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Integrated Weed Management in Wheat Grown in Irrigated Areas

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ABSTRACT

Efficacy of integrated weed control in wheat was investigated during 1999-2000 at agronomic research area, University of Agriculture, Faisalabad. Treatments comprised weedy check, one hand weeding at 25 days after sowing (DAS), two hand weeding at 25 and 50 DAS, isoproturon @ 2 kg a.i. ha^{-1} as pre-emergence application, clodinophob @250 g a.i. ha^{-1} as post-emergence , isoproturon @ 2 kg a.i. ha^{-1} as pre-emergence + one hoeing 50 DAS and clodinophob @ 250 g a.i. ha^{-1}as post emergence + one hoeing 50 DAS. All the herbicidal treatments decreased weed population and dry weight over weedy check. Maximum grain yield (6.3 t ha^{-1}) and harvest index (44.69%) was obtained in case of pre-emergence application of isoproturon @ 2 kg a.i. ha^{-1} + one hoeing 50 DAS, which however, remained at par with clodinophob @ 250 g a.i. ha^{-1}as post –emergence + one hoeing 50 DAS, isoproturon (pre-emergence) spray, two hoeing at 25 and 50 DAS and one hoeing at 25 DAS. Highest net income of Rs. 45625 $ha^{-1}$was obtained from pre emergence spray of isoproturon @ 2 kg a.i. ha^{-1} + one hoeing at 50 DAS.

Key Words: Herbicides; Integrated weed management; Wheat

INTRODUCTION

Wheat is most important cereal crop in Pakistan. Weed infestation is a serious hindrance in realizing its higher yields at farmer's fields. Uncontrolled weeds can reduce wheat yield by 15-20% and in serious cases may lead to complete failure of crop (Gill & Wallia, 1979). It has been reported that crop yield may be increased by about 37% by complete eradication of weeds (Jails & Shah, 1982).

The problem of weed infestation is becoming more serious in irrigated areas, where cropping intensity is rapidly increasing with the result that weed management through fallowing, hoeing, harrowing and cultivating practices has become impossible and weedicides use has become inevitable for obtaining higher yield and better quality of produce. Majid and Hussain (1983) compared the effectiveness of Dicuran MA 60WP, Stomp 330EC, Buctril M 20% and Herbit 20% with hand weeding practice in wheat and concluded that Dicuran Ma 60WP controlled 96.8% weeds and increased yield by 37%. Pandey *et al.* (1996) demonstrated that post-emergence application of isoproturon and metaxuron @ 1 kg a.i. ha^{-1} and 2 kg a.i. ha^{-1}, respectively gave excellent weed control in wheat. Singh *et al.* (1989) compared efficacy of cultural and chemicals methods for weed control in wheat and reported highest yield of 6.8 and 10.9 t ha^{-1} (of grain and straw respectively) from hand weeding and 6.6 and 10.9 t ha^{-1}, respectively, from pendimethalin @ 1 kg a.i. ha^{-1}. Satao *et al.* (1993) studied the effects of two hand weeding at 20 and 40 DAS, one hand weeding at 20 DAS, pre-emergence application of isoproturon and pre-emergence isoproturon + one hand weeding for the control of weeds in wheat. They reported increase in wheat grain in all treatments over control; however, two hand weeding resulted in highest yield during the two years. The objective of this study was, therefore, to investigate the effect of integrated weed management in wheat including both chemical and manual methods of control.

MATERIALS AND METHODS

A commercial wheat variety Inqulab-91 was sown in the month of November with the help of single row hand drill in 22.5 cm apart single rows using seed rate of 125 kg ha^{-1} in randomized complete block design. Net plot size was 1.8 x 10 m. N Nitrogen and phosphatic fertilizers @ 100 kg ha^{-1} each were applied. Treatments were weedy check (control), one hand weeding at 25 DAS, two hand weeding at 25 and 50 DAS, pre-emergence application of isoproturon @ 2 kg ha^{-1} (Proton 500WP), post-emergence application of clodinophob @ 250 g ha^{-1} (Topic 15WP), pre-emergence application of isoproturon @ 2 kg ha^{-1} + one hand weeding at 50 DAS post-emergence application of clodinophob @ 250 g ha^{-1} + one hand weeding 50 DAS. Five irrigations were applied in addition to *rauni* to raise the crop. From each plot a unit area of one square meter was taken at random for recording germination count, plant height, number of fertile tillers, spike length, number of grains per spike, 1000-grain weight, grain yield, straw yield, harvest index and weed count per unit area. Major weed flora of the

experimental plots was *Phalaris* minor, *Avena fatua*, *Rumex dentatus* and *Convolvulus arvensis*. Weeds were counted per unit area and then harvested from ground surface. Fresh weight of weeds was taken. Weeds were dried in an oven for 24 h at 80°C and dry weights were taken. Data were analyzed statistically using Fisher's analysis of variance technique and least significance difference test at p 0.05 was used to compare the differences among the treatments means (Steel & Torrie, 1984). Economic and marginal analyses were carried out as described by Byerlee (1988).

RESULTS AND DISCUSSION

Weed density. Data (Table I) showed a significant reduction in weed density in plots where isoproturon @ 2.0 kg a.i. ha^{-1} and clodinophob @ 250 g a.i. ha^{-1} was applied as pre and post emergence sprays, respectively. However at 50 and 75 DAS all the weed control methods significantly reduced the weed density as compared with control. Hand hoeing alone at 25 and 50 DAS and both the herbicides alone gave as good weed control as was achieved with the combination of herbicides with one hand hoeing. Reduction in weed density due to different weed control methods has also been reported by Sharar *et al*. (1994). Reduction in weed dry weight was statistically similar in all the weed control methods over control (Table I). However, use of herbicides along with on hand hosing at 50 DAS resulted in higher 53-58% reduction in weed dry weight. Shah (1994) and Sharar *et al*. (1994) have also reported reduction in weed dry weight after using different weed control strategies.

Wheat growth and yield. Data (Table II) revealed that

Table I. Weed density and dry weight count per unit area (m^2) as affected by integrated weed management in irrigated wheat

Treatments	Weed density m^{-2}			Weed dry weight (g m^{-2})
	25 DAS*	50 DAS	75DAS	75 DAS
T_1=control	178.3 a	182.7 a	180.7 a	6.81a-
T_2=One hoeing at 25 DAS	171.3 a	31.33 b	29.33 b	4.08b (40.1)
T_3=Two hoeings at 25&50 DAS	169.0 a	27.67 bc	17.33 c	4.19b (38.5)
T_4=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray	14.67 b	14.00 d	15.67 c	3.56b (47.3)
T_5=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray	182.3 a	17.67 cd	18.33 c	3.62b (46.8)
T_6=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray + one hoeing at 25 DAS	14.0 b	16.67 d	10.33 c	3.19b (53.2)
T_7=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray + one hoeing at 25 DAS	172.0 a	15.33 d	10.67 c	2.88b (57.7)

Table II. Wheat growth and yield as affected by integrated weed management in irrigated areas

Treatments	No. of fertile tillers m^{-2}	Spike length (cm)	No. of grains $spike^{-1}$	1000 -grain weight (g)	Grain yield (t ha^{-1})
T_1=control	285.67 d	12.33 c	36.40 b	45.25 c	4.87 c
T_2=One hoeing at 25 DAS	317.00 bc	12.67 bc	45.03 a	48.74 c	5.83 ab (19.71)
T_3=Two hoeings at 25&50 DAS	328.00 ab	14.67 ab	45.70 a	51.06 ab	5.87 ab (20.53)
T_4=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence Spray	308.67 c	13.00 abc	45.13 a	49.43 b	5.73 ab (17.65)
T_5=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence Spray	319.33 bc	14.33 abc	45.73 a	51.64 ab	5.60 b (14.98)
T_6=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray + one hoeing at 25 DAS	340.00 a	14.67 ab	48.40 a	53.54 a	6.30 a (29.36)
T_7=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray + one hoeing at 25 DAS	336.33 a	15.00 a	48.97 a	53.42 a	6.03 ab (23.81)

Table III. Economic analysis of different weed control methods

Treatments	Grain yield (t ha^{-1})	Adjusted yield (t ha^{-1})	Grain yield value (Rs.)	Straw yield (t ha^{-1})	Straw yield Value (Rs.)	Gross income (Rs.)	Variable weed control cost			Total cost that varied (a+b+c)	Net benefit (Rs ha^{-1})
							a. labor charges for hoeing	b. cost of herbicides	c. labor charges for herbicides application		
T_1	4.87	4.38	32920	6.73	4206	37126	-	-	-	-	37126
T_2	5.83	5.25	39375	7.27	4544	43919	1000	-	-	1000	42919
T_3	5.87	5.28	39600	7.33	4581	44181	2000	-	-	2000	42181
T_4	5.73	5.16	38700	7.10	4437	43137	-	650	125	775	42362
T_5	5.60	5.04	37800	7.07	4419	42219	-	1075	125	1200	41019
T_6	6.30	5.67	42525	7.80	4875	47400	1000	650	125	1775	45625
T_7	6.03	5.43	40725	7.53	4706	45131	1000	1075	125	2200	43231

DAS= days after sowing; Any two means not sharing a letter in common differ significantly at 5% probability level ; Figures in parenthesis show% decrease in weed dry weight over control; T_1=control; T_2=One hoeing at 25 DAS; T_3=Two hoeings at 25&50 DAS; T_4=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray; T_5=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray; T_6=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray + one hoeing at 25 DAS; T_7=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray + one hoeing at 25 DAS; Price of wheat grain @ Rs. 300/ 40 kg; Price of wheat straw @ Rs. 25/40kg; Isoproturon 80WP @ Rs. 260/800g; Topic 15 WP @ Rs. 430/100g; labor charges for spray Rs. 2.5 man days @ Rs.50 man^{-1}; manual weeding @ Rs.20 man days ha^{-1} @ Rs. 50 man^{-1}

Table IV. Marginal analysis of different weed control methods in irrigated wheat

Treatments	*Cost that vary (Rs. ha^{-1})	Net income (Rs. ha^{-1})	**MRR%
T_1=control	-	33126	
T_4=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray	775	42362	675
T_2=one hoeing at 25 DAS	1000	42919	247
T_5=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray	1200	41019	D***
T_6=Isoproturon @ 2.0 kg a.i. ha^{-1} as pre-emergence spray + one hoeing at 25 DAS	1775	45625	801
T_3=Two hoeings at 25&50 DAS	2000	42181	D
T_7=Clodinophob @ 250 g a.i. ha^{-1} as post-emergence spray + one hoeing at 25 DAS	2200	43231	D

*Cost that vary is the cost that is incurred on variable inputs in the production of a particular commodity; **Marginal rate of return (MRR%)= change in net benefit/ change in variable cost × 100; ***D= dominated, any treatment that had net benefits that were less than or equal to those of a treatment with lower variable cost was taken to be dominated.

application of isoproturon @ 2.0 kg a.i. ha^{-1} + one hand hoeing at 50 DAS resulted in the highest grain yield (6.03 t ha^{-1}) Two hand hoeings at 25 and 50 DAS gave 21% increase in grain yield over control. All other weed control methods resulted in higher grain yield over control. The increase in grain yield was attributed to higher yield components in these treatments (Table II). Several authors (Majid & Hussian, 1983; Satao *et al.*, 1993) have reported increase in wheat grain yield due to chemical and cultural methods of weed control.

Economic and marginal analyses. Economic analysis of different weed control methods (Table III) revealed that application of isoproturon @ 2.0 kg a.i. ha^{-1} + one hand weeding at 50 DAS gave the highest net returns (Rs. 45625 ha^{-1}). The marginal analysis (Table IV) showed that application of isoproturon @ 2.0 kg a.i. ha^{-1} + one hand weeding at 50 DAS gave the maximum marginal rate of return (801%). Isoproturon alone @ 2.0 a.i. kg ha^{-1} as pre-emergence spray resulted in 675% MRR. Other treatments were dominated due to higher costs involved.

REFERENCES

Byerlee, D., 1988. *From Agronomic Data to Farmers Recommendations: An Economic Training Manual*, CIMMYT, Mexico

Gill, H.S. and U.S. Wallia, 1979. Chemical weed control in wheat with particular reference of *Phararis minor* retz. and *Avene fatua*. *Pesticides*, 13: 15–20 (*Weed Absts.*, 30: 457; 1981).

Jails, A. and M.L. Shah, 1982. Experiment on post emergence application of herbicides in wheat. *Ann. Res. Report.* p. 29. Plant Physiology. Sec., Ayub Agri. Res. Inst. Faisalabad, Pakistan.

Majid, A. and M.R. Hussain, 1983 Agro-chemical weed control in wheat production under rain fed conditions. *Pakistan J. Agric. Res.*, 6: 78–81

Pandey, J.R., R. Sharma, P. Singh and S. Chander, 1996. Effect of time and method of Isoproturon application on weeds and yield of wheat (*Triticum aestivum*). *Indian J. Agron.*, 41: 570–6 (*Wheat, Barley and Triticale Absts.*, 3: 100; 1997).

Singh, S.J., S.K. Verma, K.K. Sinha and S.S. Mishra, 1989. Comparative efficacy of cultural and chemical methods of weed control in wheat. *Indian J. Agron.*, 34: 209–12 (*Wheat, Barley and Triticale Absts.*, 8: 5765; 1991).

Satao, R.N., S.G. Padle and G.S. Lahariya, 1993. Integrated weed management in late sown wheat. Inintegrated weed management for sustainable agriculture. *In: Proc. Indian Soc. Weed Science Int. Sym.*, Hisar Indian Soc. Weed Sci., 111: 78–81 (*Wheat, Barley and Triticale Absts.*, 11(5): 4552; 1994).

Sharar, M.S., M. Sharif, S.H. Shah and A. Tanveer, 1994. Efficacy of some weedicides in controlling weeds in wheat (*Triticum aestivum*). *In: 4th all Pakistan Weed Sci. Conf.*, p. 18. Univ. Agric., Faisalabad, Pakistan.

Shah, Z., 1994. Effects of post emergence herbicides application and hand weeding on wheat and wheat and weed pressure. *In: 4th all Pakistan Weed Sci. Conf.*, p. 19. Univ. Agric. Faisalabad, Pakistan

Steel, R.G.D. and J.H. Torrie, 1984. *Principles and Procedures of Statistics.* McGraw Hill Book Co., Tokyo, Japan, pp. 172–7.

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