INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-6, Issue-2, April-June-2016 Coden: IJPAJX-CAS-USA, Copyrights@2016 ISSN-2231-4490
Received: 4th Feb-2016 *Revised: 21st Mar 2016* *Accepted: 21st Mar 2016*
Research article

EFFECT OF DIFFERENT RICE ESTABLISHMENT METHODS ON GROWTH, YIELD AND DIFFERENT VARIETIES DURING *KHARIF* SEASON

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ABSTRACT: A field experiment was conducted in spit plot design with three replication to "Effect of different rice establishment methods on growth, yield and different varieties during *kharif* season" was conducted at Agronomy farm, College of Agriculture, Dapoli, Distt. Ratnagiri (M.S.) during *kharif* season of 2014 on was sandy clay loam in texture, moderately acidic in pH (5.63), medium in organic carbon content (0.82 %), electrical conductivity (Ec) 0.035 dSm^{-1} , medium in available nitrogen (284.82 kg/ha), low in available phosphorus (14.63 kg/ha) and high in available potassium (248.45 kg/ha).

The treatments of the experiment were drilling methods of sowing rice seeds were sown by using manually with 15 cm row spacing as per seed rate (60 kg ha^{-1}). In early transplanting (15 days age old seedling), transplanting as per as recommended (21 days old age seedling) and thomba methods transplanted seedling with 20x15 cm spacing with 3 to 5 seedling per hills. The other common packages of practices were followed time to time and periodically are observations were recorded on growth and yield for evaluate the treatment effects.

The results obtained during the study revealed that grain yield of the different establishment methods were in the order, transplanting as per as recommended (21 days old age seedling at par early transplanting (15 days age old seedling)followed bythomba methods transplanted and drilling methods. The highest plant height (71.09 cm), effective tillers (360.58 m^2), length of panicle (21.07 cm), test weight (22.24 g), straw yield (47.42 q ha^{-1}), dry matter (1371.92 m^{-2}), weight of per panicle (2.15 g), number of filled grains per panicle (97.08) and B:C ratio (1:2.23) were recorded in line transplanting technique. Based on the results obtained, it can be concluded that in areas where labour is available and cheap, transplanting as per as recommended (21 days old age seedling) is a better establishment methods of rice because it produces more yield and gross monetary economic return than other methods.

Key words: Rice, Growth yield, Kharif season

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INTRODUCTION

Rice commends recognition as a supreme commodity to mankind, because rice is truly life, a culture, a tradition and a means of livelihood to millions. It is an important staple food providing 66 to 70 per cent body calorie intake of the consumers. The United Nations General Assembly, in a resolution declared the year of 2004 as the "International Year of Rice", which has tremendous significance to food security. It very eloquently upheld the need to heighten awareness of the role of rice in alleviating poverty and malnutrition [1].

Total geographical area under rice in India is 43.73 million hectares with annual production of 106.19 million tones with productivity 2.46 tons per ha in 2013-2014 crop year [2], hence a significant portion of the world's agricultural research has been focused on rice. This lead to development of modern rice varieties and their improved technologies that have greatly increased the global rice production.

In Maharashtra state, rice is cultivated on 15.13 lakh hectares area in almost all four regions viz., Vidharbha (7.95 lakh ha.), Konkan (3.83 lakh ha.), Western Maharashtra (3.23 lakh ha.) and Marathwada (0.12 lakh ha.) with annual production of 41.71 lakh tons unmilled (brown rice) and 28.78 lakh tons milled rice. The area (7.95 lakh ha.) and production (16.81 lakh tons unmilled rice) of rice crop is more in Vidharbha region while as highest productivity was observed in Konkan region (2.75 t per ha) milled rice and 3.83 tons per ha unmilled (brown rice) by production of 15.26 lakh tons unmilled (brown rice) and 10.53 lakh tons milled rice from 3.83 lakh ha area of the Konkan region [3]. Drilling has been the principal method of rice establishment since the 1950's in developing countries [4]. At present, rice cultivation is as direct seeded in America, Western Europe such as Italy and French, Russia, Japan, Cuba, India, Korea, and the Philippines and in some parts of Iran, due to high technology, high labour cost and shortage of skilled labour [5]. Direct seeding technique offers a useful option to reduce the limitations of transplanted rice. Direct seeding is being practiced in many developed countries where labour is scarce and expensive [6]. Direct seeding can reduce the labour requirement by as much as 50 per cent. Land preparation, laddering, and weeding operations in this system are spread over several months, thus allowing farmer to make full use of family labour and to avoid labour bottlenecks. When rainfall at planting time is highly variable, direct seeding may help reduce the production risk [7]. Direct seeding can also reduce the risk by avoiding terminal drought that lowers the yield of transplanted rice, especially if the latter is established late due to delayed rainfall. Direct seeding can facilitate crop intensification [8].

The age of seedlings at transplanting is an important criterion in rice production as it primarily contributes to the number of tillers produced per hill. Below 10 days of age are transplanted in transplanting, which produce higher number of tillers than normal rice production systems, which contribute to higher grain yields [9]. Tillering behavior of the rice plant greatly depends on the age of seedling at transplanting [10].

In *Konkan* region of Maharashtra rice is commonly grown by puddled transplanting method which is laborious and costly method. The peak period of rice transplanting is in the month of July which results in labour shortage at the time of transplanting. Labour shortage at the time of transplanting leads to delay in transplanting and it is one of the reasons for low yields of rice. Transplanted rice in puddled field requires continuous standing water. This leads to nutrient loss through leaching. Although puddling helps in reducing water losses through percolation and controlling weed by submergence of rice fields, but besides being costly, cumbersome and time consuming, it results in degradation of soil and other natural resources, and subsequently poses difficulties in seedbed preparation for succeeding next crop in crop rotation. Deterioration of soil structure, reduced soil aggregates stability and development of hard pan at a depth of 10 to 40 cm, increase in bulk density and compaction. Transplanting can be important in escaping crops to early cessation of rain and enhancing plants bear vigor plants with effective tillers; and ensures the ultimate yield. Besides to its reduction in seeding rate which save money for seed, transplanting provides crops less competition for growth resources such as Sunlight, moisture, and nutrients; and enables easy crop management like weeding, and herbicides as well as pesticide applications. As a result of these vigor plants are grown which improves production of the crop [11]; to overcome the problem of labour shortage and make the rice cultivation more remunerative.

MATERIAL METHODS

A field experiment was conducted in spit plot design with three replication to "Effect of different rice establishment methods on growth, yield and different varieties during *kharif* season" was conducted at Agronomy farm, College of Agriculture, Dapoli, Distt. Ratnagiri (M.S.) during *kharif* season of 2014 on was sandy clay loam in texture, moderately acidic in pH (5.63), medium in organic carbon content (0.82 %), electrical conductivity (Ec) 0.035 dSm^{-1} , medium in available nitrogen (284.82 kg/ha), low in available phosphorus (14.63 kg/ha) and high in available potassium (248.45 kg/ha).

The experiment was comprised of following treatments,

The main plot treatments of the experiment were drilling methods (M_1) of sowing rice seeds were sown by using manually with 15 cm row spacing as per seed rate (60 kg ha^{-1}). In early transplanting (M_2), transplanting as per as recommended (M_3) and thomba methods (M_4) transplanted seedling with 20x15 cm spacing with 3 to 5 seedling per hills. The sub plot treatments of experiment were Karjat-184 (V_1), Palghar-1(V_2), Karjat-2(V_3), Sahyadri-2 (V_4),Karjat-3 (V_5) and Karjat-7 (V_6).Fertiliser of nitrogen at the rate 100 kg/ha in the form of urea, phosphorus at the rate of 50 kg/ha in the form of single super phosphate (SSP) and potash at the rate of 50 kg/ha in the form of murate of potash (KCL).The other common packages of practices were followed time to time and periodically are observations were recorded on growth and yield for evaluate the treatment effects.

RESULTS AND DISCUSSION

Plant Height (cm.)

Plant height was significantly affected by at 5 per cent probability level by different establishment methods. The plant height (71.09 cm) was recorded in transplanted as recommended at par with early transplanting (70.64 cm). The minimum plant height recorded in drilling (58.22 cm). Different establishment methods significantly affected the plant height, while the maximum plant height in transplanted as recommended due to the reason that plants were specific distance and the competition between the plants were minimum and deep penetration of roots resulting in efficient use of nutrient uptake and good plant growth. Treatment Sahyadri 2 observed maximum plant height (76.68 cm) and significantly superior over the all varieties during the year. The plant height was responsible for solar radiation intercepted in rice canopy and increase panicle length. Similar result recorded by Mahajan *et al.* [12] and Hardev *et al.* [13].

Effective tillers

Number of effective tillers was influenced significantly by different establishment methods. The transplanted as recommended recorded significantly highest effective panicle (360.58 m^{-2}) on par with treatment early transplanting (317.04 m^{-2}) and thomba method (302.23 m^{-2}) superior over the treatment drilling (292.22 m^{-2}). This was probably due to proper utilization of all the available and terrestrial growth resources which may be better translocation of photosynthetic from source to sink which may result higher yield attributes under transplanting. Different varieties significantly influenced the number of tillers (m^{-2}). The number of tiller (m^{-2}) was significantly highest under treatment V_3 (352.69) on par V_6 over the treatment V_4 and V_5 remaining treatments on par with each other treatments.Similar results have also been reported by Ghasal *et al* [14] and Rajiv S. K. [15].

Table. 1 Growth and yield parameters (*Oryza sativaL.*) as affected by different establishment methods and different varieties.

Treatments	Plant height (cm)	Effective tillers (m^{-2})	Dry matter (m^{-2})	Test weight (g)	Length of panicle (cm)	Weight of panicle (g)	Grain yield (q/ha)	Straw yield (q/ha)	Filled grain per panicle	Unfild grains per panicle
A. Main plot treatment (Methods)										
M_1 : Drilling	58.22	292.22	1174.93	21.77	19.35	1.22	33.20	35.53	65.94	9.35
M_2 : Early transplanting	70.64	317.04	1368.62	21.79	20.54	1.55	40.71	45.72	87.31	8.46
M_3: Transplanting as recommended	71.09	360.58	1371.92	22.24	21.07	2.15	41.97	47.42	97.08	9.01
M_4: Transplanting with thomba method	67.47	302.23	1180.49	22.21	20.93	2.01	33.37	33.70	94.69	9.14
S.Em. ±.	0.644	22.216	13.99	1.52	0.068	0.013	0.58	0.65	1.597	0.165
C.D. at 5%	2.23	76.87	48.44	0.52	0.23	0.04	2.03	2.26	5.53	0.57
F Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
D. Sub plot treatment (Varieties)										
V_1 - Karjat – 184	62.29	314.64	1119.75	17.54	17.40	0.96	31.51	34.20	67.30	8.59
V_2 - Palghar – 1	59.01	316.79	1259.75	22	20.20	1.70	36.86	40.13	96.35	9.45
V_3 - Karjat – 2	71.25	352.69	1453.46	22.90	21.46	1.65	39	42.43	88.39	9.67
V_4 - Sahyadri–2	76.68	291.08	1298.39	26.40	24.95	2.76	40.51	44.12	108.8	8.69
V_5 - Karjat – 3	67.16	295.52	1253.40	22.46	18.95	1.42	38.12	41.52	77.01	9.03
V_6 - Karjat – 7	64.46	337.39	1256.98	20.72	19.69	1.91	37.86	41.15	79.59	8.55
S.Em. ±.	0.45	8.623	23.656	0.220	0.122	0.027	0.515	0.563	1.271	0.161
C.D. at 5%	1.28	24.64	67.61	0.62	0.35	0.08	1.47	1.61	3.63	0.46
F Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

Dry matter

Dry matter was influenced significantly by different establishment methods. The transplanted as recommended recorded significantly higher dry matter production (g m^{-2}) than the remaining treatment at par with each other. Crop dry matter is directly proportion to total biological yield. Variety karjat-3 (1453.46 g m-2) produced significantly higher dry matter (g m^{-2}) than the remaining varieties. Similar results were reported by earlier workers Kumar *et al.* [16] and Senthilkumar S. [17].

Test weight

Different establishment methods significantly influenced the 1000 grain weight (g) which was found significantly more in establishment methods transplanted as recommended (22.24 g) on par with each other treatments. The variety V4 (26.40) recorded significantly maximum test weight over the all treatments except V1. Variation in filled grains per panicle was observed due to genotypic differences of varieties. Similar results were reported by earlier worker Islam *et al*. [18].

Length of panicle

Transplanted as recommended was significantly higher length of panicle as compared toearly transplanting (21.07) on par with thomba method followed by drilling.Data from the Table 17 furnished that, the length of panicle (cm) of rice was observed significantly higher treatment V_4 (24.95) over the treatmentV_1 remaining treatment on par with each other treatment. Length of panicle is directly proportional to number of grains per panicle [19].

Weight of grains per panicle

Transplanted as recommended recorded the significantly highest weight of grains per panicle (2.15 g) over the treatment drilling remaining treatment on par with each other treatments. Treatment V_4 recorded significantly highest weight of filled grains per panicle (2.96 g) over the treatment V_1 remaining treatment on par with each other treatments.

Number of filled grains per panicle

Treatment M3 recorded the significantly highest number of grains (97.08) per panicle on par with M1, M2 than M4. Variety sahyadri-2 recorded significantly highest number of filled grains per panicle (108.8) over all other varieties, the remaining varieties at par with each other except variety Karjat-184. Since fertility of spikelets and development of grains depend on environmental factors such as nutrients, moisture and light, wider spacing possibly facilitated to supply the more food materials, moisture and light for the plant and ultimately developed grains comparing to closer spacing.

Number of unfilled grains per panicle

Treatment M4 recorded the significantly highest number of unfilled grains per panicle (9.14) over the treatment M2 and on par with M3. Treatment V3 recorded significantly highest number of unfilled grains per panicle (9.67) on par with V1 and V6 and on par with V2 and V3 and V5.

Grain yield (q/ha)

Data from Table 1 indicated that, the transplanting as per recommendation recorded significantly higher grain yield at par with early transplanting with thomba method and drilling method. However, the yield differences due to early transplanting and transplanting as per the recommendation were on par. Different varieties V_4 recorded higher grain yield (40.51 q ha^{-1}) over variety V_1. The results agree to the findings of some earlier workers Ghasal *et al.* [14] and Masud *et al.* [20].

Straw yield (q/ha)

Transplanting as per the recommendation recorded significantly higher straw yield on par with early transplanting over the thomba method and drilling.Different varieties V_4 recorded higher grain yield (44.12 q ha^{-1}) on par with V_6, V_5 and V_3 as compared to treatment V_1.

CONCLUSION

The rice crop was transplanted as per recommended package of practices given by Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli then other methods viz., drilling, early transplanting and thomba method which obtained higher grain and straw yield. The hybrid rice variety Sahyadri-2 produced higher grain yield than the other varieties under study. The obtaining higher yield and maximum returns from rice crop, rice variety Sahydari-2 was transplanted with recommended package of practices given by Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. It was proposed to initiate further studies on agronomic management of hybrid rice as it will be a promising higher remunerative crop of Konkan region in near future.

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INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

ISSN 2231-4490

International Journal of Plant, Animal and Environmental Sciences