



Evaluation of bioefficacy of clodinafop-propargyl + metsulfuron-methyl against weeds in wheat

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ABSTRACT

A field experiment was conducted at Pantnagar during winter season 2005-06 and 2006-07 to study effect of rates of herbicide mixture clodinafop-propargyl 15% + metsulfuron-methyl 1% (UPH-206) for control of mixed weed flora in wheat (*Triticum aestivum* L.). Grassy weeds such as *Phalaris minor*, *Avena fatua* and broad-leaved weeds, viz., *Chenopodium album*, *Melilotus* spp., *Medicago denticulata*, *Vicia sativa*, *Rumex* spp., *Anagallis arvensis*, *Coronopus didymus*, *Lathyrus aphaca* and *Polygonum plebejum* were effectively controlled by application of UPH-206 500 g product/ha. The highest grain yield (4.17 t/ha) of wheat was also obtained with the post-emergence application of UPH-206 500 g product/ha being at par with UPH-206 400 g product/ha, and hand weeding at 35 and 55 DAS, but significantly higher than sulfosulfuron, clodinafop and isoproturon at recommended rates. No residual effect of UPH 206 at any of doses tested was obtained on succeeding crops of blackgram and maize.

Key words: Clodinafop-propargyl, Metsulfuron-methyl, UPH-206, Wheat

In North-Western part of India, wheat is mainly infested with *Phalaris minor*, *Avena ludoviciana*, *Chenopodium album*, *Medicago denticulata*, *Melilotus alba*, *Melilotus indica*, *Fumaria parviflora*, *Vicia hirsuta*, *Vicia sativa*, *Coronopus didymus* and *Rumex acetocella*. Herbicides have provided effective control of weeds; however, increased use of isoproturon led to the evolution of resistant *Phalaris minor* Retz. biotypes and shift in weed flora (Malik and Singh 1993). To overcome this problem, fenoxaprop-p-ethyl, sulfosulfuron and clodinafop-propargyl have been recommended (Chhokar and Malik 2002). Fenoxaprop-p-ethyl and clodinafop-propargyl are specific to *P. minor* and *A. ludoviciana* but are ineffective against broad-leaved weeds. Continuous use of these herbicides have resulted in tremendous increase in density of broad-leaved species like *Rumex acetocella*, *M. denticulata*, *C. album*, *Melilotus* spp., *Vicia* spp., *F. parviflora* and *C. didymus*. So there is a need to evaluate alternative herbicides with different mode of action for the control of complex weed flora in wheat. Present experiment was carried out to assess the relative bio-efficacy of new herbicide molecule clodinafop-propargyl + metsulfuron-methyl.

MATERIALS AND METHODS

A field trial was conducted during winter season 2005-06 and 2006-07 at Pantnagar to evaluate the bio-

efficacy of a ready-mix combination of clodinafop-propargyl 15% + metsulfuron-methyl 1% (UPH-206), which has been registered with trade name Vesta. The soil of the experiment field was loam in texture (38.4% sand, 45.0% silt and 16.6% clay), pH 7.5, medium in organic C (0.58%), high in available P (35.6 kg P/ha) and medium in available K (164.5 kg K/ha). Wheat variety 'UP-2425' was sown on 21 December, 2005 and 2 December, 2006 using seed rate of 100 kg/ha in rows 20 cm apart. Recommended package of practices were followed to raise the crop. Different doses of UPH-206 with surfactant were compared with isoproturon, sulfosulfuron, clodinafop-propargyl and metsulfuron-methyl at their recommended rates along with two manual weedings at 35 and 55 days after sowing (DAS) and weedy check (Table 1). Nine treatments were replicated thrice in randomized block design. All the herbicides were applied at 35 DAS, using a knapsack sprayer at a spray volume of 375 litres of water/ha in case of UPH-206, clodinafop and sulfosulfuron, and 500 litres of water/ha for isoproturon and metsulfuron-methyl. Data on density and dry matter accumulation of weeds was taken at 60 DAS, and subjected to $\sqrt{(x+1)}$ transformation before statistical analyses. To study the phytotoxic effect, visual rating on the scale of 0-10 for UPH-206 applied 400 and 800 g product/ha was made.

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RESULTS AND DISCUSSION

Grassy weeds viz., *Phalaris minor* and *Avena fatua* constituted 62.4% of total weed population, while the remaining were broad leaved species viz., *Chenopodium album*, *Melilotus* spp., *Medicago denticulata*, *Vicia sativa*, *Rumex* spp., *Anagallis arvensis*, *Coronopus didymus*, *Lathyrus aphaca* and *Polygonum plebejum*. Weed management practices significantly reduced the population and

dry matter of weeds recorded at 60 DAS as compared to weedy check (Table 1). Application of UPH-206 500 g product/ha with surfactant was most effective and provided 97.3% control of grassy weeds. This was followed by UPH-206 400 g product/ha, two manual weedings at 35 and 55 DAS, and clodinafop-propargyl 15% WP 400 g/ha. Application of sulfosulfuron 75% WG at 33.3 g/ha or isoproturon 75% WP 1333.3 g/ha was not found so effective for the control of grassy weeds. Punia *et al.* (2008)

Table 1. Effect of clodinafop-propargyl + metsulfuron-methyl and other herbicides on density of weeds in wheat

Treatment	Dose		Surfactant (ml/ha)	Weed population/m ² at 60 DAS					
	g/ha	Product (g/ha)		Grassy weeds			Broad leaved weeds		
				2005-06	2006-07	Mean	2005-06	2006-07	Mean
Isoproturon	1,000	1333.3	-	6.0 (25.0)	10.8 (95.3)	8.8 (60.2)	7.1 (37.0)	8.6 (57.3)	7.9 (47.2)
Sulfosulfuron + surfactant	25	33.3	1250	4.6 (13.0)	6.0 (25.3)	5.4 (19.2)	6.7 (32.0)	5.5 (20.3)	6.1 (26.2)
Clodinafop-propargyl	60	400	-	3.7 (7.0)	4.8 (14.7)	4.3 (10.9)	11.8 (117.0)	13.6 (159.7)	12.8 (138.4)
Metsulfuron-methyl + surfactant	4	20	625	15.5 (211.0)	12.4 (129.3)	14.0 (170.1)	4.3 (11.0)	4.1 (9.3)	4.2 (10.2)
UPH-206	45+3	300	1250	3.2 (5.0)	5.2 (17.3)	4.3 (11.2)	6.4 (29.0)	4.8 (14.7)	5.7 (21.9)
UPH-206	60+4	400	1250	2.4 (2.0)	4.5 (12.3)	3.7 (7.1)	3.5 (6.0)	3.9 (8.7)	3.7 (7.4)
UPH-206	75+5	500	1250	2.0 (1.0)	4.4 (11.7)	3.5 (6.4)	3.0 (4.0)	3.3 (5.3)	3.2 (4.7)
Hand weedings	-	-	-	1.0 (0.0)	5.0 (15.7)	3.8 (7.8)	3.2 (5.0)	2.8 (3.3)	3.0 (4.2)
Weedy check	-	-	-	15.7 (215.00)	17.0 (255.0)	16.3 (235.0)	11.7 (115.0)	13.4 (152.7)	12.6 (133.9)
LSD (P=0.05)				2.0	1.9	0.8	0.2	1.5	1.3

* Data in parentheses are transformed values $\sqrt{(x+1)}$

Table 2. Effect of clodinafop-propargyl + metsulfuron-methyl and other herbicides on weed dry weight and grain yield of wheat

Treatment	Dose		Surfactant (ml/ha)	Total weed dry weight (g/m ²) at 60 DAS			Grain yield (t/ha)		
	g/ha	Product (g or ml/ha)							
				2005-06	2006-07	Mean	2005-06	2006-07	Mean
Isoproturon	1,000	1333.3	-	6.9 (34.8)	8.6(57.0)	7.8(45.9)	3.80	3.21	3.50
Sulfosulfuron + surfactant	25	33.3	1250	5.1 (17.0)	5.5(20.2)	5.3(18.6)	3.93	3.92	3.92
Clodinafop-propargyl	60	400	-	9.5 (72.5)	10.5 (89.3)	10.0(80.9)	3.40	3.67	3.53
Metsulfuron-methyl + surfactant	4	20	625	14.0(167.8)	4.8(14.4)	14.2 (175.0)	2.72	3.43	3.08
UPH-206	45+3	300	1250	4.5(12.0)	3.9(8.5)	4.6(13.2)	3.98	3.71	3.85
UPH-206	60+4	400	1250	3.7 (7.3)	3.9 (8.5)	3.8(7.9)	4.08	4.22	4.15
UPH-206	75+5	500	1250	2.8(3.2)	2.4 (2.0)	3.1(4.25)	4.05	4.29	4.17
Hand weedings	-	-	-	1.0 (0.0)	2.4(2.0)	2.0 (1.0)	4.09	4.15	4.12
Weedy check	-	-	-	16.1 (228.0)	15.2(201.3)	15.7(214.1)	1.53	2.33	1.93
LSD (P=0.05)				1.5	1.9	1.5	0.28	0.33	0.24

*Data in parentheses are transformed values $\sqrt{(x+1)}$

also reported excellent control of grassy weeds in wheat with the application of UPH-206 400 and 500 g product/ha. Application of metsulfuron-methyl 20 g/ha was not found effective against grassy weeds in wheat.

The efficacy of the herbicides on broad-leaved weeds indicated that UPH-206 500 g product/ha resulted in their excellent control (96.5%). It was found at par with UPH-206 400 g product/ha, metsulfuron-methyl 20% WP at 20 g/ha. Excellent control of complex weed flora in wheat was observed with the tank-mix application of clodinafop + metsulfuron methyl (15:1 ratio) at 60 g/ha (Punia *et al.* 2004). On the other hand, application of clodinafop-propargyl 15% WP at 60 g/ha showed no efficacy against broad-leaved weeds. The lowest dry weight of total weeds was recorded with two manual weedings at 35 and 55 DAS, being at par with the application of UPH-206 500 g product/ha. Among the herbicide treatments, UPH-206 500 g product/ha recorded minimum weed dry weight (4.1 g/ha), which was followed by UPH-206 400 g product/ha.

Unchecked weed growth reduced grain yield of wheat by 54% when compared with UPH-206 500 g product/ha. Maximum yield (4.17 t/ha) was recorded from UPH-206 500 g product/ha, which was followed by UPH-206 at 400 g product/ha (4.15 t/ha) and manual weeding at 33 and 35 DAS (4.12 t/ha). Higher grain yield with UPH-206 500 g product/ha was due to more number of effective tillers and

number of grains/ear. No phytotoxicity symptoms *viz.*, yellowing, scorching, necrosis, epinasty and hyponasty were observed in case of UPH-206 even at higher dose of 800 g product/ha during entire wheat season. Further, no residual effect of UPH-206 applied in wheat even at 800 g product/ha on germination of succeeding crops *viz.*, urdbean and maize was observed. Germination and growth of succeeding crops in plots treated with UPH-206 400 and 800 g product/ha were similar as untreated control plots.

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