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Alternative methods of isoproturon application in wheat

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Abstract

A field experiment was conducted during 2002-03 and 2003-04 at Research Farm of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur to study the alternative methods of isoproturon application for the control of weeds in wheat. The dominating weed in the experimental field was *Phalaris minor* (74.5%). Broadcast application of isoproturon at 1.50 kg ha^{-1} with 150 kg ha^{-1} sand and 1.00 kg ha^{-1} with 130 kg ha^{-1} urea resulted in significantly lower population of *Phalaris minor* as compared to other weed control treatments. The broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg ha^{-1} urea was as effective as spray application of isoproturon at 1.50 kg ha^{-1} in reducing the total weed count and dry weight and increased grain yield of wheat. Broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg ha^{-1} urea gave highest net return over weedy check (Rs 15207/ha) and marginal benefit cost ratio (24.5).

Key words: alternative methods, isoproturon, urea, sand, wheat.

Introduction

Introduction of high yielding dwarf wheat varieties, improved fertilizer and irrigation facilities coupled with scientific background and farmers vision have led India to the prestigious second position in wheat production in the world. But the productivity of wheat is still very low mainly because of poor weed management as many farmers have not yet adopted the recommended weed management practices (Sohl *et al.* 1995; Singh *et al.* 1998). Wheat is infested with a large number of weeds, comprising both grassy as well as broad leaf, causing immense yield losses depending upon type and intensity of their infestation. Isoproturon is quite effective, safe and economical herbicide in wheat (Singh *et al.* 1998). Spraying proved to be the most effective application method (Balyan *et al.* 1994; Yaduraju and Ahuja 1990; Gill *et al.* 1988). Because of small holdings and poor economic conditions of the farmers, acquiring spray pumps in each household or sometimes even in the village may not be possible. Therefore, alternative methods of herbicide application are of utmost importance. Keeping these facts in mind, the present investigation was undertaken to study the alternative method of isoproturon application *i.e.* broadcast with sand or urea mix for the control of weeds in wheat.

Material and Methods

A field experiment was conducted during the winter season of 2002-03 and 2003-04 at the research farm of Department of Agronomy, CSK Himachal Pradesh Krishi Vvishvavidyalaya, Palampur. The soil of the experimental field was silty clay loam in texture, acidic in reaction (pH 5.6) and medium in available N (346.4 kg N ha^{-1}), P (20.5 kg ha^{-1}) and K (211.8 kg ha^{-1}). Twelve treatment combinations *viz.* spray application of isoproturon at 1.0 and 1.50 kg ha^{-1} alone and 1.50 kg ha^{-1} with 3% urea, broadcast application of isoproturon at 0.50, 0.75 and 1.00 kg ha^{-1} with 65 and 130 kg/ha urea and at 1.50 kg ha^{-1} with 150 kg ha^{-1} sand, hand weeding twice and weedy check were tested in randomized block design with three replications. The doses of N (urea) used with the herbicide were adjusted in the total N recommended for the crop. Wheat variety 'HPW-89' was sown on November 14, 2002 and November 25, 2003 using 100 kg seed ha^{-1}. Spray application of the herbicide was made with backpack power sprayer using 600 l water per hectare. Except weed control, the crop was raised in accordance with the recommended package of practices. Weed count and dry weight were recorded at 120 DAS from two randomly selected spots (0.25 m^2) in each plot and expressed as number and g m^{-2}, respectively. Yield was recorded from net plot which was 6.6 m^2. Net returns over weedy check were calculated by subtracting the net return of weedy check from the net return of a particular treatment. MBCR (Marginal benefit cost ratio) was obtained by dividing net return due to weed control by the cost of weed control treatment.

Results and Discussion

The major weeds in the experimental field were *Phalaris minor* (74.5%), *Avena ludoviciana*

(8.3%), *Vicia sativa* (4.2%), *Anagallis arvensis* (8.7%) and *Ranunculus arvensis* (2.9%). The other weeds like *Coronopus didymus, Lathyrus aphaca* and *Lolium temulentum* were in minority and constituted only 1.4% of the total weed population.

All the weed control treatments were significantly superior to weedy check in influencing total weed count as well as total dry matter accumulation during 2003-04 only (Table 1). Broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg ha^{-1} urea was statistically at par with spray of isoproturon at 1.50 kg ha^{-1} (the recommended practice) and hand weeding twice in reducing total weed count. However, broadcast application of isoproturon at 0.75 kg ha^{-1} with 65 kg ha^{-1} urea was also as good as broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg ha^{-1} urea in influencing total dry matter accumulation by weeds.

The broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg ha^{-1} urea resulted in significantly higher effective tillers and grain yield of wheat during both the years of investigation (Table 2). This was ascribed to effective species-wise and total control of weeds. However, spray application of isoproturon at 1.50 kg ha^{-1} during both the years and isoproturon at 0.75 kg ha^{-1} with 130 kg urea and at 1.00 kg ha^{-1} with 65 kg urea in 2002-03 were as good as the broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg urea/ha in influencing grain yield of wheat.

Table 1. Effect of treatments on total weed count (No/m^2) and total weed dry weight (g/m^2) at 120 DAS in wheat (Transformed data)

Treatment	Dose (kg ha^{-1})	Method of application	Weed count		Weed dry weight	
			2002-03	2003-04	2002-03	2003-04
IPU	1.5	Spray	10.9 (118.7)	8.8 (77.3)	9.5 (97.0)	8.8 (78.4)
IPU + urea	1.5 + 3%	Spray	14.5 (209.3)	10.5 (110.0)	10.9 (119.6)	12.4 (154.1)
IPU + sand	1.5 + 150	Broadcast	9.9 (97.3)	9.7 (94.6)	12.1 (146.8)	10.5 (110.4)
IPU	1.0	Spray	12.5 (154.7)	9.7 (93.3)	12.8 (166.9)	10.1 (101.6)
IPU + urea	1.0 + 65	Broadcast	11.6 (133.4)	10.7 (114.6)	10.0 (99.7)	10.9 (119.6)
IPU + urea	1.0 + 130	Broadcast	10.3 (105.5)	8.6 (73.3)	9.4 (93.0)	9.6 (90.6)
IPU + urea	0.75 + 65	Broadcast	13.7 (188.0)	11.2 (125.2)	10.3 (110.2)	9.6 (93.7)
IPU + urea	0.75 + 130	Broadcast	10.0 (99.9)	9.5 (90.6)	9.8 (96.9)	10.1 (101.2)
IPU + urea	0.50 + 65	Broadcast	13.2 (173.0)	10.6 (113.3)	12.7 (175.0)	12.8 (167.3)
IPU + urea	0.50 + 130	Broadcast	14.2 (200.0)	10.4 (108.0)	12.2 (150.6)	12.1 (148.5)
Hand weeding		30 & 60 DAS	9.4 (88.0)	7.7 (58.6)	9.8 (96.9)	7.3 (54.1)
Weedy check			15.4 (237.4)	14.7 (218.0)	16.9 (287.4)	13.5 (184.1)
LSD (P=0.05)			1.4	1.2	2.4	1.9

IPU, isoproturon; I,; II,; DAS, days after sowing; The data given in parentheses are the means of original values

Table 2. Effect of treatments on effective tillers, grain yield (kg ha^{-1}), net return over weedy (Rs/ha) and MBCR in wheat

Treatment	Dose (kg ha^{-1})	Method of application	Effective tillersm^{-2}		Grain yield		Net return over weedy	MBCR
			2002-03	2003-04	2002-03	2003-04		
IPU	1.5	Spray	291.5	272.3	3378	2607	12665	16.0
IPU + urea	1.5 + 3%	Spray	291.3	271.0	3250	2371	10992	13.3
IPU + sand	1.5 + 150	Broadcast	288.5	273.0	2902	2277	8898	9.6
IPU	1.0	Spray	257.3	245.5	2351	2239	6558	10.6
IPU + urea	1.0 + 65	Broadcast	284.5	264.5	3309	2331	11283	18.2
IPU + urea	1.0 + 130	Broadcast	297.0	276.0	3863	2649	15207	24.5
IPU + urea	0.75 + 65	Broadcast	263.5	243.5	2668	2104	7462	13.9
IPU + urea	0.75 + 130	Broadcast	287.6	265.5	3361	2431	12052	22.5
IPU + urea	0.50 + 65	Broadcast	270.5	249.0	2763	1861	6881	15.3
IPU + urea	0.50 + 130	Broadcast	272.5	261.5	3101	2395	10805	24.0
Hand weeding		30 & 60 DAS	276.5	255.0	3274	2229	4286	0.6
Weedy check			224.5	203.5	1733	1262	-	-
LSD (P=0.05)			8.7	7.9	570	206	-	-

DAS, days after sowing; The data given in parentheses are the means of original values. MBCR, marginal benefit cost ratio

Due to low cost of application, the net return over weedy check and marginal benefit cost ratios following herbicidal treatments were considerably higher over hand weeding twice. Broadcast application of isoproturon at 1.0 kg ha^{-1} with 130 kg urea/ha gave highest net return over weedy check (Rs 15207/ha) and marginal benefit cost ratio (24.5). This was followed by spray application of isoproturon at 1.50 kg ha^{-1} and isoproturon at 0.75 kg ha^{-1} with 130 kg urea in terms of net return over weedy check and isoproturon 0.50 and 0.75 with 130 kg urea/ha in terms of marginal benefit cost ratio.

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