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Effect of Different Establishment Methods on Growth and Yield of Rice

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Abstract

An experiment was conducted during *kharif* of 2008 in sandy clay loam soil to study the effect of different establishment methods on growth and yield of rice. The investigation consisted of six establishment methods viz., zero tillage, aerobic method, system of rice intensification (SRI) method, drum seeding, self propelled mechanical transplanting and hand transplanting. Among different establishment methods, growing of rice by SRI method recorded significantly higher plant height (81.7 cm), leaf area per hill (2,252.7 cm^2), number tillers per hill (30.8), total dry matter production per hill (70.8 g), number of seeds per panicle (87.9), panicle length (22.9 cm), panicle weight (2.5 g), grain yield (5435 kg/ha) and stover yield (7842 kg/ha) followed by rice established by aerobic method compared to other method rice establishment methods. Significantly lower plant height (72.4 cm), leaf area per hill (1,690 cm^2), number tillers per hill (20), total dry matter production per hill (54.2 g), number of seeds per panicle (71.9), panicle length (21.9 cm), panicle weight (2.18 g), grain yield (4261 kg/ha) and stover yield (6,028 kg/ha) were recorded in rice established by zero tillage method.

Key words : Growth, Yield, Establishment methods, Rice.

Rice (*Oryza sativa* L.) is the major source of food for nearly half of the worlds population. The slogan 'Rice is life' comes from the understanding that rice based cropping systems are essential to everyone directly or indirectly for food security, livelihood improvement, cultural heritage and sustainable development for global peace. Rice plays a major role in the national economy in many developing countries. Rice occupies largest cropped area of 43 million hectares with an annual production of 109.5 million tonnes in India. In Karnataka rice is grown over an area of 1.42 million hectares with a production of 3.6 million tones (1). In recent years different establishment methods have been developed and they are under practice also. The rice yield could be tripled by adopting SRI method compared to traditional method of cultivation (2). The establishment methods largely influence on growth and yield of rice. So the present investigation was taken up on growth and yield of rice under different establishment methods.

Methods

An experiment was conducted during *kharif* of 2008 at Agriculture Research Station, Kathalagere, Davanagere Dist, Karnataka. The soil of the experimental site was sandy clay loam with slightly acidic in pH (5.2), slightly high in organic carbon (0.60%), low in available nitrogen (274.6 kg/ha), medium in phosphorus (22 kg/ha) and low in potassium (197 kg/ha). The experiment was laid out in randomized complete block design with six establishment methods viz., zero tillage, aerobic method, SRI method, drum seeding, self propelled mechanical transplanting and hand transplanting and replicated four times. The recommended dose of fertilizers (100 : 50 : 50 NPK kg/ha) was applied to all the treatments. Helf dose of nitrogen and full dose of phosphorus and potassium were applied at the time of seeding or transplanting by using urea, single super phosphate and murate of potash, respectively. The remaining 50% of nitrogen was applied in two splits at tillering and panicle initation stage to all treatments. The rice variety IR-64 was used for this experiment. The seeds were sown according to spacing recommended for different methods of establishment.

Aerobic Method

Two seeds per hill were sown at a spacing of 25

cm × 25 cm and depth of not more than 2 cm by adopting seed rate of 7 kg/ha. Ten days after sowing only one seedling was maintained by removing the excess seedling.

SRI Method

The land was ploughed using bullock drawn M. B. plough and leveled. The raised beds 1 m × 1 m width were prepared. The beds were prepared near to the main field. FYM at 10 t/ha was added to nursery bed and seeds were sown at 7 kg/ha and 12 days old seedlings were planted (one seedling per hill) at spacing of 25 cm × 25 cm during *kharif* of 2008. At transplanting , the seedlings were removed from nursery bed with seed, soil and roots intact carefully and planted in main field without plunging too deep into the soil.

Hand Transplanting Method

The land was ploughed using bullock drawn MB plough and leveled. Then raised beds of 1 m ×1 m width were prepared. The beds were prepared near to the main field and seeds were sown in nursery bed at 62kg/ha and 25 day old seedlings were planted at a spacing of 20 cm × 10 cm (one seedling/hill) during *kharif* of 2008.

Self Propelled Mechanical Transplanting

For the preparation of healthy seedlings mat type of nursery was used in mechanical transplanting methods. The nursery bed was prepared in trays with 5 cm soil mix layer. The soil mix was prepared by mixing soil and FYM in 2 : 1 ratio. The sprouted seeds were broadcasted uniformly on the bed. Finely powdered and well decomposed FYM was sprinkled over the seeds. Watering was done thrice a day using rose can so as to saturate the soil layer and 25 days old seedlings from the mat type of nursery were placed onto the self propelled transplanter pulled in the field one seedlings per hill with a spacing of 25 cm × 25 cm.

Drum Seedling

In drum seedling, seeds which were soaked kept for pre-germination for 24 hours. The individual drums were filled with pre-germinated seeds and seeds were sown at 20 cm between the rows and afterwards extra seedlings were thinned out to maintain desired population.

Table 1. Growth parameters of rice as influenced by different establishment methods.

Treatments	Plant hight (cm)	Leaf area per hill (cm^2)	Number of tillers (g/hill)	Total dry matter production (g/hill)
Zero tillage	72.4	1690.0	20.0	54.2
Aerobic method	79.6	2042.3	29.2	67.4
SRI method	81.7	2252.7	30.8	70.8
Drum seeding	78.4	2068.7	28.8	64.6
Self propelled mechanical transplanting	75.9	1998.1	27.0	60.0
Hand transplanting	75.0	1891.8	21.4	58.8
SE ±	1.55	72.16	0.73	2.27
CD at 5%	4.67	217.49	2.19	6.86

Zero Tillage

In zero tillage, sowing of seeds was carried out without doing any tillage in the main field by dibbling the seeds at a spacing of 25 cm × 25 cm. Two seeds were sown per hill at depth of not more than 2 cm by adopting seed rate of 7 kg/ha. Ten days after sowing only one seedling was maintained by removing the excess seedlings.

Water Management

For aerobic and zero till method irrigation was given once a week depending upon rainfall. In SRI method, regular irrigations were given to keep the soil moist. For hand transplanted, self propelled mechanical transplanted and drum seeded plots, 2.5 cm water height was maintained from planting to 10 days after planting (DAP) and 5 cm water height was maintained from 11 DAP to physiological maturity. The measured quantity of water was given to the experiment by using pershall flume. The growth and yield parameters were recorded at harvest by following standard procedures.

Results and Discussion

Effect of Different Establishment Methods on Growth Parameters of Rice

Growth parameters of rice were greatly influenced

Table 2. Yield parameters of rice as influenced by different establishment methods.

Treatments	Number of seeds/ panicle	Panicle length (cm)	Panicle weight (g)	Sterility percentage	Grain yield (kg/ha)	Straw yield (kg/ha)
Zero tillage	71.9	21.9	2.18	8.49	4261	6028
Aerobic method	86.7	22.6	2.46	5.86	5225	7285
SRI method	87.9	22.9	2.50	5.28	5435	7842
Drum seeding	82.1	22.3	2.44	6.81	5202	6714
Self propelled mechanical transplanting	70.3	22.1	2.23	5.40	5033	6549
Hand transplanting	79.2	22.1	2.21	5.50	4814	6328
SE ±	1.65	0.07	0.06	0.28	178	288
CD at 5%	4.99	0.21	0.18	0.85	537	868

by crop establishment methods (Table 1). Rice was established by SRI method recorded significantly higher plant height (81.7 cm), leaf area per hill (2,252.7 cm^2), number tillers per hill (30.8) and total dry matter production per hill (70.8 g) which is onpar with aerobic method rice cultivation (plant height (79.6 cm), leaf area per hill (2,042.3 cm^2), number tillers per hill (29.2), total dry matter production per hill (67.4 g) and compared to other establishment methods. This may be due to planting of seedlings before third phyllochron (10 to 12 days old seedlings). Phyllochron, which has been used to characterize the growth dynamics of cereals, is defined as intervals of leaf emergence (3). The other reasons could be shallow depth of planting and wider spacing (25 × 25 cm). The young seedlings sustained least injury to the roots and leaves as they contained maximum amount of nutrients and quickly established after transplantation which leads to large root volume, profuse and strong tillers (4), Lower plant height (72.4 cm), leaf area per hill (1690 cm^2), number tillers per hill (20) and total dry matter production per hill (54.2 g) were recorded in rice established by zero tillage method. The lowest growth parameters were recorded in zero tillage might be due to more damage from weeds, improper soil condition due to high bulk density leading to poor growth of roots which in turn affected nutrient uptake and ultimately less growth parameters. The results are in accordance with the findings of Higuchi and Yoshida (5), Koide and Takamatsu (6).

Effect of Different Establishment Methods on Yield and Yield Parameters of Rice

Yield and yield parameters are greatly differed with different estabishment methods (Table 2). Among different establishment methods, rice is established by SRI method recorded significantly number of seeds per panicle (87.9), panicle length (22.9 cm), panicle weight (5.2 g), grain yield (5,435 kg/ha) and stover yield (7842 kg/ha) which is at with aerobic method of rice cultivation viz., number of seeds per panicle (86.7), panicle length (22.6 cm), panicle weight(2.46 g), grain yield (5225 kg/ha) and stover yield (7285 kg/ha). This may be due to increase in growth and yield parameters in SRI method was attributed to favorable condition provided by transplanting of young seedlings, cono-weeding operation provided more aeration to roots which resulted in profuse root system it ultimately resulted in higher growth and yield attributes of rice (4). Lower number of seeds per panicle (71.9), panicle length (21.9 cm), panicle weight (2.18 g), grain yield (4, 261 kg/ha) and stover yield (6,028 kg/ha) were recorded in rice established by zero tillage method. This might be due to physical hindrance exhibited to root growth by left over stubbles of previous crop in zero tillage method of establishment of rice cultivation.

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