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Impact of Field Preparation Equipment on productivity of Rice

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ABSTRACT

Field preparation is considered to be pre-requisite for the successful cultivation of rice. Three different field preparation treatments consisting of farmer's practice (FP) as preparing field through cultivator (3 pass) and then planking (CP), second was technical option 1 (TO1) as preparing field through cultivator (1 pass) and then rotavator (1 pass) (CR) and third was technical option 2 (TO2) as preparing field through rotavator (1 pass) (R) were used to assess the puddling performance on productivity of rice. Depth of puddling was 9.8, 12.8 and 11.9 cm in these treatments, respectively. Transplanting of rice was done by seasonal daily labourer in each plot. Cost of puddling was Rs 3100/, Rs 2100/ and Rs 1100/ ha for CP, CR and R, respectively. The grain yield for FP, TO1 and TO2, treatments was found to be 33.9, 36.8 and 34.4 q/ha, respectively. The average grain yield was observed as slightly higher (36.8 q/ha) in TO2 *i.e.,* puddling rice field by cultivator (1 pass) & then rotavator (1 pass) among other treatments of puddling. The benefit cost ratio (B:C ratio) was also recorded highest 2.00 in TO2 *i.e.,* puddling by cultivator (1 pass) & then rotavator (1 pass) (CR).

Key Words: Cultivator, Puddling, Pudding equipments, Rotavator, Transplanting, Yield.

INTRODUCTION

Rice (*Oryza sativa*) is an increasingly important staple food of Jharkhand state. The state falls under the agroclimatic zone VII (Eastern Plateau and Hilly Region). The state receives annual rainfall of 1200 to 1600 mm, about 82 per cent of rainfall occurs within monsoon season from June to September. Rice is the major kharif crops in Jharkhand and its cultivation is done across 18 lakh ha in Jharkhand during kharif season. In Jharkhand, annual production of rice has increased from 1.11Mt in 2010-11 to 4.08 Mt in 2017-18 (Statista Research Department, 2020). This was due to use of high yielding varieties, improved weed and pest control, mechanization and Government support. Rice can be grown both in upland and lowland conditions. In Jharkhand the cultivation of rice in upland conditions is not very popular due to non-stagnation of rain water, long crop duration variety (MTU-7029) and problems of weeds. By cultivating rice in lowland conditions, the above problems can be solved through various tillage practices. These tillage practices viz. compaction, sub-surface barriers and puddling have been evaluated for decreasing percolation losses (Saimbhi, 2016).

Puddling is the most popular practice under transplanted rice as apart from reducing percolation losses, it helps to control weeds and creates soft medium for easy transplantation of rice seedlings (Saimbhi, 2016). Puddling in general refers to the destruction of soil aggregates into ultimate soil particles at moisture content near saturation. It is also defined as the destruction of aggregated condition of the soil by mechanical manipulation within a narrow range of moisture contents above and below field capacity, so that soil aggregates loose their identity and converted into structurally more or less homogenous mass of ultimate particles.

From farmer's point of view, puddling is simply the mixing of saturated soil with water to make it soft for transplanting and impervious to water. Puddling

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helps in better growth of rice seedlings, maintain standing water conditions and check nutrient loss by reducing leaching besides controlling weeds. Puddling is the process of churning of soil and water upto a depth of 10-15 cm. This causes soil particles to go under suspension for some time and then settle. The bigger particles settle first and then the finer ones with passage of time. Thus, the finer particles formed a layer at the top which helps in reducing infiltration (Ujoh *et al*, 2014).

In Jharkhand, farmers mainly use tractor-mounted cultivators for puddling operation. The shape of cultivators and its operation is such that it opens the soil but does not churn the soil for effective puddling. Planking generally follows the cultivator operations to seal the soil at the surface only. In fact, the rice crop requires a well-prepared soil with a compact layer of low infiltration rate below the root zone to impede water leaching. In comparison with cultivator operation, rotary tillage achieves the essence of puddling by virtue of its ability to pulverize to high degree and to transform compaction to lower layer of soil by scrubbing (Ujoh *et al*, 2014 and Kumar *et al*, 2018 and Saimbhi, 2016). A study was therefore under taken to study the performance of different field preparation equipment in term of percolation losses and puddling index and the effect of these treatments on productivity of rice.

MATERIALS AND METHODS

The study was carried out during *kharif* season in the year 2017-18 by the KVK Sahibganj, Jharkhand. The trials with seven replications were carried out at farmers' field in villages namely Lohanda, Paharpur, Birbalkandar and Banjhi in Borio block and Lalbandh, Parariya and Kajigaon in Rajmahal block of Sahibganj district of Jharkhand. There were three treatments namely farmer's practice (FP), technology option 1 (TO1) and technology option 2 (TO2) in each replication and carried out at each farmer's field of selected villages. The plot size for each treatment was kept at 1000 m^2 (40mx25m) after harvesting of previous wheat crop with about 7-10 cm of stubble height. Summer ploughing of all selected fields was carried out in the month of April and May. In the month of last week of July, all selected summer ploughed field were flooded with rain water. The standing water was kept in the fields overnight for saturation. Three different puddling treatments consisting of Farmer's practice *i.e.,* puddling by tractor operated cultivator three times prior to transplanting and then planking (CP), technology option 1 *i.e.,* puddling by tractor operated cultivator one pass and followed by rotavator having one pass prior to transplanting (CR) and technology option 2 *i.e.,* puddling by rotavator one pass before transplanting (R) were evaluated to ascertain the productivity of rice. The sedimentation period was kept for 24 hr. Transplanting of paddy was done by random transplanting with daily wages labour in each plot. Puddling bed depth, cost of puddling operation and effective field capacity were measured in all the three different treatments plots. The agronomic conditions like seed rate, seed treatment**,** fertilizer application, plant protection and weed control were kept same for all the field plots under investigations. The data were recorded from the demonstration and control plots and analyzed for comparative performance of technological option and farmer's practice by random crop cutting method.

RESULTS AND DISCUSSION

The average depth of puddling was found to be highest (12.8 cm**)** in technology option 1. The average cost of operation for developing favourable puddled bed and average field capacities were also calculated for all the treatments. The average effective field capacity was found to be highest (0.9 ha/h) in the case of Technology option 1 whereas cost of operation for developing favourable puddled bed was highest Rs 3100/= per ha in farmer's practice method as puddling by tractor operated cultivator three times prior to transplanting and then planking. Saimbhi (2016) also found similar type of observations.

Table 1. Depth of puddling, effective field capacity and cost of puddling operation in different treatments.

Sr. No.	Parameter	(FP)	(TO 1)	(TO 2)
1	Depth of puddling, cm	9.8	12..8	11.9
2	Effective field capacity, ha/h	0.3	0.9	0.7
3	Cost of operation, Rs/ha	3100	2100	1800

The agronomic yield data during the crop growth period was measured in all the different treatments plots shown in Table 2. The effective tillers per hills were as 265.5, 285.4 and 280.2 in FP, TO 1 and TO 2 treatments, respectively. The number of grains per panicle and weight of grains per panicle in grams for FP, TO 1 and TO 2 treatments were found to be 173.4, 181.8, 179.6 and 3.4, 4.6, 4.2, respectively. Higher number of hills per metre square affects the weight of grains per hill, no. of grains per panicle, and a thousand grain weight. The grain yield was found to be 33.9, 36.8 and 35.4 q/ha for FP, TO1 and TO2 treatments, respectively and highest in technology option 1 as compared to other options. This type of trend was also found by Saimbhi (2016).

The gross return, net return and benefit cost ratio were calculated on the basis of available grain yield data, cost of cultivation data for different treatments plots and minimum support price (MSP) given by government. The grain yield was found to be 33.9, 36,8 and 35.4 q/ha, respectively for FP, TO1 and TO2 treatments and was higher (36.8 q/ha) in TO1 *i.e.,* puddling rice field by cultivator (1 pass) & then rotavator (1 pass) among other treatments of puddling. The average grain yield was observed as slightly low (33.9q/ha) in farmer,s practice puddled fields as compared to other two technology options.

Results of economic analysis parameter revealed that the rice recorded higher total gross return of Rs 58880/ ha under TO1as compared to other field treatments. Technologies demonstrated (TO1 and TO2) also had positive influence on net return and there by benefit cost ratio (B:C ratio) over farmer's practice. The net return was highest (Rs 29380/ ha) in TO1 and relatively low (Rs 23740/ ha) in farmer's practice. The benefit cost ratio (B:C ratio) was also recorded highest 2.00 in TO1. These results were in accordance with the findings of Singh *et al* (2018).

Table 2. Crop parameters and economic analysis of different puddling treatments .

Sr. No.	Parameter	(FP)	(TO 1)	(TO 2)
1	Plant ht. at harvest, cm	109.8	112.6	111.4
2	Hills/m2	14.2	21.4	19.8
3	Effective tillers/hill	265.5	285. 4	280.2
4	No. of grains/panicle	173.4	181.8	179.6
5	Wt. of grains/ panicle,g	3.4	4.6	4.2
6	Grain yield, q/ha	33.9	36.8	35. 4
7	Cost of cultivation, Rs/ha	30500	29500	28500
8	Gross return, Rs/ha	54240	58880	55040
9	Net return, Rs/ha	23740	29380	26540
10	BC ratio	1.78	2.00	1.93

CONCLUSION

From the results of the experiment, it was concluded that field preparation by cultivator one time followed by rotavator one time prior to transplanting appears to be the best form of land preparation for rice production as it influenced maximum yield of rice. The results revealed that yield of rice in TO1 was higher (36.8 q/ha) as compared to other options taken for the study. The benefit cost ratio (B:C ratio) was also recorded higher in TO1 as compared to other two technology options.

REFERENCES

Kumar K S, Bonaventure J T, Jerome M and Jonne R (2018). Increasing paddy yields and improving farm management: results from participatory experiments with good agricultural practices (GAP) in Tanzania. *Paddy and Water Environ* **16**: 749–766.

Saimbhi V S (2016). Effect of puddling equipment on puddling characteristics under paddy cultivation In Punjab. *Int J of Agric and Environ Res* **2**(3): 332-338.

Samui S K, Maitra S, Roy D K, Mandal A K and Saha D (2000). Evaluation of frontline demonstration on groundnut. *J Indian Soc Coastal Agri Res* **18**(2): 180-183.

Singh S P, Paikra K K and Patel Chanchala Rani (2018). Performance of cluster frontline demonstration on productivity and profitability of Black gram (*Vigna mungo*) in Raigarh District of Chhattisgarh, India. *Int J Curr Microbial App Sci* **7**(06): 1325-1330.

Ujoh F T and Ujoh F (2014). Effects of different tillage operations on rice yield at Yandev Central Nigeria. *Agric Sci Dev* **3**(1): 132-138.

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