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Influence of Planting Methods and Varieties on Yield and Economics of Paddy

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ABSTRACT

A field experiment was carried out using split plot design with three replications during kharif 2017 to evaluate the effect of planting methods and varieties on yield and economics of paddy. The study comprised of five planting methods as main plots and two varieties as sub plots. Results revealed that, maximum grain yield (27.96 q ha^{-1}) and straw yield (42.93 q ha^{-1}) was obtained with the method of PKV SRI transplanting at 25 cm x 25 cm which was significantly superior over other methods. The PKV SRI transplanting at 20 cm x 20 cm was found to be at par with drilling at 25 cm; drilling at 20 cm and farmers practice. In terms of economics, the highest gross monetary returns (Rs. 71405 ha^{-1}) and net monetary returns (Rs. 53588 ha^{-1}) were observed with the planting method of PKV SRI transplanting at 25 cm x 25 cm. Highest B:C ratio of 4.01 was also recorded with the planting method PKV SRI transplanting at 25 cm x 25 cm which was followed by PKV SRI transplanting at 20 cm x 20 cm. Grain & straw yield (q ha^{-1}), gross monetary returns, net monetary returns and B:C ratio were not influenced due to varieties.

Key words: *Paddy, Planting methods, Varieties, Yield, Economics.*

INTRODUCTION

Rice (*Oryza sativa* L.) is an important staple food crop of India, contributing 45% to the total food grain production. It is extensively grown in Eastern, Northern and Southern states of the country. In India, rice is grown under diverse agro-ecological condition such as irrigated (19.6 million ha.), rainfed upland (7.1 million ha.), lowland (16.0 million ha.) and deep water (1.5 million ha.)[11]. It is widely grown in South-Eastern part of the country covering an area of 56.08 million ha. With an annual production of 92.6 million tonnes. India rank first in respect of area 44.50 million ha., second in production 102.75 million tonne, only after China, but the productivity of rice is very low only 2.20 tonne ha^{-1} which is quite low as compared to other rice growing countries like Japan (6.8 t ha^{-1}), Korea (6.1 t ha^{-1}), China (5.9 t ha^{-1}) and Indonesia (4.3 t ha^{-1}). Among the different agronomic practices, planting methods and choice of variety play a vital role in achieving higher yield levels of rice.

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It is because of the proper distributions of crop plant unit^{-1} area and efficient utilization of available resources as well as environment. Rice is grown under direct seeding either dry broadcast after receiving first flush of shower or wet seeding of sprouted seeds in the puddle soil, which severely suffers from weeds resulting in very low yields. However, direct seeding of rice have several advantages *i.e.* saves labours, faster and easier planting, timely sowing, less drudgery, early crop maturity by 7–10 days, less water requirement, high tolerance to water deficit often high yield, low production cost and more profit, better soil physical condition for succeeding crops and less methane emission[2]. Further looking on the intensification in limited field, the System of Rice Intensification (SRI) has been highly emphasized to maximize the production of rice. Careful transplanting of young seedlings at a wider spacing under SRI cultivation ensures more number of tillers, more root growth and panicle length. Through appropriate water management strategies under SRI the field is kept moist and not flooded ensuring lesser water requirement for crop. System of Rice Intensification (SRI) is a alternative practice to solve the water crisis and as a methodology for increasing the productivity of irrigated rice by changing the management of plant, soil, water and nutrients[13]. Keeping these in view, the research was carried out to know the suitable planting methods and varieties for higher yield and economics of rice.

MATERIAL AND METHODS

A field experiment was conducted during *kharif* season of 2017 at Agronomy Farm, College of Agriculture (Dr. PDKV), Nagpur, Maharashtra. The soil of the experiment field was sandy clay loam in texture with pH 7.8, organic carbon 0.616% and available N, P2O5 and K20 as 275.9, 24.09 and 379.0 kg ha^{-1} respectively. The total rainfall received during *kharif* 2017 (1st July to 30th October) was 951.4 mm in 40 rainy days. The experiment was conducted in split plot design replicated thrice with 10 treatment combinations comprising five different drilling and transplanting methods *viz*., drilling at 20 cm (P_1), drilling at 25 cm (P_2), PKV SRI method transplanting at 20 cm x 20 cm (P_3), PKV SRI method transplanting at 25 cm x 25 cm (P_4), and farmers practice (random transplanting) (P_5) as main plots and two varieties Sye-1 (V_1) and Skl-6 (V_2) as sub plots. For SRI method, 20 cm x 20 cm & 25 cm x 25 cm markers were used for transplanting 18 days old seedlings and for farmers practice 25 days old seedlings were used for transplanting. FYM was incorporated one week before transplanting. Organic manures *i.e* FYM @ 5 t ha^{-1} were applied one week before planting. 1/3 nitrogen, total phosphorus and potassium were applied as basal at the time of drilling and puddling operations. 1/3 N was applied at maximum tillering stage and remaining 1/3 N was applied at panicle initiation stage. Nitrogen, phosphorus and potassium were applied in the form of urea, single super phosphate and muriate of potash respectively. The crop was sown on 28th June 2017 (nursery & drilling) and transplanted on 17th July 2017. In SRI method, cono weeder was operated for 2 times for control of weeds. Plant protection measures and agronomical practices were followed as per need. The observations on grain yield and straw yield were recorded at harvest. Data were collected and analyzed statistically.

RESULTS AND DISCUSSION:

Data regarding grain & straw yield, gross monetary returns (GMR), net monetary returns (NMR) and B: C ratio is given in table 1.

Planting methods: Grain and straw yield (q ha^{-1}), gross monetary returns and net monetary returns were significantly influenced due to different planting methods. Maximum grain yield (27.96 q ha^{-1}) and straw yield (42.93 q ha^{-1}) was observed with the method of PKV SRI Method transplanting at 25 cm x 25 cm which was significantly superior over remaining methods. The treatment PKV SRI transplanting at 20 cm x 20 cm was found to be at par with treatment drilling at 25 cm, 20 cm and farmers practice. Same trend was noticed with regard to straw yield. Similar results were obtained by Muhammad *et al.*[12] who reported that the maximum rice straw was obtained by rice seedlings transplantations due to better establishment and growth of rice plants over direct seed sowing. The maximum yield of grain and straw under SRI method may be due to the maximum plant growth parameters by maximum translocation of photosynthates[17, 20]. Larry *et al.*[7] studied planting methods, the most consistent planting method and best in almost all examined parameters under individual years was the seedling transplanting method followed by direct seed drilling method. Seedling transplanting method was not significantly different from direct drilling method in almost all parameters examined. Mehra *et al.*[10] reported that among the different tested varieties, Pro-Agro 6444 produced significantly highest grain yield than other varieties and further under SRI system found higher yield attributing characters and finally produced maximum grain yield. Bozorgi *et al.*[3] reported high grain yield in transplanting at 15 cm × 15 cm treatment as compared to 20 cm × 20 cm and 25 cm × 25 cm. The experiment conducted on the effect of spacing 20 cm × 10 cm, 15 cm × 10 cm and 10 cm × 10 cm on the grain yield of early, medium and late duration tall growing *indica* varieties showed that spacing of 10 cm × 10 cm gave higher yield in case of early maturing varieties while the spacing of 20 cm × 10 cm gave the higher yield for medium and late maturing varieties[4].

In terms of economics, the highest gross monetary returns (Rs. 71405 ha^{-1}) and net monetary returns (Rs. 53588 ha^{-1}) were observed with the planting method of PKV SRI Method transplanting at 25 cm x 25 cm which was significantly superior over other treatments. The values of GMR and NMR recorded with treatment PKV SRI transplanting at 20 cm x 20 cm, drilling at 25 cm, farmers practice and drilling at 20 cm were found at par. Highest B: C ratio of 4.01 was recorded with PKV SRI transplanting at 25 cm x 25 cm which was followed by PKV SRI transplanting at 20 cm x 20 cm.

Varieties: Grain & straw yield (q ha^{-1}), gross monetary returns and net monetary returns (Rs. ha^{-1}) were not influenced due to varieties and the results were non-significant. Skl-6 recorded more B: C ratio (3.31) than Sye-1 (3.19). Rana *et al.*[14] reported the rice crop established with direct seeding of the dry and sprouted seed matured 7 days earlier than transplanting. The variety BRRI dhan-39 gave the highest yield when grown with direct seeding of sprouted seed compared to other varieties. Treatment interaction effects were found non-significant.

All these above parameters were high in transplantation because of proper spacing for good water management[9] photosynthetic activities and assimilate partitioning[6], thereby resulting in good yield in well spaced rice fields. The low paddy yields recorded in drilling and farmers practice than transplanting method could have been due to overcrowding of plants thereby competition for moisture, nutrients, space and sunlight. Lower light penetration to lower leaves increases foliar shading and produces thinner stem. All these factors collectively contribute to a decrease in photosynthesis; assimilate production and its partitioning resulting reduction in stem diameter. However, plants grown in wider spacing have more area of land around them to extract more nutrients and had more solar radiation to absorb for better photosynthetic process. The results are quite in line with Thakur[16] and Mahajan *et al.*[8] who achieved higher grain yield in transplanted technique as compared to direct sowing. Ali *et al.*[1] during the study revealed that grain yield and cost benefit ratio of the different planting techniques were in the order line transplantation > conventional transplantation> direct seed dibbling> direct seed drill > pre germinated seed broadcast. The highest seed index, straw yield, and cost benefit ratio were recorded in line transplanting technique. Gupta *et al.*[5] reported 10% higher yields in direct seeded rice than flooded transplanting. Sheieh[15] also reported an increase of grain yield due to the increase in the panicle number per unit ground area. Uddin *et al.*[18, 19] indicated 20.6% grain yield increments from 120 plants m^{-2} as compared to 20 plants m^{-2}.

Table 1: Yield and economics of paddy as influenced by different planting methods and varieties

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	GMR (Rs ha^{-1})	NMR (Rs ha^{-1})	B:C ratio
Planting methods					
P_1 -Drilling at 20 cm	20.76	31.76	52992	33549	2.73
P_2 -Drilling at 25 cm	23.90	36.00	60948	41945	3.21
P_3 -PKV SRI 20 cm x 20 cm	24.77	37.20	63176	45331	3.54
P_4 -PKV SRI 25 cm x 25 cm	27.96	42.93	71405	53588	4.01
P_5-Farmers practice	21.97	33.84	56112	35910	2.78
SE (m)±	0.53	0.67	1334	1334	-
CD at 5%	1.73	2.18	4350	4350	-
Varieties					
V_1 - Sye-1	23.42	35.84	59787	40925	3.19
V_2 - Skl-6	24.33	36.85	62066	43204	3.31
SE (m)±	0.30	0.35	746	746	-
CD at 5%	N.S	N.S	N.S	N.S	-
Interaction					
SE (m)±	0.66	0.79	1669	1669	-
CD at 5%	N.S.	N.S.	N.S.	N.S	-

Market price for Paddy Rs. 2400/- q^{-1}

CONCLUSIONS

Maximum grain yield was observed with the transplanting method of PKV SRI 25 cm x 25 cm which was significantly superior over remaining methods. Highest GMR, NMR and B:C ratio were also observed with the transplanting method of PKV SRI 25 cm x 25 cm. Grain & straw yield, GMR, NMR was not influenced due to varieties.

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