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STATUS OF AGRICULTURAL MECHANIZATION IN MYMENSINGH AND KISHOREGANJ DISTRICTS

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Abstract

Mechanization can increase around 20% productivity of cropping system which is not yet well introduced among farmers for a sustainable agriculture. The study was conducted to assess mechanization status of 8 upazillas in Mymensingh and Kishoreganj districts on field survey and PRA basis. Information about farm operations such as tillage, seeding, irrigation, harvesting, threshing, winnowing, drying, etc were collected during this study. Average cropping intensity of the surveyed area found 192.87%. Only tillage operation was found mostly mechanized by using power tiller and tractor. Irrigation has been also found mechanized by using STW (49%), DTW (44%) and LLP (5%). Seeding/transplanting, weeding, and harvesting operations were done manually. The demand for reaper is increasing day by day due to low operating cost and high field capacity. Knapsack sprayers (83%) have been used for plant protection. Threshing has been done mostly 44% by using close drum thresher. Winnowing operation was done still manually and usually done by *Kula* (97%). Mechanical dryer is not being used for drying operation in the study areas. By minimizing some constraints it can be possible to develop mechanization for additional food production in the study areas.

Key words: Cropping intensity, harvesting, irrigation, mechanization, tillage.

Introduction

Agricultural mechanization is an art and scientific application of agricultural machinery, tool and implement for increasing farm production and cropping intensity. Mechanization is an important tool for profitable and competitive agriculture. The need for mechanization is increasing fast with the decrease of draught power and man power. Without mechanization it will not be possible to maintain multiple cropping patterns, which need quick land preparation, planting, weeding, harvesting, processing etc (MoA, 2009). The proper utilization of mechanization has been conducted for tillage and irrigation operations and partially for other activities (Sultan, 2014). With the growing needs for foods, the decision makers realized that Bangladesh agriculture will have no other alternative to adopt mechanized cultivation to feed her ever growing population. Animal power is becoming less available and 46% of farming families were found to possess no draught animal (Alam, 2001). Mechanization is gradually progressing in Bangladesh as the farmers are getting benefits by using various machines available for farming operations. Cost of tillage of land with power tiller is found to be economically advantageous because of the higher cost of using animal power. Moreover, mechanization is helping increase of cropping intensity and introduction of new crops (Chowdhury, 1991). Farm power availability in Bangladesh has been increasing day by

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day and it was found 1.50 kw/ha (Islam, 2010). On the other hand, farm power availability in major industrialized countries such as, Japan, Italy, France and UK are 8.75, 3.01, 2.65, and 2.50 kW/ha, respectively (Tandon, 2004). During the last three decades, average growth of rice production of the country was 2.6%. However, over the same period the growth of population was 2.1%. At present the cropping intensity of the country is reached to 191% (BBS, 2015). The demand for food is projected from 20 million tons to 30 million in 2020. The demand for food cannot be mitigated unless the cropping intensity is to be increased from 191 to 200 percent. Shortage of labor and draught power in agriculture has become serious problem during peak period of planting and harvesting. Moreover, Bangladesh does not have any additional land for expanding cultivation. In this context, farm mechanization with small, low cost and easily operable farm machinery could lead to make cultivation more profitable and to maximize production (Ziauddin and Ahmmed, 2010).

From the above discussion it is important to measure the level of utilization of agricultural mechanization overall our country. But it is very difficult to perform at the field level. A lot of resources and researchers will require for collecting data from every village of our country. In this paper the data on mechanization level in 8 upazillas of 2 districts were collected. In the light of above discussion the study was designed and carried out to assess the present status of agricultural mechanization in Mymensingh and Kishoreganj districts.

Methodology

The study was conducted in eight upazillas, five from Mymensingh district (Phulpur, Muktagachha, Isshwargonj, Trishal, Fulbaria) and three from Kishoreganj district (Katiadi, Tarail, karimganj). The survey has been provided to gather information about the present condition of land, cropping intensity, access to farm machinery in tillage, seeding/transplanting, weeding, irrigation, plant protection, harvesting, threshing, winnowing and drying operations. Constraints associated to mechanization, environmental hazard due to mechanization scenario of different farm power availability also have been assessed during the study period in the study areas. Therefore, to collect this information the survey was categorized into two parts: field survey though interview schedule questionnaire with the individual household and Participatory Rural Appraisal (PRA) with group of households. Field Survey had multiple indicators. The survey considered a multi-stage random sampling of selecting 400 households for the interview. The required sample size in each upazilla was divided equally, i.e. 8×50 = 400 households were selected for the study. For achieving objective to gather information the procedures have been followed:

i. Transect walk: Walking and observing from one end of the village to another end.
ii. Semi-structured interview (SSI): The data/information primarily collected through sample household survey method administering pre-designed and pre-tested questionnaire or interview schedule.
iii. Focus group discussion (FGD): Involving men and women farmers in a group having knowledge on production systems.

The participants of the PRA were selected from the following groups:

a) Farmers of different categories
b) Agricultural Machinery Rental Service Providers (RSP)
c) Community influential people (UP chairman, leaders, farmers etc.)
d) Upazilla Agricultural Officer (UAO) and Sub-Assistant Agricultural Officer (SAAO).

Results and Discussion

By increasing mechanization it is possible to decrease the turnaround time of crops and to increase the cropping intensity. The results of the study regarding the available machinery in the selected area have been presented and discussed in this section.

Land Type and Cropping Intensity

The study recorded cropped land of the surveyed respondent households as single, double and triple cropped in a year. Cropping intensity was recorded the highest at Phulpur in Mymensingh, which was 268.88% for own land and 227.90% for other land (Table 1), while the lower CI was recorded at Tarail in Kishoreganj, which was 100.04% for own land and 189.76% for other land. Average single and double cropped lands of the respondent households were estimated as 102.24 decimal and triple cropped land was 25.31 decimal. Average cropping intensity (CI) of the surveyed respondent household farms in two districts was 192.87%, which was slightly higher than the national average (191%).

Table 1. Land type and cropping intensity by district

Sl. No.	District	Upazila	Type of land	Cropped land (decimal)			Total area (dec.)	Net area (dec.)	Cropping intensity (%)
				Single	Double	Triple			
1	Mymensingh	Phulpur	Own	20.00	25.00	11.00	150.57	56.00	268.88
			Other	13.00	14.00	4.00	70.65	31.00	227.90
2	Mymensingh	Muktagachha	Own	11.39	32.63	30.40	170.59	74.42	229.22
			Other	0.00	17.00	16.29	58.57	33.29	175.93
3	Mymensingh	Isshwargonj	Own	60.22	20.95	10.8	170.45	91.97	185.33
			Other	60.59	20.00	0.00	135.12	80.59	167.66
4	Mymensingh	Trishal	Own	22.11	70.33	25.19	230.77	117.63	169.18
			Other	7.89	15.17	43.19	133.65	66.25	201.73
5	Mymensingh	Fulbaria	Own	15.20	30.43	23.79	125.43	69.42	180.68
			Other	31.76	49.00	0.00	150.00	80.76	185.73
6	Kishoreganj	Katiadi	Own	65.00	17.00	11.90	190.70	93.90	203.08
			Other	45.50	27.54	0.00	155.67	73.04	213.12
7	Kishoreganj	Tarail	Own	44.22	33.21	23.10	100.94	100.53	100.04
			Other	18.00	30.76	11.80	114.92	60.56	189.76
8	Kishoreganj	Karimganj	Own	53.67	26.87	31.66	234.39	112.20	208.90
			Other	22.83	28.31	10.10	119.75	61.24	195.54

Machinery demands for different operations have been increased. At present the demand for machinery like rice transplanter, thresher, reaper, weeder and artificial dryer are increasing (Table 2). The maximum tillage operations are done by using machinery like power tiller and tractor operated moldboard plough, rotavator, rotary tiller and disc plough instead of country plough.

Table 2. Specific use of farm machinery and its demand for immediate adoption

District	Upazila	Exiting machines in use	Demand for adoption
Mymensingh	Phulpur	Power tiller, Tractor, STW (Motor), DTW, Sprayer, Rice huller	Rice transplanter, Thresher, Reaper.
Mymensingh	Muktagachha	Power tiller, High speed rotary tiller, Sprayer, Reaper, Winnower	Rice transplanter
Mymensingh	Isshwarganj	Power tiller, Tractor, STW(Engine), DTW, Sprayer, Rice huller	Weeder, Dryer
Mymensingh	Trishal	Power tiller, Tractor, STW (Engine), DTW, Sprayer, Rice huller	Weeder, Reaper, Winnower
Mymensingh	Fulbaria	Power tiller, High speed rotary tiller, STW(Engine), Rice huller	Reaper, Winnower
Kishoreganj	Katiadi	Power tiller, Tractor, STW (Engine), Sprayer, Pedal thresher, Rice huller	Rice transplanter, Weeder, Reaper
Kishoreganj	Tarail	Power tiller, LLP, Pedal thresher	Rice transplanter.
Kishoreganj	Karimganj	Power tiller, STW (Motor), LLP, Sprayer, Reaper, Pedal thresher.	Rice transplanter, Weeder, Reaper.

Status of machinery and power used in the study areas

Different types of machinery used in various farm operations for crop production and processing are discussed below:

Tillage operation

Tillage is the land preparation by mechanical instrument of various types, such as digging, stirring, and overturning. Tractor and Power tiller are two major prime movers for operating tillage machinery and implements in Bangladesh. In the study areas about 90% respondents used power tiller for tillage operation. Power tillers were also being used in transportation of agricultural commodities. Only 5% of the farmers used tractor and the rest 3% were still using draught animal (Table 3). So, it can be said that tillage operation are almost fully mechanized.

Seeding and Transplanting

Seeding and Transplanting are the crucial farm operations. Transplanting is the technique of moving a plant from one location to another. Most often this takes the form of starting a plant from seed in optimal conditions. Adoption rate of modern machines for this crucial operation were very slow in the study area. The farmers are not yet acquainted with the proper use of modern machine. They are still feeling comfortable in manual process for seeding and transplanting. About 97% respondents seeded and transplanted manually. Only 3% respondents used machinery for seeding/transplanting. Seed drill, drum seeder and transplanter have been using there. The demand for rice transplanter has been increasing for transplanting seedlings in vast areas within a short time. Different research institutes like BARI, BRRI etc promoted transplanter among the farmers.

Table 3. Scenario of mechanization in study areas

Types of operations	Name of Machines	District							
		Mymensingh					Kishoreganj		
		Phul pur	**Mukta gachha**	**Isshwa rganj**	**Trishal**	**Ful baria**	**Katiadi**	**Tarail**	**Karim ganj**
Tillage Operation	Tractor	4 (9)	5 (10)	4 (8)	1 (2)	1 (2)	1 (2)	2 (4)	3 (6)
	Power tiller	40(85)	42(88)	46(92)	46(96)	37(86)	36(86)	44(92)	49(94)
	Draft animal	2 (4)	1 (2)	0 (0)	1 (2)	3 (7)	4 (10)	1 (2)	0 (0)
	Manual	1 (2)	0 (0)	0 (0)	0 (0)	2 (5)	1 (2)	1 (2)	0 (0)
Seeding/ Trans planting	Seed drill	0 (0)	0 (0)	1 (2)	1 (2)	0 (0)	0 (0)	0 (0)	1 (2)
	Drum seeder	0 (0)	0 (0)	3 (7)	2 (5)	0 (0)	0 (0)	0 (0)	2 (4)
	Traditional	40(100)	38(100)	41(91)	39(93)	40(100)	37(100)	40(100)	43 (94)
Weeding	Dry land weeder	3 (7)	1 (2)	2 (5)	0 (0)	1 (2)	0 (0)	3 (7)	2 (5)
	Wet land weeder	23(56)	25(56)	24(60)	16(41)	22(54)	15(37)	20(48)	17(39)
	Manual weeder	15(37)	19(42)	14(35)	23(59)	18(44)	26(63)	19(45)	24(56)
Irrigation	STW	22(61)	16(47)	23(44)	18(33)	18(60)	21(37)	38(83)	24(43)
	DTW	10(28)	13(38)	26(50)	35(63)	9 (30)	29(51)	7 (15)	31(55)
	LLP	3 (8)	4 (12)	1 (2)	2 (4)	0 (0)	6 (11)	0 (0)	1 (2)
	Treadle pump	1 (3)	1 (3)	2 (4)	0 (0)	3 (10)	1 (2)	1 (2)	0 (0)
Plant protection	Hand sprayer	11(24)	9 (20)	4 (9)	7 (16)	8 (21)	6 (15)	13(30)	2 (5)
	Knapsack sprayer	34(76)	37(80)	41(91)	37(84)	30(79)	35(85)	31(70)	38(95)
Harvesting	Sickle	39(95)	41(100)	44(100)	36(92)	45(100)	40(95)	35(90)	47(100)
	Reaper	2 (5)	0 (0)	0 (0)	3 (8)	0 (0)	2 (5)	4 (10)	0 (0)
Threshing	Paddle thresher	11(24)	14(30)	8 (18)	9 (18)	16(36)	10(22)	6 (14)	7 (14)
	Open drum thresher	5 (11)	7 (15)	9 (20)	11(22)	6 (14)	8 (17)	8 (18)	9 (18)
	Close drum thresher	13(28)	17(37)	19(43)	21(43)	15(34)	25(54)	23(52)	30(61)
	Hand beating	11(24)	4 (9)	6 (14)	8 (16)	4 (9)	3 (7)	2 (5)	3 (6)
	Animal threading	6 (13)	4 (9)	2 (5)	0 (0)	3 (7)	0 (0)	5 (11)	0 (0)
Winnowing	Kula	45(100)	41(100)	47(98)	35(88)	37(90)	33(80)	46(98)	40(93)
	Power winnower	0 (0)	0 (0)	0 (0)	1 (3)	2 (5)	2 (5)	0 (0)	1 (2)
	Electric fan	0 (0)	0 (0)	1 (2)	3 (8)	2 (5)	6 (15)	1 (2)	2 (5)
Drying	Boiler (chatal)	13(30)	18(46)	17(39)	14(38)	22(45)	11(22)	2 (6)	25(56)
	On mud floor	30(68)	21(54)	27(61)	23(62)	25(51)	33(66)	29(85)	18(40)
	On road	1 (2)	0 (0)	0 (0)	0 (0)	2 (4)	6 (12)	3 (9)	2 (4)

NB: Figures in the parentheses indicate percentage.

Weeding

Weeding operation is done by various types of weeder machines and by manual processes. Wetland weeder, dry land weeder or both are the different types of weeder used in weeding operation. The study depicted that about 49% respondents (Table 3) used manual weeding. They used khurpi, nirani etc for manual weeding. In the study areas, about 44% farmers used wetland weeder such as Japanese rice weeder in paddy field and only 4% farmers used dry land weeder such as wheel hoe.

Irrigation

Irrigation is the artificial application of water to the land or soil for plant growth and development. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and re-vegetation of disturbed soils in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has few other uses in crop production. Shallow Tube Well (STW), Deep Tube Well (DTW) and Low Lift Pump (LLP) were identified as the common irrigation devices used in the study areas. DTW irrigation was recorded to be the highest in Trishal, Mymensingh (63%), while highest irrigation coverage by STW was recorded in Tarail, Kishoreganj (83%) and LLP found 11% highest in Katiadi, Kishoreganj district (Table 3).

Plant protection

A sprayer is a piece of equipment that is used to apply herbicides, pesticides and fertilizers on agricultural crops. Usually knapsack sprayer and a limited extent with hand sprayers are used in plant protection operations. In the study area about 83% of the farmers used knapsack sprayers and 17% used hand sprayers for plant protection (Table 3).

Harvesting operation

Harvesting is the process of gathering mature crops from the fields. On large mechanized farms harvesting utilizes the most expensive and sophisticated farm machinery, such as the combine harvester. Now self propelled reapers are becoming popular for harvesting wheat and paddy. In the study areas about 97% respondents found who were using sickle for manual harvesting and only 3% respondents used reaper for mechanical harvesting (Table 3).

Threshing operation

Threshing is the process of loosening the edible part of cereal grain (or other crop) from the scaly, inedible chaff that surrounds it. It is the step in grain preparation after harvesting and before winnowing. In Bangladesh, threshing operation was done by traditional methods. At present, closed and open drum threshers are becoming popular among the farmers. In the study areas, threshing of paddy and wheat were found about 44%, 22%, 17%, 11%, and 6% (Table 3) with close drum, pedal thresher, open drum, hand beating and animal threshing respectively. It indicates that threshing operation is mostly mechanized in the study areas.

Winnowing operation

Winnowing is an agricultural method developed by ancient cultures for separating grain from chaff. It is also used to remove weevils or other pests from stored grain. Threshing, the loosening of grain or seeds from the husks and straw is the step in the chaff-removal process that comes before winnowing. In Bangladesh, it is mostly done by the women with traditional *Kula*. In the study area, about 93% (Table 3) respondents used *Kula* and 7% used electric fan or winnower for winnowing operation.

Drying

Drying means removal of water from a wet product to a safe level of moisture content. The safe moisture content for cereal grain usually 12-14% moisture on wet basis. The final moisture content for drying must be adequate for storage. In the study area, drying of grains was found to be traditional. No mechanical dryer was used there. About 61% of the farmers used mud floor for drying and 35% used boiler which was locally called *chatal* and 4% drying happened on the road (Table 3).

Constraints associated with mechanizations

The following constraints were identified during study period

a) Inadequate supply of spare parts, tools and accessories required for further major and minor repairing and maintenance of machinery.
b) The price difference between locally made machinery and imported machinery.
c) Absence of standardization test of locally made and imported product.
d) Lack of knowledge and skill for efficient use, proper maintenance and repair of machinery at all levels of users and traders.
e) Supply of poor quality fuel and lubricating oil at village level.
f) Absence of extension workers activity to become familiar with new technology with farmers.

Environmental hazards in using agricultural machinery

Though from the findings of field survey, PRA, FGD have not gained sufficient information regarding environmental hazards associated with agricultural machinery, however from expert point of view there are few important environmental hazards that are delineated below which could be mitigated by increasing awareness among the operators:

Table 4. Probable environmental hazards due to use of agricultural machinery

Machinery	Environmental / health hazard	Risk mitigation
Power tiller	Excess carbon emission due to improper placement of plunger or gasket or replacing low quality engine spare parts.	Regular maintenance, use of quality spare parts with skill mechanics.
Knapsack sprayer, Power sprayer	Acute poisonings, chronic effects such as neurotoxicity if more hazardous products are used with minimal personal protective equipment (PPE).	Use of gloves, musk and protective glass in eyes.
Waste engine oil and fuel	Engine oil can wreak havoc on the environment if disposed of improperly. Used engine oil contains toxic substances that are harmful to soil, plants and animals and water supplies.	Proper recycling or disposal can prevent environment and health hazard.
Agricultural tractor noise pollution	Hearing impairment of tractor operators may causes from loud sounding machinery.	Prediction of the noise levels and in open air by using standard methods.

Source: Tamanna, 2012

Conclusion

Agricultural mechanization is the process whereby equipments, machinery and implements are utilized to boost agricultural and food production. It is the application of machinery, equipments and implements in the day to day farm activities to increase productivity in food production and poverty eradication. Agricultural mechanization reduces drudgery which hitherto makes it difficult for large scale food production. Average cropping intensity of the surveyed farms in two districts was 192.87%, which was slightly higher than the national average cropping intensity (191%). Tillage operation

was found overwhelmingly mechanized and use of tractor in tilling and transportation has been increasing and it will be replaced by PT operation in substantial level soon. Transplanting was also found overwhelmingly manual; however there was a demand for mechanical transplanter among the farm households of the study areas. Weeding was mostly done by manual. Irrigation coverage of the cultivable land was estimated as 76% and the technological means were STW (49%), DTW (44%), and LLP (5%). Knapsack sprayer and hand sprayers were manually operated and performance was satisfactory for plant protection. Grain harvesting was found absolutely manual. Acute labor crisis in harvesting season incurred higher cost to the farm. Threshing of paddy was found mostly mechanized. Winnowing was found still manual and usually done by *Kula*. Drying of cereals was found still traditional level. Taking proper step to initiate mechanization can fulfill food crisis for surplus population in our country.

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