Indian J. Agron. **41** (3) : 397–400 (September 1996)

Effect of seed hardening, potassium fertilizer and paraquat as anti-transpirant on rainfed wheat (*Triticum aestivum*)

J. C. DAS AND A. K. CHOUDHURY

Assam Agricultural University, Jorhat 785 013

Received: December 1994

ABSTRACT

An experiment was conducted during 1988–89 and 1989–90 at Jorhat, to study the effect of 2 seed hardening (normal and hardened seed with 1% KH_2PO_4, soaking for 18 hr), 4 levels of potassium (0, 30, 60 and 90 kg K_2O/ha) and application of paraquat as anti-transpirant at 4 different growth stages (control, tillering, boot-leaf and tillering + boot-leaft) on rainfed 'Sonalika' wheat (*Triticum aestivum* L. emend. Fiori & Paol.). hardened seed proved better than normal seed and 30 kg K_2O/ha significantly increased the yield over the control. The paraquat application did not show any significant effect. Seed hardening, 30 kg K_2O/ha and application of paraquat were found viable proposition for rainfed wheat.

Rainfed wheat (*Triticum aestivum* L. emend. Fiori & Paol.) cultivation in Assam becomes unsuccessful due to inadequate and uneven distribution of rainfall causing moisture stress. Inducement of drought tolerance through pre-sowing seed hardening with potassium salts assumes prospect in this situation (Misra and Pal, 1978). Potassium fertilization increases water uptake by crops. Moreover, reduction of transpiration loss by the use of 50 ppm paraquat as antitranspirant (Borgohain and Choudhury, 1991) may be of added advantage in this situation. Therefore, the present investigation was carried out to study the combined effect of seed hardening, postassium fertilization and paraquat as anti-transpirant on the performance of rainfed wheat.

MATERIALS AND METHODS

The field experiment was conducted at the AAU, Jorhat, during the winter (*rabi*) season of 1988–89 and 1989–90. The treatments comprised 2 types of seed hardening viz., normal seed and hardened seed (18 hr seed soaking once in 1.0% KH_3PO_4 solution); 4 levels of potassium, viz., 0,30, 60 and 90 kg K_2O/ha; and application of 50 ppm paraquat as anti-transpirant at 4 stages, viz. the control, at tillering, at boot-leaf and at tillering + boot-leaf. Treatment combinations were tested in split-plot design with 3 replications. The concentration of 50 ppm paraquat was fixed through experiments conducted both under pot and field conditions. The soil was sandy loam, medium acidic in reaction (pH 5.5), medium in nitrogen (organic carbon 0.54%), available phosphorus (58.6 kg P_2O_5/ha) and available potassium (240.0 kg K_2O/ha).

Recommended doses of nitrogen (40 kg N/ha) and phosphorus (20 kg P_2O_5/ha) and potassium as per treatment were applied basal. The crop ('Sonalika') was sown on 16 November and 20 November in 1988 and 1989 respectively with a row-to-row spacing

Table 1. Effect of seed hardening, levels of potassium and application of paraquat as antitranspirant on yield attributes and yield of wheat

Treatment	Effective tillers/m		Length of panicle (cm)		Filled grains/ panicle		1,000-grain weight (g)		Grain yield (q/ha)	
	1988–89	1989–90	1988–89	1989–90	1988–89	1989–90	1988–89	1989–90	1988–89	1989–90
Seed hardening										
Normal seed	44.27	47.43	9.58	9.92	21.92	22.34	43.01	43.93	18.17	19.75
Hardened seed	46.32	48.58	10.02	10.15	23.03	23.16	43.81	44.72	20.01	20.66
CD (P = 0.05)	1.89	NS	0.35	NS	0.62	NS	0.49	NS	1.48	NS
(kg K_2O/ha)										
0	41.56	45.58	9.14	9.74	20.58	20.92	42.62	41.29	15.79	17.65
30	44.93	47.86	9.71	10.15	22.40	22.71	43.61	44.53	18.91	20.23
60	46.47	47.98	10.26	10.23	23.26	23.26	43.68	45.26	20.26	21.14
90	48.20	50.59	10.11	10.02	23.66	24.11	43.75	46.20	21.40	21.82
CD (P = 0.05)	2.68	3.14	0.50	NS	0.54	1.30	0.70	1.62	2.09	2.28
Paraquat										
Control	44.54	46.04	9.58	10.02	22.15	22.12	43.01	44.09	18.52	19.92
At tillering	44.70	46.95	9.76	9.95	22.21	22.54	43.34	44.53	18.95	19.97
At boot-leaf	45.19	49.55	9.93	10.17	22.45	23.71	43.64	45.26	18.84	20.75
At tillering + boot-leaf	46.73	49.46	9.94	10.00	23.09	22.62	43.65	46.20	20.04	20.19
CD (P = 0.05)	NS	2.38	NS	NS	NS	NS	NS	NS	NS	NS

of 20 cm. The crop was harvested on 16 March in 1989 and 18 March in 1990.

A total rainfall of 80.7 mm (15 spells) and 109.5 mm (29 spells) were received during the growing periods of 1988–89 and 1989–90 respectively. On further partitioning it revealed that during flowering to harvest, there was rainfall of 54.8 mm on 8 spells during 1988–89 and 90.5 mm on 18 spells in 1989–90 . Thus rainfall distribution pattern was better during critical physiological stages of the crop during 1989–90.

RESULTS AND DISCUSSION

Effect of seed hardening

Significantly higher grain yield was obtained owing to seed hardening during 1988–89 (Table 1). During 1989–90 also, this treatment gave higher yield. This yield increase due to seed hardening may be attributed to significantly higher values of effective tillers/m length of panicle, filled grains/panicle and 1,000-grain weight. The values under those parameters were also higher during 1989–90 for seed-hardening treatment.

During 1988–89 the rainfall from flowering to harvest were substantially less and crops suffered from intermediate moisture stress. Under the circumstances, seed hardening must have imparted resistance to withstand the stress and as such yield was significantly higher than that of normal seeds. This differential effect was not marked during 1989–90 owing to well-distributed rainfall.

Effect of potassium

In both the years, application of 30 kg K_2O/ha significantly increased the yield of wheat over that of the control (Table 1). During 1988–89, yield differences between 30 and 60 kg K_2O/ha and that between 60 and 90 kg K_2O/ha were at par. During

Table 2. Monetary returns in rainfed wheat as influenced by seed hardening, levels of potassium and application of paraquat

Treatment	Cost of cultivation (Rs/ha)	Net return (Rs/ha)		Return/rupee investment	
		1988–89	1989–90	1988–89	1989–90
Seed hardening					
Normal seed	2,728	2,724	3,198	1.99	2.17
Hardened seed	2,852	3,151	3,346	2.10	2.10
(kg K_2O/ha)					
0	2,652	2,086	2,646	1.78	1.99
30	2,771	2,902	3,298	2.05	2.19
60	2,836	3,242	3,506	2.14	2.23
90	2,901	3,519	3,645	2.21	2.25
Paraquat					
Control	2,745	2,811	3,231	2.02	2.18
At tillering	2,787	2,897	3,203	2.03	21.15
At boot-leaf	2,787	2,864	3,437	2.02	2.23
At tillering + boot-leaf	2,831	3,182	3,227	2.12	2.14

1989–90 , yield due to 30, 60 and 90 kg K_2O/ha were found at par. Therefore. This level also significantly increased the effective tillers/m, length of panicle, filled grains/panicle and 1,000-grain weight, over those of the control except the length of panicle during 1989–90, which was non-significant. Under rainfed situation, the role of potassium in increasing the yield of crop has been revealed in the present experiment. Misra *et al.,* (1982) and Das and Mazumdar (1988) reported varying degree of response of wheat to potassium fertilization.

Effect of paraquat

In both the years application of paraquat could not show any significant change in yield attributes or in yield, except the effective tillers/m during 1988–89 (Table 1). Since the crop did not experience any complete drought situation, during the growth periods in any of the years, the efficiency of paraquat could not be expressed in the present experiment.

Economics

Return per rupee investment on an average was found higher with hardened seeds (Table 2). With potassium, the magnitude of such return was higher than with the control. However, the margin of return due to 30, 60 and 90 kg K_2O/ha was close. Application of antitranspirant, on the other hand showed no conspicuous variation.

Since treatments selected were aimed at inducing drought resistance in rainfed wheat, use of hardened seeds along with 30 kg K_2O/ha may be considered. Application of paraquat may be made optional apprehending possibility of drought in a particular growth stage of the crop.

REFERENCES

Borgohain, B. and Choudhury, A. K. 1991. Effect of paraquat as antitranspirant on direct seeded, upland, summer rice (*Oryza sativa*). *Indian Journal of Agricultural Sciences* **61** (3) : 201–203.

Das, N. R. and Mazumdar, B. 1988. Response of potash to wheat crop in wheat-rice cropping system. *Environment and Ecology* **6** (2) : 470–472.

Misra, N. M. and Pal, H. 1978. Effect of different techniques and concentration of potash seed treatment on growth and yield of rainfed wheat. *Indian Potash Journal* **3** (3) : 10–14.

Misra, M. K., Dubey, S. K., Tembhare, B. R. and Agarwal, S. K. 1982. Response of paddy and wheat to potassium application in farmers field. *Food Farming and Agriculture* **14** (7) : 97–100.