farmers income

custom hiring of tractor operated plough, rotavator and energy consuming nature of tillage operation. The lowest MTL for transplanting due to not popularization of transplanting equipment, high cost and less suitable for soil condition. Low level of MTL in sowing found due to fewer number of animals and tractor operated seed drills.

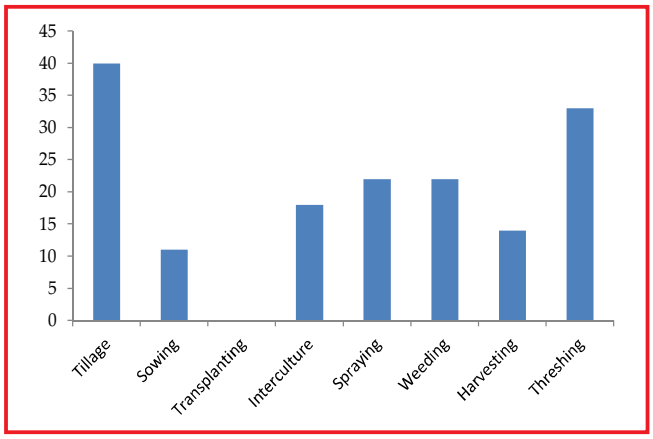

Fig 3: MTL indicator with different farm operations

Future strategies for mechanization development

The wide fragmented and scattered land holding in region to be consolidated (Virtual or real) to give access for their owner to benefit of agricultural mechanization. There is a need to innovate custom service or rental model by institutions or Government authority. Need to design and develop ergonomically suitable implements for sowing, transplanting, and harvesting operation (Mehta *et. al.*, 2014). The Government has laid emphasis to provide financial assistance to the farmers and other target groups for purchase of different kinds of farm equipment, demonstration of new equipment among farmers for spread of new technology, human resource development in operation, maintenance/ repairs and management of agricultural machinery, one of the latest important policies exist and in effect is the Twelfth Five Year Plan(2012–2017) (Anonymous, 2013), it came with title; Faster, More Inclusive and Sustainable Growth and has new strategy for promoting farm Mechanisation. Government should encourage a greater number of custom hiring centre at block/district level to increase the availability of costly/heavy machinery for enhance mechanization (Sundaram *et al.*, 2020).

CONCLUSION

The mechanization tool level (MTL), which indicates percentage of mechanization used for particular farming operation in Dediapada region were found to be tillage 40%, sowing 11%, transplanting 0%, intercultural 18%, spraying 35%, weeding 22%, harvesting 14% and threshing 33%. Therefore design, development and popularization of small hand tools and equipment suitable for sowing, transplanting and harvesting operations in Dediapada region needs to be done on priority basis in order to enhance mechanization index in selected operations and also to increase the income of farmers. Government should encourage more number of custom hiring centre at block/district level to increase the availability of costly/heavy machinery for enhance mechanization.

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