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# EFFECT OF MECHANIZED CULTIVATION ON YIELD PARAMETERS OF MUNGBEAN

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## ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Jessore during Kharif-I 2013 with four treatments viz. $T_1$ = conventional tillage + manual seeding (in line), $T_2$ = conventional tillage + manual seeding (in broadcasting), $T_3$ = power tiller operated seeder (PTOS) and $T_4$ = seeding with bed planter method used in the experiment. The objective of this study was to achieve the goal of increased mungbean production in Bangladesh through different tillage and seeding methods. Besides, to disseminate information in the farmer's level conservation tillage is new technology for increasing and sustaining productivity and profitability of mungbean cultivation in mechanized way. From the study, the results revealed that seeding with bed planter method treatment was the most effective and profitable for production of mungbean among all tillage and seeding methods in considering gross margin (40705 Tk /ha) and benefit cost ratio (1.73).

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## INTRODUCTION

Bangladesh is the most densely populated country of the world. Its present population is about 159 million which is increasing annually at the rate of about 1.42 percent. By the year 2030, the population will be increased to about 200 million. On the other hand, the cultivable land is decreasing by 1% every year (BBS, 2013). Therefore, Bangladesh has to produce additional food for millions of people every year. To produce more crop in the limited area two most important techniques to be adopted. Firstly producing two or more crops on the same piece of land round the year and secondly to increase the productive efficiency of the individual crop depending on how well it utilizes by applying agronomic practices, mechanizations and the basic resources especially, the limiting ones, like water and nutrients. Although Bangladesh is nearly self-sufficient in rice production, other foods such as pulses, wheat, vegetables, oil crops etc. are still deficit to a large extent.

In Bangladesh agriculture, rice dominates the crop sector occupying nearly 73% of the cropped area and contributing 70% of the value of output (Islam et al, 2007). Cultivation of HYVs of crops and adoption of modern technologies is leading to severe depletion of nutrients from the soil. Rice-rice cropping pattern is most prevalent in Bangladesh (Quayyum et al., 2002) and causes a considerable depletion of soil nutrients in each year. Moreover, the farmers are reluctant in adding organic matter to the soil through farmyard manure, compost and crop residues as they use those as fuel or cattle feed. As a result, in deterioration of native soil fertility and created a serious threat to long-term sustainability of crop production (Anonymous, 2009). Intercropping of grain legumes with cereals is good for higher productivity and for improving organic matter status of soil. Organic matter status of the soil can be raised up by intercropping of legumes with rice. Thus accommodation of legumes in the cereal based cropping patterns can improve the soil health.

Mungbean (*Vigna radiata*) is one of the major pulse crops in Bangladesh during kharif-1 season. It is a good source of protein for both man and domestic animals. It also contains amino acid lysine, which is generally deficit in food grains (Elias, 1986). Besides protein, pulses are also important source of carbohydrates, vitamins, minerals and other functional micro molecules (Rahman, 2007). Being leguminous, this crop maintains soil fertility by fixing the atmospheric nitrogen (Malik, 1994; Senanayake et al., 1987; Zapata et al., 1987). But the overall scenario of pulses production of the country is not increasing sufficiently to meet up the demand of the increasing population. According to WHO (World Health Organization), the recommended rate of pulse consumption is 45 g/head/day (Fakir *et al*., 2007). Therefore, to maintain the present consumption rate, availability of pulses has to be increased by 21.5% over the present supply. But total production of pulses during 2012 in Bangladesh was around 6.97 lakh metric tons from 6.65 lakh hectare of land at the rate of 1.05 metric ton per hectare (Agriculture Information Service, 2013). As a result, Bangladesh is running in shortage of pulses. To meet up the pulses demand of increasing population, mungbean production in the rabi season needs to be increased, by increasing the present low yield (980 kg/ha) (Agriculture Information Service, 2013). Among the factors responsible for the low yield of the mungbean, non-mechanized cultivation is the important ones. Mechanized cultivation of pulse can reduce production cost and increase yield. Conventional tillage is laborious, costly and time consuming. Farmers face trouble completing agricultural operations due to labour shortage, especially during the planting season, during harvesting and threshing periods. Labour shortage is one of the main constraints to successful crop production. Small agricultural machinery such as the power tiller, powe tiller operated seeder and power tiller operated bed planter are alternative ways to manage labour shortage and keep crop production at a high and economic level. Therefore, to achieve the goal of increased mungbean production in Bangladesh, the present study was, undertaken with the objectives to find out proper tillage and seeding method of mungbean for application in Jessore condition.

## MATERIALS AND METHODS

The experiment was conducted at Regional Agricultural Research Station, Jessore, Bangladesh during Kharif-I 2012-2013. The experimental site was located at $23.111^0$ N latitude and 89.140 E longitude which is 15 m above the sea level belongs to the “High Ganges floodplain” (AEZ-11). The land type and soil of experimental area were flood free high land with silty loam to silty clay loam in texture, well drained, having a pH in the ranges of 7.0 to 8.0. The predominant soil had a Calcareous brown top soil with a plough pan below. The soil is low in moisture holding capacity, very low in organic matter (1.0%) and low in most of the available nutrients ( N,P,K,S

Zn and Mo). The experimental area is under the sub–tropical climatic zone characterized by relatively scanty rainfall, high humidity, high temperature, and long day period during March to May. The temperature during the season (December to February) remains fairly low and goes up during the hot season. The average (10 years) annual rainfall is 1650 mm. most of which fell during May-September. The warmest and coldest months are April ($35^0$ C maximum) and January ($15^0$ C minimum), respectively. Bangladesh's overall mean temperature in summer ranges between 25 and 33 $^0$C, and winter remains between 11-26 $^0$C. The experiment consisted of four treatments –

I. $T_1$ = conventional tillage + manual seeding (in line)
II. $T_2$ = conventional tillage + manual seeding (in broadcasting)
III. $T_3$ = power tiller operated seeder (PTOS) and
IV. $T_4$ = seeding with bed planter method

Details of the treatments (Figure 1):

i). $T_1$ = conventional tillage + manual seeding (in line) : The land was ploughed and cross-ploughed four times with bullock driven country plough followed by laddering to obtain a good tilth. Then seeds were sown manually by hands in line.

ii). $T_2$ = conventional tillage + manual seeding (in broadcasting): The land was ploughed and cross-ploughed four times with bullock driven country plough followed by laddering to obtain a good tilth. Then seeds were sown manually by hands in broadcast method.

iii). $T_3$ = power tiller operated seeder (PTOS): Power tiller operated seeder was modified and improved seeder which simultaneously creates a furrow and performs seeding in the furrow in one operation behind the power tiller machine.

iv). $T_4$ = seeding with bed planter method : Power tiller operated seeder was modified and improved seeder which simultaneously creates a trapezoidal raised bed and performs seeding on the top of the bed in one operation behind the power tiller machine.

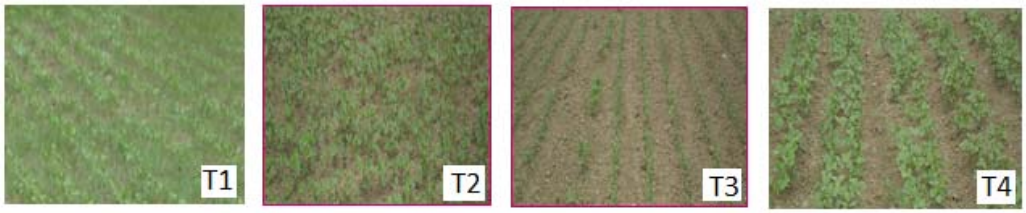


**Figure 1** . Plot view of different seeding methods

Treatments were assigned randomly in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 17 m x 12 m. The land was uniformly fertilized with at the rate of 14-20-20-10 kg/ha NPKS respectively. Fertilizers namely Urea, TSP (Triple Super Phosphate), MP (Muriatic of potash), and Gypsum were used as source of N, P, K and S respectively. Total amount of all the fertilizers were applied during the final land preparation and incorporated with the soil through ploughing and laddering. The land was opened with tractor drawn disk plough. Later on, the land was ploughed and cross ploughed three times by a power tiller followed by laddering to obtain the desirable tilth. All the weeds, stubbles and crop residues were removed from the experimental plot. A newly released promising Mungbean variety "BARI mung 6" was used in the study as test crop. The crop variety was developed by Bangladesh Agricultural Research Institute (BARI) in 2003. The seed rate was 30 kg/ha. The seed had 95% germination line sowing was followed, maintaining 40 cm x 10 cm row and plant spacing respectively. The seeds were sown on 4 April 2013 in farrows at 5 cm depth from surface of soil and covered with fine soil to ensure uniform germination. Late germinated ones, extra plants and other species were removed time to time from the plots to ensure uniformed plant to plant distance. Before sowing seed was treated by provex-200 @ 3.5gm/kg seed to prevent collar rot disease of Mungbean. Irrigation, insecticide, weeding and other intercultural operations were done as and when necessary. Data were collected from the sampling area of the plots excluding border plant. Two $m^2$ middle of the plots were kept for final harvest to record data on yields of seed and stover.

At the time of growing stages and harvesting following data on crop characters were recorded –

i). Plant height (cm),
ii). Number of pods per plant,
iii).100 seed weight (g),
iv). Seed yield (ton/ha) and

v). Stover yield (ton/ha)

Plant height (cm): Plant height was recorded with the help of measuring tape at harvest (68 DAS). For this purpose ten plants of each treatment were selected randomly, their length was measured from ground level to the top of the terminal leaflets and averages were computed.

Number of pods per plant: For this purpose ten selected plants of each treatment were uprooted at the time of harvesting and number of pods from each plant was counted. Finally averages were computed.

100 seed weight (g): Four handfuls of grain were drawn from the bulk product of each unit plot and from which one lot of 100-seed was counted and weighted. The weight was adjusted at 10% moisture content. Seed and stover yield: For this purpose crops in $2m^2$ area of each treatment were uprooted with the help of a sickle during harvesting. The harvested crop of each plot was bundled separately, tagged properly and brought to clean threshing floor for sun drying. After threshing, cleaning and drying seed yield of each plot were recorded and converted to ton per hectare. The stover left after threshing and cleaning of the seed from 2 $m^2$ area of each treatment was weighted and converted to ton per hectare.

**Statistical analysis**

The means and analysis of variance for all the parameters were calculated by F-variance test MSTATC software. The significance of the difference between means was evaluated by Duncan's Multiple Range Test (DMRT).

## RESULTS AND DISCUSSION

**Plant height**

The effect of different tillage and seeding methods on plant height of mungbean was showed significant variation (Table 1). The highest plant height (77.3cm) was recorded in conventional tillage + manual seeding in broadcasting treatment which was significantly different from that of conventional tillage + manual seeding in line (70 cm), Power tiller operated seeder (73.5 cm), and seeding with bed planter method (69.1cm) respectively. On the other hand, the lowest plant height (69.1cm) was recorded in Seeding with bed planter method which was significantly similar with Conventional tillage plus manual seeding in line (70cm). It indicates that different tillage and seeding methods played little role in stimulating vegetative growth. Moreover, the plant height of mungbean in case of conventional tillage + manual seeding and seeding with bed planter method indicates enjoyed similar favourable conditions throughout their growing period. These findings are accordance with those of Bhaumik (1976).

**Number of pods per plant**

Number of pods per plant is an important yield determine factor. The data indicated that different tillage and seeding methods had significant influence on pod setting in plant (Table 1). The highest pods per plant (31) was obtained from seeding with bed planter method treatment which was statistically identical with conventional tillage + manual seeding in line (29). The increase in number of pods per plant might be influence by tillage and seeding methods. The lowest pods per plant (23) was obtained from the conventional tillage + manual seeding in broadcasting treatment which significantly identical with power tiller operated seeder treatment(24). These findings accordance with those of Growda and Growda (1978).

**100-seed weight**

In case of plant characters, all the parameters showed significant variation except Different tillage and seeding practices had no significant influence on 100-seed weight (Table 1). It might be due to use of same variety in all treatments.

**Seed yield**

The data indicated that different tillage and seeding methods had a significant effect on seed yield of mungbean (Table 1). The highest yield (1562 kg/ha) was obtained from seeding with bed planter method treatment which was statistically identical with the conventional tillage + manual seeding in line (1415 kg/ha). The lowest yield (1342 kg/ha) was obtained from the conventional tillage + Manual seeding in broadcasting treatment which was statistically identical with the Power tiller operated seeder (1373 kg/ha). But seeding with bed planter method treatment significantly differ from Power tiller operated seeder treatment. It might be due the production of lowest number of pods per plants. These findings are line with those of Sandhu et al. (1970).

**Table 1.** Effect of different tillage and seeding method on the yield and yield contributing characters of mungbean

| Treatments | Plant height (cm) | Pods/ Plant (No.) | 100-Seed wt.(g) | Seed yield (kg/ha) | Stover yield (kg/ha) |
|---|---|---|---|---|---|
| $T_1$= conventional tillage + manual seeding (in line) | 70.0 | 29 | 4.99 | 1415 | 1850 |
| $T_2$ = conventional tillage + manual seeding (in broadcasting), | 77.3 | 23 | 4.96 | 1342 | 1664 |
| $T_3$= power tiller operated seeder (PTOS ), | 73.5 | 24 | 4.83 | 1373 | 1710 |
| $T_4$= seeding with bed planter method | 69.1 | 31 | 4.99 | 1562 | 2235 |
| CV (%) | 1.32 | 10.14 | 2.62 | 218.56 | 225.10 |
| LSD(0.05) | 1.91 | 5.54 | NS | 12.65 | 9.25 |

NS = Non significant

**Table 2.** Cost and return analysis of BARI Mung 6 in manually line sowing, broad cast method, Bed planting and PTOS at RARS, Jessore

| Treatments | Yield (kg/ha) Seed | Total variable cost (Tk/ha) Stover | Gross return (Tk/ha) - | Gross margin (Tk/ha) - | Benefit cost ratio (BCR) - | - |
|---|---|---|---|---|---|---|
| $T_1$ = conventional tillage + manual seeding (in line) | 1415 | 1850 | 57060 | 84900+1850 = 86750 | 29690 | 1.52 |
| $T_2$= conventional tillage + manual seeding (in broadcasting) | 1342 | 1664 | 56020 | 82184+1664 = 83848 | 27828 | 1.49 |
| $T_3$ = power tiller operated seeder (PTOS ) | 1373 | 1710 | 56550 | 82380+1710 = 84090 | 27540 | 1.48 |
| $T_4$= seeding with bed planter method | 1562 | 2235 | 55250 | 93720+2235 = 95955 | | 40705 |

Note: Urea = Tk 16.00 /kg, TSP = Tk 22.00 /kg, MP = Tk 15.00 /kg, , Gypsum = Tk 10.00 /kg, Labour = Tk 250.00/8 hr/head, Conventional tillage = TK 5000 /plough/ha, Stover selling = Tk 1/kg, Mungbean = Tk 60/kg, Mungbean in case of seed = Tk 80/kg, Pesticide cost = TK. 3000/ha, Land hire= TK 30000/ha/annum, Power tiller operated seeder (PTOS ) cost = Tk 1810/ha ( hire + fuel), Bed planter operated seeder cost = 4000/ha (hire + fuel), Pods picking cost= Tk 10000/ha.

**Stover yield**

The data indicated that different tillage and seeding methods had a significant effect on stover yield of mungbean (Table 1). The highest yield (2235 kg/ha) was obtained from seeding with bed planter method treatment whereas the lowest stover yield (1664 kg/ha) was obtained from the conventional tillage + manual seeding in broadcasting treatment. But seeding with bed planter method treatment significantly differ from power tiller operated seeder treatment. It might be due to produce of the lowest plants height (69.1cm) (Table 1). These findings are on accordance with Khan (1970).

**Economic Analysis**

In the economic analysis it was found that the highest gross margin (40705 Tk /ha) and BCR (1.73) were obtained from seeding with bed planter method treatment under different tillage and seeding methods in field condition. On the other hand, the lowest gross margin (27540 Tk /ha) and BCR (1.48) were found in power tiller operated seeder (PTOS) treatment (Table 2). Here also observed that the second highest gross margin (29690 Tk /ha) and BCR (1.52) were obtained from conventional tillage + manual seeding in line treatment.

## CONCLUSION

The results revealed that seeding with bed planter method treatment was the most effective and profitable for production of mungbean among all tillage and seeding methods in considering gross margin (40705 Tk /ha) and benefit cost ratio (1.73). It might be due to low cost of production and high yield producing treatment.

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