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Research Communication

Performance of Kashmir *basmati* 'Shalimar Sugandh 1' rice (*Oryza sativa*) under different nitrogen levels and weed-management practices under temperate valley conditions

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ABSTRACT

An experiment was conducted during rainy season of 2018 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Khudwani, Jammu and Kashmir, to study the response of 'Shalimar Sugandh 1' Kashmir *basmati* rice (*Oryza sativa* L.) to different nitrogen levels. Three nitrogen levels (0, 45 and 90 kg N/ha) and 5 weed-management practices, including 3 herbicides, viz. florpyrauxifen-benzyl @ 31.25 ml/ha, penoxsulam @ 22.5 g/ha and pyrazosulfuron-ethyl @ 60 g/ha + pretilachlor @ 300 g/ha, were evaluated to ascertain the most effective nitrogen dose and herbicide in controlling weeds in Kashmir *basmati* (rice). The results depicted significantly higher growth, yield and yield-attributing characters in the treatment comprising nitrogen @ 90 kg/ha and penoxsulam @ 22.5 g/ha (10 days after transplanting).

Key words: Basmati, Florpyrauxifen-benzyl, Nitrogen, Penoxsulam, Shalimar sugandh 1, Weed management

Rice has become one of the major exportable food commodities with 22.1% share of the total agriculture exports in the recent years. *Basmati* rice has lower water requirement and offers greater returns than non-basmati/coarse rice owing to its higher price in the market. In Jammu and Kashmir, *basmati* rice is cultivated on an area of 40,000 ha, with the production of 88,000 tonnes (Parray, 2017). Nitrogenous fertilizers are an important input for improving the grain yield. *Basmati* varieties do not withstand high rates of nitrogen fertilizer to increase yields. Besides, weed competition is severe in scented rice culture in view of its early slow growth rate. They reduce the yield, lower the market value by deteriorating the quality of the produce and increase the cost of harvesting, drying and cleaning. Although herbicides have come to stay as farmer-friendly practice in rice culture, their indiscriminate use causes environmental pollution. Thus, there is a need to develop effective and economical weed control and nutrient-management practices for obtaining higher yields and profitability.

The experiment was conducted during the *kharif* season of 2018 at Mountain Research Centre for Field Crops (MRCFC), Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Khudwani, Jammu and Kashmir. Climatically the experimental site is in mid-altitude temperate zone, with an average annual precipitation of 890 mm. The soil of the experimental site was silty clay loam. The experiment was laid in randomized block design with 2 factors, viz. nitrogen levels and weed management practices. Three nitrogen levels of 0 (N_1), 45 (N_2) and 90 (N_3) kg N/ha were applied in split applications in addition to a basal uniform dose of 45 kg/ha of P_2O_5 and 30 kg/ha of K_2O through single superphosphate and muriate of potash respectively. First dose of nitrogen (urea) was given at the time of transplanting and the rest of it was given in 2 splits–at active tillering and panicle-initiation stage. Weed-management practices included florpyrauxifen-ben-

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zyl @ 31.25 ml/ha as early post-emergent (W_1), penoxsulam @ 22.5 g/ha as early post-emergent (W_2), pyrazosulfuron-ethyl @ 60 g/ha + pretilachlor @ 300 g/ha as pre-emergent (W_3), weed-free (W_4) and weedy check (W_5). Photosynthetically active radiation (PAR) was measured using Luxmeter and SPAD values by SPAD meter (SPAD 502 - Soil Plant Analysis Development section, Minolta Camera Co. Ltd, Japan).

Effect of nitrogen on growth parameters

Application of 90 kg N/ha significantly improved plant height, dry-matter accumulation, leaf-area index (LAI), PAR and SPAD values at all growth stages over application of 45 kg N/ha and no-N application (Table 1). The superiority for dry-matter accumulation exhibited by the application of 90 kg N/ha (N_3) at harvesting over N_1 and N_2 levels was 11.9 and 5.2% respectively. The LAI and PAR significantly increased up to 60 and 90 days after transplanting (DAT), respectively, by the application of higher dose of nitrogen (90 kg N/ha), thereafter started to decline. Hussain *et al*., (2018) also recorded significant effects on growth parameters with the application of higher levels of nitrogen.

Effect of weed management on growth parameters

Application of penoxsulam @ 22.5 g/ha (W_2) significantly improved the plant height, dry-matter production, LAI, PAR and SPAD values of rice at various growth stages over other weed-control methods (Table 1). Penoxsulam resulted in higher plant height over the W_1 and W_5 treatments by 3.5 and 4.6%, respectively, at harvesting. Similarly, penoxsulam @ 22.5 g/ha ensued 19.2, 13.6, 30.2% higher dry-matter at 60 DAT and 14.4, 9.2, 30.2% at harvesting stage over W_1, W_3 and W_5 treatments, respectively. The LAI was also higher by 12.4 and 23.2% at harvesting by penoxsulam application @ 22.5 g/ha over W_1 and W_5 respectively. Moreover, PAR interception was significantly lower under florpyrauxifen-benzyl @ 31.25 ml/ha (W_1) application at all the crop growth stages as compared to the control. Similar results were reported by Ganai *et al*., (2018).

Effect of nitrogen on yield and yield-attributing characters

Significant increase in the yield attributes was observed with the application of 90 kg N/ha as compared to the control (Table 2). The superiority exhibited by N_3 level in recording more panicles over N_2 and N_1 were 4.9 and 10.9% respectively. The superiority exhibited by N_3 level over the control in recording higher panicle weight was 9.92%. Application of 90 kg N/ha (N_3) showed superiority to N_2 and N_1 by 6.8 and 16.7% respectively for grains/panicle. The superiority exhibited by N_3 in recording higher 1,000-grain weight to N_1 level was 7.2%. Balasubramanian (2002) also concluded that, application of N fertilizer to rice led to an increase in plant height, panicle number, leaf size, spikelet number and grain yield. The N_3 level resulted in higher grain yield than N_2 and N_1 levels by 12.3 and 24.3% respectively. For straw yield, the superiority exhib-

Table 1. Effect of nitrogen levels and weed-management practices on growth parameters of *basmati* rice

Treatment	Plant height (cm)			Dry-matter accumulation (t/ha)			Leaf-area index			PAR interception (%)			SPAD values	
	60 DAT	90 DAT	H	60 DAT	90 DAT	H	60 DAT	90 DAT	H	60 DAT	90 DAT	H	60 DAT	90 DAT
Nitrogen levels														
N_1	69.6	94.9	96.4	5.57	8.13	108.9	4.65	4.18	2.67	72.1	75.0	71.0	37.8	31.8
N_2	72.4	96.2	98.9	5.95	9.25	117.1	5.51	4.59	2.89	76.9	79.9	75.5	39.9	35.7
N_3	76.1	98.6	100.1	6.23	9.99	123.5	6.45	4.92	3.21	78.7	80.9	77.0	40.9	37.5
SEm±	1.03	0.82	0.84	1.27	1.56	1.93	0.17	0.12	0.06	1.24	0.95	1.15	0.64	1.11
CD (P=0.05)	2.97	2.37	2.43	3.68	4.53	5.60	0.48	0.35	0.17	3.59	2.76	3.32	1.84	3.22
Weed-control methods														
W_1	71.6	94.6	96.7	5.41	8.27	110.4	4.97	4.48	2.76	67.9	75.6	68.6	38.1	33.2
W_2	74.1	98.3	100.2	6.69	10.50	128.9	6.29	4.87	3.15	76.2	79.2	76.1	40.9	36.0
W_3	73.4	97.1	99.6	5.78	8.60	117.0	5.78	4.71	2.98	74.6	75.7	72.8	39.6	34.1
W_4	75.4	98.7	100.4	7.03	11.04	136.4	6.38	5.03	3.30	79.4	80.9	77.2	41.1	39.7
W_5	69.1	94.1	95.6	4.67	7.20	89.9	4.25	3.72	2.42	81.3	81.9	78.1	37.9	31.9
SEm±	1.32	1.05	1.08	1.64	2.02	2.49	0.21	0.16	0.076	1.60	1.23	1.48	0.82	1.43
CD (P=0.05)	3.84	3.06	3.14	4.75	5.84	7.23	0.62	0.45	0.22	4.65	3.56	4.29	2.38	4.16
Interaction														
N × W	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

N_1, 0 kg N/ha; N_2, 45 kg N/ha; N_3, 90 kg N/ha; W_1, florpyrauxifen-benzyl 31.25 ml/ha early PoE; W_2, penoxsulam 22.5 g/ha early PoE; W_3, pyrazosulfuron ethyl 60 g/ha + pretilachlor 300 g/ha; W_4, weed-free; W_5, weedy check; H, at harvesting; PoE, post-emergent

Table 2. Effect of nitrogen levels and weed-management practices on yield-attributing characters and yield of *basmati* rice

Treatment	Panicle density/ m^2	Panicle weight (g)	Grains/panicle (No.)	1,000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvesting index
Nitrogen levels							
N_1	261.8	2.54	89.8	26.42	4.91	6.73	41.6
N_2	279.3	2.76	100.5	27.89	5.69	7.33	43.4
N_3	293.7	2.82	107.8	28.46	6.49	8.14	44.2
SEm±	3.99	0.07	1.58	0.48	0.103	0.125	0.65
CD (P=0.05)	11.6	0.20	4.58	1.39	0.30	0.36	1.89
Weed-control methods							
W_1	270.9	2.51	90.8	26.71	5.44	7.33	42.5
W_2	302.2	3.14	109.7	28.52	6.46	7.70	45.6
W_3	290.0	2.61	101.7	27.90	5.96	7.60	43.8
W_4	309.9	3.20	113.3	28.77	6.75	8.03	45.7
W_5	218.2	2.06	81.3	26.04	3.89	6.33	37.7
SEm±	5.16	0.09	2.04	0.62	0.133	0.16	0.84
CD (P=0.05)	14.9	0.26	5.92	1.79	0.39	0.47	2.44
Interaction							
N × W	NS	NS	NS	NS	NS	NS	NS

N_1, 0 kg N/ha; N_2, 45 kg N/ha; N_3, 90 kg N/ha; W_1, florpyrauxifen-benzyl 31.25 ml/ha early PoE; W_2, penoxsulam 22.5 g/ha early PoE; W_3, pyrazosulfuron ethyl 60 g/ha + pretilachlor 300 g/ha; W_4, weed-free; W_5, weedy check; H, at harvesting; PoE, post-emergent

ited by the application of 90 kg N/ha (N_3) to N_2 and N_1 levels was 10.0 and 17.3% respectively. Hussain *et al.,* (2018) also reported similar findings.

Effect of weed-management on yield and yield-attributing characters

Application of penoxsulam @ 22.5 g/ha (W_2) significantly increased all the yield-attributing characters over the other weed-management practices and weedy check (Table 2).The superiority exhibited by the application of penoxsulam @ 22.5 g/ha in recording the panicle density to unweeded control was 27.8%. For panicle weight, the superiority exhibited by W_2 to W_1, W_3 and W_5 levels was of the order $W_2 > W_3 > W_1 > W_5$, and the corresponding values of superiority were 16.7, 20.2 and 34.4% respectively. Same trend was also found in case of grains/panicle. Application of penoxsulam @ 22.5 g/ha (W_2) resulted in more grain yield than to W_1, W_3 and W_5 levels by 15.8, 7.7 and 39.8%, respectively (Table 2). Penoxsulam @ 22.5 g/ha (W_2) also recorded higher straw yield over W_1 and W_5 by 4.8 and 17.8%, respectively. These results are in close conformity with Ganai *et al.,* (2017). Highest benefit: cost ratio of 3.91 was also realized with the combination of 90 kg N/ha in penoxsulam application @ 22.5 g/ha. From the present investigation it is concluded that, among the various nitrogen levels, application of 90 kg N/ha was more effective in enhancing the growth and yield of Kashmir *Basmati* ('Shalimar sugandh 1') rice and among the weed-management practices, penoxsulam @ 22.5 g/ha proved significantly effective.

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