

EFFECT OF CROP ESTABLISHMENT METHODS AND WEED MANAGEMENT PRACTICES ON PROTEIN CONTENT, NUTRIENT UPTAKE AND YIELD OF RICE (*Oryza sativa* L.)

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ABSTARCT

A field experiment was conducted during two consecutive Kharif seasons of 2003 & 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 (54.72q ha⁻¹) was also recorded under transplanting which was at par with drum seeding (54.53 q ha⁻¹) during first year and significantly superior over other methods during second year. Chemical + 2 hand weeding produced significantly higher grain yield (61.04 q ha⁻¹ & 60.88 q ha⁻¹) over other weed management practices during first and second year, respectively.

Key words: Crop establishment methods, Rice, Nutrient uptake, Protein content, Weed management practices.

INTRODUCTION

Rice is one of the most important cereal crops, 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 our productivity as a low cost technology. Although, transplanting has been reported to be the best establishment method (Jana *et al.* 1981; Singh *et al.* 1997) but due to high labour charges and unavailability of field workers during peak period some alternative like drum seeding, zero tillage, direct seeding under moist condition, must be explored, to ensure optimum population at a lower cost. Weeds compete with plants for all critical growth factors viz. space, sunlight, water and nutrient thus cause considerable yield loss. Manna (1991) reported yield reduction due to weeds to the extent of 25% in transplanted rice, 32% in puddled broadcast rice and 52% in direct sown rice. Keeping in view these

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facts, an attempt has been made to find out the best weed management practice for different establishment methods.

MATERIALS AND METHODS

The present experiment was conducted at Agronomy Research farm of Narendra Dev University of Agriculture and Technology, Kumarganj, Faizabad, India during Kharif 2003 & 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⁻¹) and medium in phosphorus (14.20-15.11 kg ha⁻¹) and potassium (246.4-268.08 kg ha⁻¹). The experiment was laid down in split plot design, main plot treatments comprise 4 crop establishment methods viz. M₁-dry seeding under moist condition, M₂-drum seeding, M₃- zero tillage and M₄- transplanting while sub plot treatments consisted of 4 weed management practices i.e. W₀- control, W₁- chemical + one hand weeding (20 DAS/DAT), W₂-two hand weeding (20 & 40 DAS/DAT) and W₃- chemical + two hand weeding (20 & 40 DAS/DAT). Different herbicides were used for different establishment method as glyphosate @ 1.0 kg a.i. ha⁻¹ for zero tillage, butachlor @ 1.5 kg a.i. ha⁻¹ for transplanting, anilofos @ 0.4 kg a.i. ha⁻¹ for drum seeding and pendimethalin @ 1.0 kg a.i. ha⁻¹ for dry seeding under moist condition and zero tillage plots. The rice variety Sarju-52 was used for sowing and fertilized with NPK @ 120:60:40 kg ha⁻¹. Irrigation and other agricultural operations were conducted as per recommendation.

RESULTS AND DISCUSSION

Nutrient uptake by crop

N, P and K uptake by rice was significantly influenced by different crop establishment methods and weed management practices during both the years (Table-1). Transplanting and drum seeding (96.22 & 96.42 kg ha⁻¹) 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⁻¹) was found significantly superior over all other methods in 2004. This might be due to the fact that puddling reduced the weed population as well as 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 + 2 hand weeding. These results are in conformity with Singh *et al.* (1998) and Jaiswal and Singh (2001).

Nutrient uptake by weed

The loss of nutrients through weeds was minimum with transplanting followed by drum seeding (Table-1). Highest nitrogen

uptake of 8.82 & 3.81 kg/ha was recorded under zero tillage during first and second year, respectively. Similarly during first and second year P & K uptake was also higher with zero tillage which was 1.82 & 0.78 kg ha⁻¹ for P and 11.10 & 4.28 kg ha⁻¹ for K. occurrence of more number of weeds per unit area and favorable growing condition, turning crop weed competition in favour of weed, resulted significant increase in dry weight of weed under zero tillage. These findings are also in agreement with number of researchers like Nandal & Singh (1994) and Sinha *et al.* (2005). NPK uptake by weeds was also significantly influenced by different weed management practices during both the years. Highest value of nitrogen loss 12.21 and 4.77 kg ha⁻¹ was recorded with control plots during both the years. Weed management practices chemical + 1 hand weeding (W₁), two hand weeding (W₂) and chemical + 2 hand weeding (W₃) reduced the loss of nitrogen to the extent of 46.84, 67.48 & 70.59 kg ha⁻¹ in first year and 44.86, 66.45 and 72.32 kg ha⁻¹ during second year. During first and second year, highest removal of P & K (2.46 and 0.96 kg ha⁻¹ and 13.35 & 5.41 kg ha⁻¹ respectively) was found under control plots. All the weed management practices significantly reduced the loss of nutrients over control. Lowest removal of nutrients was found with chemical + two hand weedings during both the years. The results are similar to those reported by Raghupati *et al.* (1992).

Protein content in grain and Straw

Protein content in grain and straw was significantly influenced by different crop establishment methods and weed management practices in 2003 while non significant differences were observed during 2004 (Table-2). Highest protein content (7.53%) in grain was recorded with transplanting during first year. Regarding weed management practices, highest protein content (7.57%) was recorded with chemical + 2 hand weeding which was significantly superior over control only. In straw highest protein content of 3.38% was recorded with zero tillage which was 4.20, 3.43 and 2.65 per cent higher dry seeding under moist condition (M₁), drum seeding and transplanting, respectively during first year. Different weed management practices failed to bring any significant variation during both the years. Rana *et al.* (2000) and Singh, (2002) have also reported similar findings in their studies.

Yield

Grain and straw yields were significantly influenced by different crop establishment methods and weed management practices during both the years (Table-2). Highest grain yield was recorded under transplanting (54.72q ha⁻¹) which was at par with drum seeding (54.53 q ha⁻¹) during first year, while during second year transplanting (55.29 q ha⁻¹) significantly increased the grain yield over all other methods.

Table-1. Nutrient uptake by crop & weed as influenced by crop establishment methods & weed management practices.

Treatments	N uptake by crop (kg ha ⁻¹)		P ₂ O ₅ uptake by crop (kg ha ⁻¹)		K ₂ O uptake by crop (kg ha ⁻¹)		N uptake by weed (kg ha ⁻¹)		P ₂ O ₅ uptake by weed (kg ha ⁻¹)		K ₂ O uptake by weed (kg ha ⁻¹)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	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
C .D 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 +2hand 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
C .D 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

Table-2. Yield and protein content in grain and straw as influenced by crop establishment methods & weed management practices.

Treatments	Yield (q ha ⁻¹) 2003		Yield (q ha ⁻¹) 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
C.D. 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 +2hand weeding (W ₃)	61.04	72.27	60.88	68.95	7.57	7.13	3.35	3.37
C.D. at 5%	3.01	3.74	2.66	2.74	0.30	NS	NS	NS

The increase in grain yield due to transplanting, drum seeding and zero tillage was 46.85, 46.43 and 19.51 per cent higher during first year and 43.94, 31.45 and 10.05 per cent 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 (2000) and Yadav *et al.* (2005). The highest yield during both the years was recorded under chemical + 2 hand weeding. The increase in yield due to chemical + 1 hand weeding (W_1), two hand weeding (W_2) and chemical + two hand weedings (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 & 63.94 q ha⁻¹) followed by drum seeding. In weed management practices highest straw yield during both the years was recorded under chemical + 2 hand weeding while lowest yield was found under control plots. Similar results have also been reported by Bhan *et al.* (1980) and Kumar and Gautam (1986).

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