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Quality Wheat Seed Production through Integrated Weed Management

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ABSTRACT

A field experiment was carried out at Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal during winter (**rabi**) seasons of 2007-08 and 2008-09 to study the efficacy of different weed management practices on economical, quality wheat (variety PBW 343) seed production. Uncontrolled weeds reduced the wheat seed yield upto 34%. Highest wheat seed yield was observed with two manual weedings followed by hoeing (dutch hoe) + isoguard plus, due to effective weed control. Despite of additional cost for weed management, all the weed management treatments resulted in additional wheat seed production and additional benefit. Wheat seed produced by weed management in wheat with hoeing at 21 DAS + isoguard plus 1250 g/ha or metribuzin 175 g/ha at 28 DAS showed high vigour in seedling parameters though other treatments were also better than weedy check and seed of local farmers' field.

Key words : Seed production, weed management, wheat, seed quality, cost

INTRODUCTION

To meet the food demand of increasing population in India, wheat area has to be increased in non-traditional states like West Bengal, Assam and other parts of eastern India by adopting sound agro-techniques. But the availability of quality seed must be foremost criteria to be considered while planning for crop production in non-traditional areas. In wheat seed production, the quantity and quality may deteriorate due to many factors among which weeds play a major role. Tiwari and Parihar (1993) recorded that 34.5% loss of seed production in wheat could be reduced through integrated approach of weed management. Keeping these views in mind, an experiment was carried out to study the efficacy of different weed management practices on quality wheat (variety PBW 343) seed production economically.

MATERIALS AND METHODS

A field experiment was carried out at Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal during winter (**rabi**) seasons of 2007-08 and 2008-09 to study the efficacy of different weed management practices on quality wheat (variety PBW 343) seed production economically. Eight weed control treatments include : hoeing with dutch hoe at 21 days after sowing (DAS) (T_1), isoguard plus 1250 g/ha at 28 DAS (T_2), hoeing with dutch hoe at 21 DAS + isoguard plus 1250 g/ha at 28 DAS (T_3), metribuzin 175 g/ha at 28 DAS (T_4), hoeing with dutch hoe at 21 DAS+metribuzin 175 g/ha at 28 DAS (T_5), manual weeding once at 21 DAS (T_6), manual weeding twice at 21 and 42 DAS (T_7) and weedy check (T_0). Wheat variety used was cv. PBW 343. Randomized block design with three replications was used. The size of gross plot was 6.00 x 3.22 m or 19.32 sq. m with 23 cm row spacing. Table 1 shows the soil and climatic properties during experimental period.

For growth and yield component analysis, 20 plants from each plot were selected randomly and observations were taken on plant height, tiller density, dry matter production and spike density, spike length, spike weight, filled grain density, test weight and seed yield.

After harvesting of seed from different treatments, the seedling quality parameters were analyzed through glass-plate method (Chakraborty and Basu, 1994). Seeds were placed on blotting paper covered glass-plate in sterilized condition. The lower portion of individual set was placed in water within a polythene packet and put it into slanting stand at 27-29°C. Root and shoot lengths were measured by the average length at 10th day of the seedlings, speed of germination was counted in a regular way with the help of following formulae :

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Table 1. Soil and climatic condition during the experiment

Year	Soil properties						Weather chart			
	Soil texture	pH	Organic carbon (%)	Available N (kg/ha)	Available PO^{-}_{4} (kg/ha)	Exchangeable K_2O (kg/ha)	Min. temp. (°C)	Max. temp. (°C)	Total precipitation (mm)	Relative humidity (%)
2007-08	Sandy loam	7.2	0.47 to 0.52	203.42	7.16	181.30	11.1 to 22.5	23.1 to 37.6	146.5	32.9 to 99.7
2008-09	Sandy loam	7.3	0.46 to 0.54	205.45	15.90	215.84	8.3 to 21.4	25.4 to 38.0	1.2	31.0 to 99.0

$$\text{Speed of germination} = \frac{N}{X_1} + \frac{N}{X_2} + \frac{N}{X_3} \cdots\cdots\cdots\cdots$$

Where, N=Number of seeds germinated daily

X=Days after placing of seeds

Fresh and dry weight (in hot air oven for 6 h at 100°C) was calculated by weighing 15 seedlings and expressed in gram.

RESULTS AND DISCUSSION

Effect on Wheat Growth Parameters

Plant height, tiller density and dry matter production of wheat were remarkably increased by all tested methods of weed management as compared to weedy check (Table 2). Improvement in plant height (Sardana *et al.*, 2001; Pandey and Verma, 2002) and increase in tiller density (Dixit and Bhan, 1997) due to effective weed management were reported earlier.

Effect on Yield Components

Highest spike density, spike length, spike weight, filled grain density and test weight of seed were observed with two manual weedings (T_7) followed by hoeing+ isoguard plus (T_3) (Table 3), which is in confirmity with the findings of Marwat *et al.* (2003). This observation undoubtedly indicates that integrated weed management is directly related with the seed yield components.

Wheat seed yield increased significantly in the treatments having hoeing + isoguard plus (T_3), hoeing + metribuzin (T_5), isoguard plus (T_2) and two manual weedings (T_7) in comparison to weedy check control (T_0) (Table 3). Other weed management treatments also significantly enhanced the quantity of production compared to weedy check control. The results confirm the findings of Sardana *et al.* (2001), Singh *et al.* (2002) and Marwat *et al.* (2003).

Effect on Weed Control

Density and dry weights of grasses, sedges and broad-leaved weeds were significantly reduced by different weed management treatments (Table 4). Minimum weed density and dry weight of weeds were

Table 2. Effect of different weed control treatments on wheat crop growth parameters

Weed control treatments	Plant height at harvest (cm)		Tiller density/ m^2		Dry matter production (t/ha)	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
Hoeing with dutch hoe (21 DAS) (T_1)	87.3	74.8	256	263	7.69	8.53
Isoguard plus 1250 g /ha (28 DAS) (T_2)	91.2	77.5	284	281	8.26	8.72
Hoeing (21 DAS)+Isoguard plus 1250 g /ha (28 DAS) (T_3)	90.7	78.5	282	261	8.42	8.89
Metribuzin 175 g/ha (28 DAS) (T_4)	91.0	76.7	267	260	7.38	8.29
Hoeing (21 DAS)+Metribuzin 175 g/ha (28 DAS) (T_5)	91.0	76.7	282	284	7.75	8.42
One manual weeding (21 DAS) (T_6)	87.1	73.3	265	256	7.47	8.22
Two manual weedings (21 and 42 DAS) (T_7)	93.2	78.1	295	309	8.30	8.95
Weedy check (T_0)	85.2	66.2	241	234	5.33	6.68
LSD (P=0.05)	1.95	4.55	30.3	35.8	0.73	0.91

DAS–Days after sowing.

Table 3. Yield attributes and yield of wheat as influenced by weed control treatments

Weed control treatments	Spike density/ m		Spike length (cm)		Filled grains/ spike		1000-grain weight (g)		Seed yield (t/ha)	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
T_1	247	253	9.03	10.83	36.2	38.8	36.33	36.53	2.81	3.05
T_2	274	275	9.37	10.73	37.0	40.3	39.17	38.70	3.22	3.27
T_3	271	252	9.20	11.03	45.3	48.0	40.83	38.58	3.29	3.40
T_4	262	248	10.07	9.13	32.7	35.0	37.50	38.60	2.97	3.16
T_5	261	271	9.83	11.27	36.3	44.3	38.17	37.87	3.24	3.33
T_6	262	243	9.97	11.00	46.3	40.7	37.67	37.57	2.90	3.07
T_7	268	278	10.30	11.67	47.7	51.7	40.67	43.00	3.22	3.27
T_0	225	206	9.63	9.10	32.3	34.0	32.33	32.48	2.28	2.14
LSD (P=0.05)	15.5	10.6	NS	0.41	3.8	4.3	3.48	3.36	0.3	0.31

NS–Not Significant.
Treatment details are given in Table 2.

Table 4. Weed density and dry weight as affected by different weed control treatments in wheat

Weed control treatments	Weed density		Weed dry weight (g/m^2)	
	40 DAS	60 DAS	40 DAS	60 DAS
T_1	13.6 (184.5)	13.7 (187.2)	12.8 (163.3)	16.2 (261.9)
T_2	6.1 (36.7)	6.2 (38.0)	7.3 (53.3)	7.6 (57.2)
T_3	7.6 (57.3)	5.5 (29.8)	6.9 (47.6)	7.6 (57.2)
T_4	5.0 (24.5)	3.6 (12.5)	5.1 (25.5)	6.0 (35.5)
T_5	4.8 (22.5)	4.4 (18.6)	4.9 (23.5)	6.2 (38.0)
T_6	7.9 (61.9)	6.4 (40.5)	7.7 (58.8)	8.1 (65.1)
T_7	3.6 (12.5)	5.6 (30.4)	4.6 (20.7)	4.0 (15.5)
T_0	17.6 (309.3)	17.7 (312.8)	17.8 (316.3)	20.8 (432.1)
LSD (P=0.05)	1.5	1.9	3.9	3.3

Transformation values [$\sqrt{(x+0.5)}$] were analyzed from actual values within parentheses.
Treatment details are given in Table 2.

recorded with two manual weedings followed by the isoguard plus (T_2) or metribuzin (T_4) in alone or in combination with hoeing (T_3/T_5). This indicates that manual or chemical or combination of mechanical and chemical methods would be essential to control the weeds in wheat.

Production Values and Additional Benefit

Despite of additional cost for weed management, all the weed management treatments resulted in additional wheat seed and additional benefit (Fig. 1). The enhanced wheat seed production was observed in combination treatments as well as manual weeding (twice). But due to higher cost of manual weeding either once (T_6) or twice (T_7) than mechanical (hoeing) (T_1), chemical (herbicide) (T_2/T_4) or combination of both (T_3/T_5), higher net returns were obtained from the later treatments.

Effect on Seedling Parameters

The assessment on seedling quality of the produced seed is the basic seed production principle. Wheat seed produced from hoeing+chemical (T_3/T_5) weed management treatment showed high vigour in seedling parameters though other treatments were also better than weedy check and seed of local farmers' field (Table 5). The higher seedling dry matter, higher length of root-shoot and speed of germination reflect the high vigour of seed.

Quality seed production not only improves the grain/seed quantity, but also gives the 'quality assurance'

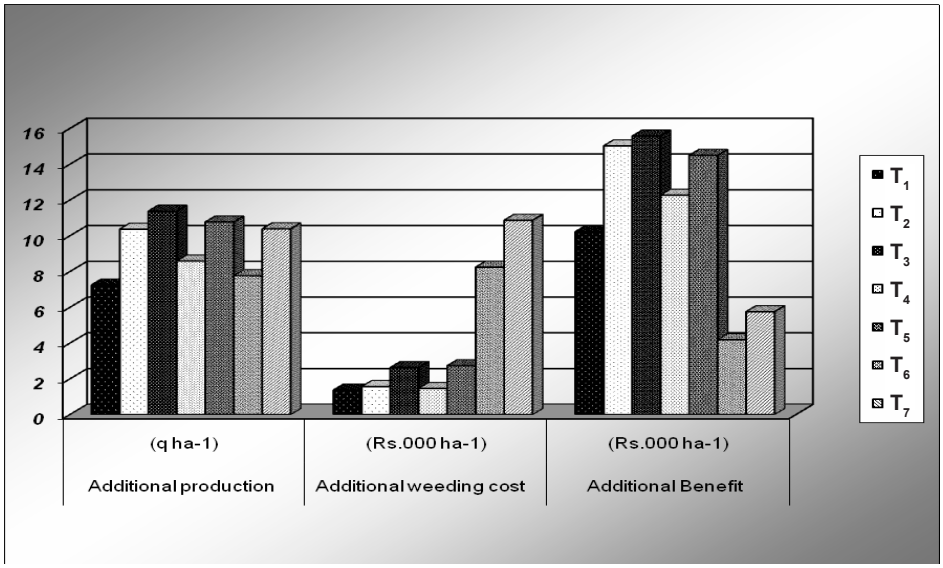

Fig. 1. Additional wheat seed production, weeding cost and benefit due to different weed control treatments (considering the seed cost Rs. 16.00 /kg at local market) (For T_1-T_7 refer Table 2).

Table 5. Germination and seedling characteristics of freshly harvested wheat seed from different weed control treatments

Weed control treatments	Shoot length (cm)	Root length (cm)	Speed of germination	Fresh weight (g)	Dry weight (g)
T_1	10.06	13.64	13.20	2.22	0.31
T_2	9.61	13.20	11.43	1.64	0.30
T_3	11.27	14.30	15.86	2.72	0.64
T_4	9.82	12.05	13.18	2.15	0.30
T_5	10.95	13.95	14.90	2.29	0.40
T_6	9.40	12.75	8.76	1.97	0.14
T_7	11.71	14.07	15.03	2.60	0.56
T_0	3.45	6.13	8.61	1.45	0.13
Wheat seed from farmers' field	5.68	8.23	9.67	1.65	0.22
LSD (P=0.05)	0.06	0.06	0.57	0.02	0.01

Treatment details are given in Table 2.

of the seed lot for attaining higher wheat production with the use of quality seed. Thus, the weed management mainly hoeing or its combination with chemicals must be practised for quality wheat seed production.

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