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Research Article

Studies on Method of Establishment and Weed Management Practices on Growth and Yield of Rice (*Oryza sativa* L.) Under Irrigated Condition

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Abstract The field experiment was conducted during the Kharif season of, 2018 at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology (Kumarganj) Ayodhya (U.P.). The experiment consisted of three rice establishment method viz; transplanting, drum seeded and direct-seeded method and five weed management technique viz; Pyrazosulfuron-ethyl 10% WP @ 30 g/ha at 5 days after sowing(DAS)/days after transplanting (DAT), Almix (chlorimuron-ethyl + Metsulfuron-methyl) @ 4 g/ha at 10 DAS/DAT, Bispyribac-sodium @ 25 g/ha at 30 DAS/DAT, Hand weeding at 20 and 40 DAS/DAT and Weedy check making fifteen treatment combination which was assigned in a factorial RBD replicated thrice. Results showed that the transplanting method of rice establishment promoted growth attributes viz; the plant height, number of tillers, leaf area index, dry matter accumulation at all crop stages except 30 days stages, the yield attribute viz; effective tiller, length of panicle, number of grain/panicle and test weight, biological, grain and straw yield ha-1 over Drum and Direct methods of rice establishment of NDR-2065 variety of rice. The use of hand weeding practices twice of weed management techniques enhanced the growth parameters viz. initial plant population, plant height, number of tillers, leaf area index and dry matter accumulation, yield attributes viz; effective tiller, number of grain/panicle, length of panicle, test weight, yields viz; biological yield, grain yield, straw yield and harvest index followed by bispyribac sodium @ 25 g ha-1 at 30 DAS/DAT, Pyrazosulfuron-ethyl 10% WP @ 30 g ha-1, Almix @ 4 g ha-1 and Weedy check during study year, respectively. Therefore, used method of transplanting for rice establishment with two hand weeding practices of weed management technique proved to be growth and yield attributes and yields of NDR-2065 variety of rice during study year.

Keyword: Weed management, establishment methods, transplanting, rice, drum seeding

Introduction

Rice, India's most prominent crop, and it's belong to the Poaceae family. Rice (*Oryza sativa* L.) is the staple food of the people of the eastern and southern parts of the country. The term 'rice is life' is most appropriate for India as this crop plays a vital role in the country's food security and is the backbone of livelihood for millions of rural households. Globally rice is cultivated in a 158 M ha area with an annual production of around 470 million tonnes at average productivity of 2.76 t/ha. The highest area in rice crop is found in India but second place in the production after China. In India rice is grown in 44.86 million ha with a production of 109.15 million tonnes and the productivity is about 2390 kg/ha. Among the states of India, Uttar Pradesh has the largest area of rice i.e 5.87 million ha with a production of 12.51 million tonnes. Among the productivity of rice in Uttar Pradesh is 2123 kg/ha which is considered to be low as compared to Punjab, Haryana, Andhra Pradesh, West Bengal & Tamil Nadu. (Anonymous, 2016). Paddy field mechanization is one of the most important necessities for higher yield in the future. Mechanization in paddy can be possible at every stage of operation i.e. from land leveling to the harvesting of the crop and up to its preparation of value-added products. The various equipment such as laser land leveler, puddler, paddy drum seeder, Chinese paddy transplanter, vertical conveyor reaper, paddy thresher, etc. The paddy drum seeder and Chinese paddy transplanter

play vital roles in bringing the real mechanization in paddy direct seeding and transplanting respectively in the world. A self-propelled rice transplanter fitted with a 3 hp engine can transplant three to eight seedlings per hill. Weed management is an important key factor in obtaining higher crop yield. Weeds compete with crop plants for moisture, nutrients, light, space, and other growth factors. Unchecked weed growth causes a reduction in grain yield by about 30-36% in transplanted rice and 61% in wet direct-seeded rice. With this perspective, the present was conducted to find out the most suitable establishment method and weed management technique for the growth and yield of rice crops under irrigated conditions.

Material and Methods

The field experiment was conducted during the Kharif season of, 2018 at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology (Kumarganj) Ayodhya (U.P.). The experimental site falls under the subtropical condition with remarkable humidity and lies between 24.40 North latitudes and 82.100 East longitudes with an altitude of about 113 meter from mean sea level. The experimental plot had silty loam in texture, having basic in reaction (pH 8.1), and Ec of 0.28 mm hos/cm. at 25 C, low in organic carbon (0.43%), available Nitrogen (200.45 kg/ha), available Phosphorous (18.40 kg/ha), and high in available Potash (295.35 kg/ha). The experiment consisted of three rice establishment method viz; transplanting, drum seeded and direct-seeded method and five weed management technique viz; Pyrazosulfuron-ethyl 10% WP @ 30 g/ha at 5 days after sowing(DAS)/days after transplanting (DAT), Almix (chlorimuron-ethyl + Metsulfuron-methyl) @ 4 g/ha at 10 DAS/DAT, Bispyribac-sodium @ 25 g/ha at 30 DAS/DAT, Hand weeding at 20 and 40 DAS/DAT and Weedy check making fifteen treatment combination which was assigned in a factorial Randomized Block Design replicated thrice. The paddy variety NDR-2065 was sown on 6th July 2018, transplanted on 30th July 2018 and crop was harvested on date 15th November 2018. The recommended dose of fertilizer viz; 120 kg nitrogen, 60 kg phosphorous, and 60 kg potash were applied uniformly in each plot. The initial plant population per m2 was recorded at 15 DAS/DAT, plant height (cm.), number of tillers (m-2), dry matter accumulation (g/m2), at different growth stages of rice crop. Leaf area index was computed by using the formula as given by yosihida et al, (1972) and multiplied with the total leaves from each group as well as grain and straw yield of rice and other yield attributing characters like effective tillers, panicle length, grain/ panicle were recorded at harvest. Harvest index (%) was calculated by using the biological yield (grain + straw) after harvest.

Result and Discussion

Effect of Rice Establishment Method

The rice establishment method showed significant effect on growth parameters (Table-1), viz; plant height (cm.), number of tillers (m^{2}), Leaf area index, Dry matter accumulation (g m^{2}). Transplanting method recorded more plant height (79.90 cm.), number of tillers (310.77 m^{2}), leaf area index (4.65), dry matter accumulation (950.33 g m^{2}) over direct seeding method but being recorded at par with drum seeding method. While initial plant population were not affected significantly due to different establishment method. Numerically the maximum plant population (52.60 m^{2}) was found under transplanting method and lowest (52.04 m^{2}) was recorded under direct seeded method. The present result are in agreement with those of Naresh et al. (2013), Raj et al. (2013), Yadava et al. (2014) and Netam et al. (2018).

Different crop establishment method exhibited significant influence on all the yield attributes studied (table 2). Among them, transplanting method produce higher yield attributes, viz; number of effective tiller's m-2 (294.09), length of panicles (22.92 cm.), number of grain per panicles (100.01) over direct seeded method, however it was at par with that of drum seeded method. The result are in agreement with the finding of Naresh et al. (2013), Raj et al. (2013), Rana et al. (2014) and Tao et al. (2016). While test weight was not influence significantly due to establishment method but numerically maximum value (22.57 g) was recorded under transplanting and as a minimum (22.02 g) was found under direct seeding method. Similar finding were reported by Awan et al. (2007), Saharawat et al. (2010).

Grain and straw yield is direct result of growth and yield attributes of the crop. The various rice establishment method showed significant impact on rice yield (Table- 3), viz; biological yield grain yield, and straw yield. The transplanting method being recorded higher biological yield (97.11 q/ha), grain yield (47.80 q/ha), straw yield (49.31 q/ha) over direct seeded rice. While drum seeding method of rice establishment being recorded at par with both of the treatment. The percentage increment over drum seeding of 7.43%, 4.87% and direct seeding of 13.27%, 10% in grain and straw yield respectively during the year

of investigation. Although harvesting index was not significantly influenced by various method of establishment but numerically highest value (49.10 %) was found under transplanting and lowest value (48.04 %) was found under direct seeding method. The result were in co-ordination with earlier finding of Sridevi et al. (2017), Singh et al. (2017) and Kumar et al. (2018).

Effect of Weed Management Technique

Growth attributes like plant height, number of tillers per meter square, leaf area index and dry matter accumulation are the reflective process of effective utilization of resources in a better crop production environment. Dramatic variation in growth attributes of rice was noticed due to different weed control methods. The highest plant height (86.47 cm.), higher number of tillers per meter square (343.90), leaf area index (4.99) and dry matter accumulation (1112.77 g m-2) was recorded by hand weeding twice which was significantly superior followed by bispyribac-sodium @ 25 g/ha at 30 DAS/DAT over rest of the treatment (table 1). However weedy check treatment recorded significantly lower plant height (64.94 cm.), number of tillers per meter square (220.27), leaf area index (3.86) and dry matter accumulation (480.06 g m-2) over rest of the weed management technique. The initial plant population was not influenced significantly due to various weed management techniques but numerically highest was recorded under manual weeding twice at 20 and 40 DAS/DAT (53.67) followed by bispyribac-sodium @ 25 g/ha at 30 DAS/DAT (52.98) and lowest was observed under weedy check (51.11).

The yield attributes viz; effective tillers (m-2), number of grain per panicles, length of panicles (cm.) was influenced significantly with different weed management technique (table 2). Among various weed management technique, hand weeding twice being recorded significantly higher value of these yield attributes followed by bispyribac-sodium @ 25 g/ha at 30 DAS/DAT over Pyrazosulfuron-ethyl 10% WP @ 30 g/ha, Almix (chlorimuron-ethyl + Metsulfuron-methyl) @ 4 g/ha and thereafter weedy check. While the test weight was not influenced significantly due to various weed management techniques but numerically highest test weight (23.57 g) was recorded under hand weeding at 20 and 40 DAS/DAT followed by bispyribac-sodium @ 25 g/ha at 30 DAS/DAT (22.96 g) and lower test weight (21.07 g) was recorded under weedy check. This might because of the treatment which were able to control effect only gave poor crop-weed competition and result to which higher value of yield attributes. The finding is in conformity with the result of Kumar et al. (2018).

The biological yield, grain yield, straw yield varies significantly with various weed management technique. Manual weeding twice at 20 and 40 DAS/DAT being achieved significantly higher value of biological yield (109.92 q/ha), grain yield (54.14 q/ha) and straw yield (55.78 q/ha) followed by bispyribac-sodium @ 25 g/ha at 30 DAS/DAT as post emergence alone over rest of weed management technique. The percentage increment of hand weeding over Pyrazosulfuron-ethyl of 14.26%, 12.89, Almix of 17.72%, 16.62, bispyribac-sodium of 6.19%, 7% and weedy check of 111.15%, 85.68% in gain and straw yield respectively. The percentage increment of bispyribac-sodium over Pyrazosulfuron-ethyl of 7.59%, 5.50%, Almix of 10.85%, 8.99%, and weedy check of 98.82%, 73.53% in gain and straw yield respectively. The lowest biological yield (55.67 q/ha), grain yield (25.64 q/ha) and straw yield (30.04 q/ha) was recorded by weedy check. While harvesting index was not significantly influenced by various weed management technique but numerically highest value (49.43 %) was given by bispyribac-sodium @ 25 g/ha at 30 DAS/DAT (22.96 g) and lowest value (45.79 %) was found under weedy check method. Similar result were obtained by Baloch et al. (2006) and sairam et al. (2012).

Table- 1: Effect of establishment methods and weed management practices on growth attributes of rice crop.

Treatment	Initial plant population (m-2)	Plant height (cm.)	Number of tillers (m-2)	Leaf area index (LAI)	Dry matter accumulation (g m-2)
Method of rice establishment					
Transplanting	52.60	79.90	310.77	4.65	950.33
Drum seeded	52.26	76.33	295.18	4.41	903.34
Direct seeded	52.04	72.47	279.59	4.22	858.13
SEm ±	**0.95**	**1.38**	**5.38**	**0.08**	**16.42**
LSD (P=0.05)	**NS**	**4.03**	**15.65**	**0.23**	**47.82**

Weed management technique					
Pyrazosulfuron-ethyl 10% WP @ 30 g ha-1	52.35	75.01	298.47	4.33	954.34
Almix @ 4 g ha-1	51.39	73.82	293.62	4.29	935.15
Bispyribac sodium @ 25 g ha-1	52.98	80.93	319.65	4.65	1037.33
Hand weeding	53.67	86.47	343.90	4.99	1112.77
Weedy check	51.11	64.94	220.27	3.86	480.06
SEm ±	**1.23**	**1.79**	**6.94**	**0.10**	**21.20**
LSD (P=0.05)	**NS**	**5.20**	**20.21**	**0.30**	**61.73**

Table- 2: Effect of establishment methods and weed management practices on yield attributes of rice crop.

Treatments	Effective Tiller (No. m-2)	Length of panicles (cm)	No. of grain panicle-1	Test weight (g)
Methods of rice establishment				
Transplanting	294.09	22.92	100.01	22.57
Drum seeded	280.10	21.80	96.03	22.20
Direct seeded	267.29	20.67	91.10	22.02
SEm ±	**5.11**	**0.39**	**1.75**	**0.40**
LSD (P=0.05)	**14.87**	**1.15**	**5.10**	**NS**
Weed management techniques				
Pyrazosulfuron-ethyl 10% WP @ 30 g ha-1	283.79	21.42	94.04	22.34
Almix @ 4 g ha-1	279.14	20.59	92.40	21.38
Bispyribac sodium @ 25 g ha-1	304.50	23.41	103.49	22.96
Hand weeding	329.85	25.01	112.44	23.57
Weedy check	205.18	18.54	76.19	21.07
SEm ±	**6.59**	**0.51**	**2.26**	**0.52**
LSD (P=0.05)	**19.20**	**1.48**	**6.58**	**1.52**

Table- 3: Effect of establishment methods and weed management practices on yield of rice crop

Treatments	Grain yield (q ha-1)	Biological yield (q ha-1)	Straw yield (q ha-1)	Harvest index (%)
Methods of rice establishment				
Transplanting	47.80	97.11	49.31	49.10
Drum seeded	44.49	91.51	47.02	48.32
Direct seeded	42.20	86.97	44.78	48.04
SEm ±	**0.81**	**1.66**	**0.85**	**0.88**
LSD (P=0.05)	**2.35**	**4.82**	**2.47**	**NS**
Weed management techniques				
Pyrazosulfuron-ethyl 10% WP @ 30 g ha-1	47.38	96.79	49.41	48.95
Almix @ 4 g ha-1	45.99	93.83	47.83	49.02
Bispyribac sodium @ 25 g ha-1	50.98	103.11	52.13	49.43
Two hand weeding	54.14	109.92	55.78	49.25
Weedy check	25.64	55.67	30.04	45.79
SEm ±	**1.04**	**2.14**	**1.10**	**1.14**
LSD (P=0.05)	**3.03**	**6.22**	**3.20**	**NS**

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