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AN APPROACH TO THE SUITABILITY OF MECHANIZATION IN BARIND AREA

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ABSTRACT

In this paper an attempt has been made to analyse the present status of agricultural mechanization in the actual Barind tract of Bangladesh. Discussions have been concentrated on the suitability of mechanization and use of draught power, overall socio-economic status of the population, soil conditions, water availability and cropping pattern in the region. The mechanization policy has been analysed both in terms of energy consumption and economic cost relations maintaining soil structures. While using mechanical power, the two wheel tractors have been found suitable rather than the four wheel tractors.

INTRODUCTION

In Bangladesh, land resources are limited and have very little opportunity to reclaim land, rural population density is the highest in the world, and infrastructural development such as town growth, industry, road development etc. are occupying more and more agricultural land. In this context, every inch of cultivable land should be taken under meaningful cultivation matching with field conditions to increase yield per unit area of land and improved preservation and processing and storage of already produced commodities.

The actual Barind tract in this study includes the north west part of Bangladesh comprising of the districts of Nawabgonj, Naogaon and Rajshahi (Fig. 1). The tract consists of a total area of 7744 sq. km, total population of 5.616 million and 0.583 million hectare of cultivable land. Annual rainfall in the area is 1300 to 1800 mm. Both rainfed and irrigated paddy cultivation is preferably done in the whole cropping seasons and to some extent wheat, potato, mustard and vegetable cultivation is also done where irrigation facilities are available in the tract.

The peculiarity of the soil and lithological views of the tract have drawn the attention of the agricultural engineers to install deep tube wells for irrigation by which water crisis has almost been eliminated. Agricultural practices in this area are still mostly traditional. The socio-economic conditions of the people are at subsistence level. To overcome this stagnation, crop production operations need to be changed and efforts should be made to adopt appropriate techniques for the area. Selective mechanization and water use policies need to be introduced to improve the socio-economic conditions of the people. Careful planning and utilisation of the above resources can bring in sustainable agricultural growth and development in the area.

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One of the reasons for the low productivity is the shortage of draught power in this area. The draught capacity of the work animals has been rated at the highest value of 0.373 kW (0.5 HP) per bullock. But the Bangladeshi cattle is too weak to produce the above power and stagnated number of draught cattle makes it imperative to supplement mechanical power to mitigate the shortage of animal draught power (Satter, 1995).

Energy use from mechanical sources has the potential to influence both the economic and social programmes. In Bangladesh some of the basic agricultural production resources are land, water, human and animal power, commercial and non commercial energy, crop technology and capital. Energy flow in Bangladesh agricultural food chain has been described by Huq`s energy model (Bala, 1980). This dynamic model provides one of the effective way of evaluating and improving the energy change or conservation if the parameters of the model are determined. Rational introduction of tractors, selection and adoption of appropriate machinery and technology for increased field efficiency, careful assessment of the available resources and improvement of the socio-economic status of the population are some of the pre-requisites for development planning and development of energy conservation systems through reduced tillage.

Satter (1995) has developed a system dynamics model and pictured clearly that cattle in Bangladesh will not be able to supply the required draught power for rice production. The author has shown that draught power shortage in terms of number of draught animals will vary from 2.2 million to 6.5 millions, according to various production strategies adaptable for rice cultivation in Bangladesh. The study categorically claims that draught power requirement for rice production in Bangladesh can not be met alone by draught animal and introduction of mechanical power is inevitable and beneficial for the country.

Quaiyum and Zaman (1988) made an on-farm study on energy requirement in irrigated boro rice production in Bangladesh Agricultural University Farm. According to the study, it appeared that energy requirement for irrigation is the highest (19.4%) and for chemical energy (fertilizer) is the minimum (0.0984%). The second highest is the energy demand for land preparation (7.79%). The energy use efficiency was 441%. They also studied cost benefit relationship. The cost of irrigation by 25 hp electric motor was the highest (Tk. 2281/ha) and the cost for chemicals used was the second highest (Tk. 2017/ha). Cost of land preparation using small tractor equipped with offset disk harrow stands very low (Tk. 860/ha) in comparison to the cost of land preparation by animal powered traditional method (Tk. 2242/ha). The cost-benefit ratio was found to be 3.28.

Anazodo (1985) studied the traditional and mechanized system of maize production in Nigeria He studied the systems on the basis of cost benefit ratio rather than energy input-output ratio. He found that financial efficiency for traditional system was 85% where as in mechanized system the efficiency was 158% which shows that mechanized cultivation is economically justified.

Sarker *et al.* (1981) worked on energy input-output relationships in traditional and mechanized rice cultivation in Bangladesh. According to the authors selective mechanization is suitable for Bangladesh conditions. From the result it appeared that selective mechanized cultivation requires energy a little bit higher (less than 5%) than the traditional one. But energy output in mechanized system is 25% higher than traditional system which implies that mechanized cultivation system dominates over the traditional system.

Quaiyum and Zaman (1988) reported average service life of a power tiller to be 6 years. On the basis of 5% remaining value this gives the annual depreciation of 16% of the purchase price. They found annual repair and maintenance cost of power tillers to be in the vicinity of 2% of purchase price. Hanif and Alam (1997) found effective life of a power tiller to be 8 years, after which the cumulative cost curve starts rising steeply and suggests that after 8 years of service it is better to have a new power tiller than to continue with the old one. They found the average yearly maintenance cost to be 6% of purchase price. In both the studies depreciation, when combines with yearly maintenance cost, are found to be 18% of purchase price.

METHODOLOGY

A comparison has been made between a two wheel tractor (power tiller) and a four wheel tractor for their suitability in field conditions. Assuming all other factors remaining constant, the energy and cost of machine operation have been considered. The operating cost of the machine was considered on the basis of purchasing a 2-wheel tractor and hiring a 4-wheel tractor. The following formula was used to calculate the annual cost of operating a machine,

$$AC = FC\%\ P + \{(8.25\ A/SWE)\ (RMP + L + O + F)\}$$

where, AC = Annual operating cost Tk./yr

FC = Fixed cost = 16% P
P = Purchase price of the unit, Tk. [Tk. 54000]
A = Annual use in acre.
S = Forward speed, km/h [2.81]
W = Width of action, m [0.8]
E = Field efficiency, % [80]
RMP = Repair and maintenance cost, percent of purchase price, % P [2]
L = Labour rate, Tk./h [6.50]
O = Oil cost, Tk./h [6.00]
F = Fuel cost, Tk./h [23.55]

In this study data from Quaiyum and Zaman (1988) has been considered for solving the above equation.

RESULTS AND DISCUSSION

For a two wheel and four wheel tractors the following results were obtained (Table 1).

Table 1 Energy inflow of a four-wheel tractor and a two-wheel tractor

Input item	2-wheel tractor		4-wheel tractor	
	Amount/ha (four pass)	Energy (kcal)	Amount/ha (four pass)	Energy (kcal)
Fuel	39.75 lit	306129	46.68 lit	360037
Oil	0.35 lit	2699	0.36 lit	2777
Operator	26.68 man-hr	856	7.65 man-hr	246
Total Energy		309684		363060

Source: Quaiyum and Zaman (1988)

It was found that for Boro rice land preparation, a 2-wheel tractor consumed less energy than a 4-wheel tractor. The operating cost of a power tiller was found to be Tk. 75/hr, and Tk. 1660/ha. The farmers of this area get tractor custom service from the BADC and Agro Service Centre, Rajshahi at a charge of Tk. 200/hr or Tk. 1500/ha. Most of the farmers have no capability of purchasing a tractor along with associated implements. The topography of the land, being undulating, poses difficulty in tractor operation. Moreover the plots of the individual farmers are small in size and scattered in the field for which tractor operation is very much difficult. A 4-wheel tractor creates a hard pan at the subsoil due to its repeated pressure on the soil by the wheels during operation and this will retard percolation. But Barind area needs better deep percolation for its full recharge. With these points in view, the use of 2-wheel tractors are inevitable and beneficial for sustainable agricultural development in the region.

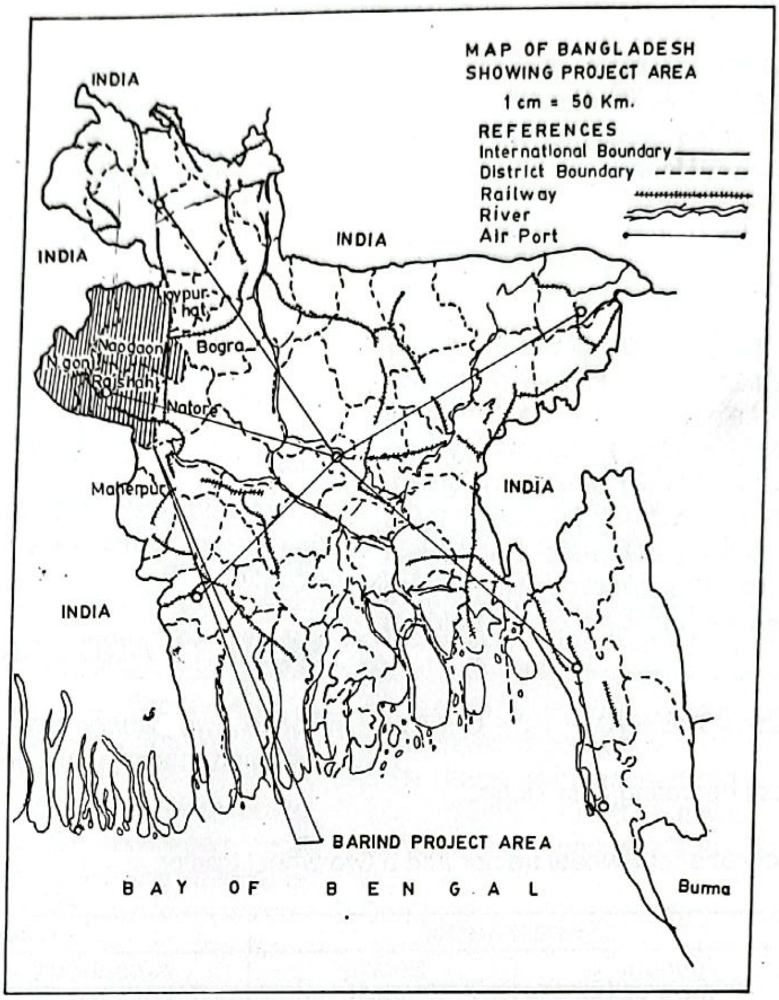

Fig. 1 Map of Bangladesh showing the project area at Barind tract

CONCLUSION

it can be concluded and recommended that mechanization is pertinent and beneficial for the Barind area. Selective mechanization using 2-wheel tractor is better for its operational suitability and maintenance of soil structure in Barind area.

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