Environment & Ecology 27 (1) : 238—241, 2009
 ISSN 0970-0420

Effect of Crop Establishment Methods and Weed Management Practices on Nutrient Uptake, Yield and Quality of Rice (*Oryza sativa* L.)

VIVEK YADAV, L. R. SINGH, RAJENDRA SINGH AND D. N. MISHRA

S. V. B. Patel University of Agriculture and Technology, Zonal Research Station Nagina, Bijnor, 246762, UP, India

Abstract

A field experiment was conducted during two consecutive *kharif* seasons of 2003 and 2004, to find out most suitable weed management practices for different crop establishment methods. Maximum loss of nutrients by weeds was recorded under zero tillage followed by dry seeding under moist condition while highest content of protein in grain and straw was recorded under transplanting. Highest grain yield (54.72 q/ha) was recorded under transplanting which was at par with drum seeding (54.53 q/ha) during first year and significantly superior over other methods during second year. Chemical + two hand weeding produced significantly higher grain yield (61.04 q/ha and 60.88 q/ha) over other weed management practices during first and second years, respectively.

Key words : Crop establishment, Rice, Quality, Weed management, Yield.

Rice is one of the most important cereal crop, as it is staple food of more than 70% population of the world. The slogan "rice is life" is most appropriate for India as this crop plays a vital role in national food security. It is well documented that initial plant stand contributes substantially in productivity as a low cost technology. Although transplanting supposed to be best establishment method but due to high labor charges and unavailability of labors during peak period some alternative must be explored. Weeds compete with plants and cause considerable yield loss. Manna (1) reported yield reduction of 25% in transplanted rice, 32% in puddle broadcast rice and 52% in direct sown rice. Keeping these in view an attempt was made to find out best weed management practice for different establishment methods.

Methods

The experiment was conducted at agronomy research farm of Narendra Dev University of Agriculture and Technology, Kumarganj, Faizabad during *kharif* of 2003 and 2004. The soil of the experimental field was silty loam in texture with low organic carbon (0.36—0.39%) and nitrogen (180.12—193.70 kg/ha) and medium in phosphorus (14.20—15.11 kg/ha) and potassium (246.4—268.08 kg/ha). The experiment was laid down in split plot design, main plot treatment comprises four crop establishment methods viz. M_1—Dry seeding under moist condition, M_2—Drum seeding, M_3—Zero tillage and M_4—Transplanting while sub-plot treatments comprises four weed management practices i. e. W_0—Control, W_1—Chemical + one hand weeding, W_2—Two hand weeding and W_3—Chemical + two hand weeding. Different herbicides were used for different establishment method as glyphosate at 1.0 kg a. i./ha for zero tillage, butachlor at 1.5 kg a.i./ ha for transplanting, anilofos at 0.4 kg a.i./ ha for drum seeding and pandimethalin at 1.0 kg a. i. /ha for dry seeding under moist condition and zero tillage plots. The rice variety Sarju-52 was used for sowing and fertilized with NPK at 120 : 60 : 40 kg/ ha. Irrigation and other agricultural operations were conducted based on recommendation.

Results and Discussion

Protein Content in Grain and Straw

Protein contents in grain and straw were significantly influenced by different crop establishment methods and weed management practices in 2003 while non-significant difference was observed during 2004 (Table 1). Highest protein content (7.53%) in grain was recorded with transplanting during first year.

Table 1. Yield and protein content in grain and straw as influenced by crop establishment methods and weed management practices.

Treatments	Yield (q/ha) 2003		Yield (q/ha) 2004		Protein content in grain (%)		Protein content in straw (%)	
	Grain	Straw	Grain	Straw	2003	2004	2003	2004
Method of Crop Establishment								
Dry seeding (M_1)	37.26	47.15	38.41	42.53	7.36	7.07	3.25	3.33
Drum seeding (M_2)	54.53	65.61	50.62	58.57	7.26	7.05	3.27	3.35
Zero tillage (M_3)	44.53	53.23	42.27	48.27	7.45	7.03	3.38	3.40
Transplanting (M_4)	54.72	66.02	55.29	63.94	7.53	7.13	3.30	3.38
CD at 5%	1.31	1.56	4.12	4.43	0.26	NS	0.07	NS
Weed Management Practices								
Control (W_0)	28.12	34.89	26.47	33.52	7.11	7.03	3.27	3.35
Chemical + 1 hand weeding (W_1)	44.52	55.58	43.77	49.32	7.37	7.10	3.32	3.36
Two hand weeding (W_2)	57.28	69.27	55.46	61.53	7.51	7.03	3.26	3.38
Chemical + 2 hand weeding (W_3)	61.04	72.27	60.88	68.95	7.57	7.13	3.35	3.37
CD at 5%	3.01	3.74	2.66	2.74	0.30	NS	NS	NS

Regarding weed management practices, highest protein content (7.57%) was recorded with chemical + two hand weeding which was significantly superior over control only. In straw highest protein content content of 3.38% was recorded with zero tillage which was 4.20, 3.43 and 2.65 higher dry seeding under moist condition (M_1), drum seeding and transplanting , respectively during first year. Different weed management practices failed to bring any significant variation during both the years.

Nutrient Uptake by Crop

N, P and K uptake by rice significantly influenced by different crop establishment methods and weed management practices during both the years (Table 2). Transplanting and drum seeding (96.22 and 96.42 kg/ha) being at par, significantly increased the uptake of N, P and K over dry seeding and zero tillage during 2003 while transplanting (96.53 kg/ha) was found to be significantly superior over all other methods in 2004. This might be due to the reason that puddling reduced the weed population and infiltration rate which led to higher grain and straw yield under transplanting and when multiplied by corresponding nutrient content resulted in significant increase in N, P and K uptake in both grain and straw. Significantly higher values of N, P and K uptake were recorded with chemical + two hand weeding. These results are in conformity with Singh and Singh (2).

Nutrient Uptake by Weed

The loss of nutrient through weeds was minimum with transplanting followed by drum seeding (Table 2). Highest nitrogen uptake of 8.82 and 3.81 kg/ha was recorded under zero tillage during first and second year, respectively. Similarly during first and second year P and K uptake were also higher with zero tillage which were 1.82 and 0.78 kg/ha for P and 11.10 and 4.28 kg/ha for K. Occurrence of more number of weeds per unit area and favorable growing condition, turning crop weed competition in favor of weed, resulted significant increase in dry weight of weed under zero tillage. These finding are also in agreement with number of reports (3,4). NPK uptake by weed was also significantly influenced by different weed management practices during both the years. Highest value of nitrogen loss of 12.21 and 4.77 kg/ha was recorded with control plots during both the years. Weed management practices chemical + one hand weeding (W_1), two hand weeding (W_2) and chemical

Table 2. Nutrient uptake by crop and weed as influenced by crop establishment methods and weed management practices.

Treatments	N uptake by crop (kg/ha) 2003	2004	P_2O_5 uptake by crop (kg/ha) 2003	2004	K_2O uptake by crop (kg/ha) 2003	2004	N uptake by weed (kg/ha) 2003	2004	P_2O_5 uptake by weed (kg/ha) 2003	2004	K_2O uptake by weed (kg/ha) 2003	2004
Method of Crop Establishment												
Dry seeding (M_1)	66.58	67.10	13.50	14.02	23.06	23.17	8.59	3.16	1.75	0.64	9.14	3.55
Drum seeding (M_2)	96.42	88.40	19.68	18.00	33.18	30.37	5.40	1.85	1.10	0.39	6.06	2.13
Zero tillage (M_3)	77.98	73.13	15.93	14.66	26.51	24.87	8.82	3.81	1.82	0.78	11.10	4.28
Transplanting (M_4)	96.22	96.53	19.68	19.68	33.18	33.18	3.45	1.50	0.70	0.31	3.85	1.68
CD at 5%	2.12	6.96	0.38	1.56	1.16	2.33	2.21	0.71	0.21	0.15	1.07	0.80
Weed Management Practices												
Control (W_0)	51.00	47.30	10.28	9.56	18.16	16.31	12.21	4.77	2.46	0.98	13.35	5.41
Chemical + 1 hand weeding (W_1)	79.26	76.96	16.06	15.47	27.80	26.61	6.49	2.63	1.07	0.54	7.48	2.95
Two hand weeding (W_2)	99.96	95.73	20.55	19.38	35.06	32.72	3.97	1.60	0.96	0.33	4.72	1.80
Chemical + 2 hand weeding (W_3)	107.20	105.76	21.93	21.37	36.00	36.00	3.59	1.32	0.89	0.27	4.59	1.48
CD at 5%	5.40	4.45	1.13	0.97	1.50	1.5	1.55	0.55	0.65	0.12	1.10	0.65

+ two hand weeding (W_3) reduced the loss of nitrogen to the extent of 46.84, 67.48 and 70.59 kg/ha in first year and 44.86, 66.45 and 72.32 kg/ha during second year. During first and second year, highest removal of P and K i.e. 2.46 and 0.96 kg/ha and 13.35 and 5.41 kg/ha, respectively was found under control plots. All the weed management practices significantly reduced the loss of nutrient over control. Lowest removal of nutrient was found with chemical + two hand weeding during both the years. Rana et al. (5) and Singh (6) have also reported similar trend of result.

Yield

Grain and straw yields were significantly influenced by different crop establishment methods and weed management practices during both the years (Table 1). Highest grain yield was recorded under transplanting (54.72 q/ha) which was at par with drum seeding (54.53 q/ha) during first year, while during second year transplanting (55.29 q/ha) significantly increased the grain yield over all other methods. The increases in grain yield due to transplanting , drum seeding and zero tillage were 46.85, 46.43 and 19.51% higher during first year and 43.94, 31.45 and 10.05% higher during second year over dry seeding. Higher grain yield under transplanting was due to better crop growth and development resulting higher values of yield attributes which increased the grain yield. These findings are also in agreement with those of Goel and Verma (7) and Yadav et al. (8). The highest yield during both the years was recorded under chemical + two hand weeding. The increase in yield due to chemical + one hand weeding (W_1), two hand weeding (W_2) and chemical + two hand weeding (W_3) was to the extent of 58.32, 103.69 and 117.06% in 2003 and 65.35, 1089.52 and 130.00% in 2004 over control. Similar trend was found regarding straw yield also. Highest straw yield during both the years was recorded with transplanting (66.02 and 63.94 q/ha) followed by drum seeding. In weed management practices highest straw yield during both the years was recorded under chemical + two hand weeding while lowest yield was found under control plots.

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