Methods of Application of Herbicides in Wheat

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ABSTRACT

Two herbicides namely Arelon (isoproturon) @ 1.50 kg ha^{-1} and Envoy (cynazine + MCPA) @ 2 kg ha^{-1} were applied post emergence by mixing with 248 kg ha^{-1} each of sand, gypsum and single super-phosphate. In another treatment both of these herbicides were sprayed followed by water shower. Weed mortality percentage was higher in all the Arelon treated plots while with Envoy application mortality was very low. Water shower after spray application of Arelon was most effective in checking the weed growth followed by one hand weeding. Increase in yield with different methods of application of herbicides ranged from 11.1 to 66.1 percent. Arelon spray application followed by water shower was the most economical treatment which lead to maximum net benefit. It was followed by one hand weeding.

INTRODUCTION

Weed infestation in wheat is one of the major constraints responsible for low productivity. Yield losses because of weed infestation may vary from 15-50% (Gill *et al.* 1979) depending upon weed density.

Weed control by manual or mechanical means is in practice since long but with the introduction of labour intensive cropping system this traditional practice has become expensive. In such a situation, herbicides offer more practical, effective and economic means for reducing crop losses. Boyall *et al.* (1979) and Angirass and Modgal (1981) reported beneficial effects of herbicides.

A large number of herbicides have been introduced in Pakistan and their spray application is mostly recommended. The calculation of their dosage and spray application is highly skilled job. It oftenly becomes difficult for a common farmer to operate which results in phytotoxic effects on crop or no effect on weeds. Efforts are therefore, needed to develop methods which can easily be used by the farmers.

The present study was, therefore, undertaken to find out some suitable methods by dust application of Arelon (isoproturon) and Envoy (cyananzine + MCPA) in mixture with sand, gypsum and single super-phosphate and also as a spray application followed by water shower.

MATERIALS AND METHODS

The investigation regarding the methods of application of herbicides in wheat was carried out at Agronomic Research Area, University of Agriculture, Faisalabad, during the year 1987-88. Wheat variety LU-26S was used as a test crop. The field was fertilized at the rate of 80 kg nitrogen and 55 kg phos-

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phorus per hectare. Two herbicides namely Arelon (isoproturon) and Envoy (cyanazine + MCPA) were applied post emergence as a dust by mixing with sand, gypsum and single super-phosphate and applied also as a spray. The treatments included Arelon (Isoproturon) @ 1.50 kg/ha + Sand, Arelon @ 1.50 kg/ha + Gypsum, Arelon @ 1.50 kg/ha + single super-phosphate, Arelon @ 1.50 kg/ha + single super-phosphate, Arelon @ 1.50 kg/ha + water shower after spray application, Envoy @ 2 kg/ha + Sand, Envoy @ 2kg/ha + gypsum, Envoy @ 2 kg/ha + single super-phosphate, Envoy @ 2 kg/ha + water shower after spray application, one hand weeding and weedy check (Control).

The treatments were applied when crop was at 2-3 leaf stage. Weighed quantities of sand, gypsum or single super-phosphate were broad-casted on one of the plots to work out required quantity of these materials, which came out to be 248 kg ha^{-1}. Weighed quantity of herbicides was well mixed before broad-casting. A knapsack hand sprayer was used with 4 T-jet nozzles for spray application.

Weed population before and after herbicide application was recorded to work out mortality percentage. The treatments were replicated four times in 1.7 x 1.8 m plots, using randomized complete block design. Observations relating to components of yield were recorded at the harvest of the crop. Economic analysis was done by calculating Marginal Rate of Return (Perrin *et al.*1979).

RESULTS AND DISCUSSION

Weed population in the study area comprised grassy weeds as well as broad-leaved weeds such as *Phalaris minor* Retz. (Dumbi grass), *Chenopodium album* L. (Bathu), *Convolvulus arvensis* L. (Lehli), *Melilotus alba* Desf. (Senji), *Rumex dentatus* L. (Jangli palak), *Angallis arvensis* L. (Billibooti), *Coronopus didymus* L. (Jangli haloon), *Euphorbia helioscopia* L. (Dhodak) and *Medicago denticulata* L. (Maina). The field was dominated by *Phalaris minor* Retz. a grassy weed which accounted 79.24% while 20.76% were dicot weeds. Weed population before and after spray with mortality percentage is given in table 1. Different application methods with Arelon worked very well. Water sprinkling after spray application proved to be more effective. Average mortality percentage value for Arelon ranged from 36.3% to 96.2%, whereas range for Envoy varied from 13.3% to 19.0%. Hand weeding continued to be a better practice. Although *Phalaris* was not affected by Envoy with different application methods (Table 1) but control of broad leaved weeds was reasonable with Envoy and Arelon. *Convolvulus* population was not affected by Arelon application while Envoy considerably reduced *Convolvulus* population. Effectiveness of weedicides and different methods of application has also been shown by O' Sullivan and Vanden Born (1980) and Waheed and Piracha (1983).

Data on fertile tillers (Table 2) indicate that water shower after spray application of Arelon @ 1.50 kg ha^{-1} proved to be beneficial by producing

Table 1. Efect of methods of application of herbicides on percent mortality of individual weed population in wheat.

Treatments	Phalaris minor Retz	Chenopodium album L.	Melilotus alba Desf.	Rumex dentatus L.	Anagallis arvensis L.	Coronopus didymus L.	Euphorbia heteropcpia L.	Medicago denticulata L.	Convolvulus arvensis L.	Total *	Weeds **	Mortality %age
Arelon (Isoproturon) @ 1.50 kg/ha + Sand	62.0	66.7	61.4	66.4	62.7	64.5	75.0	60.0	11.1	754.25	286.13	62.06
Arelon (Isoproturon) @ 1.50 kg/ha + Gypsum	52.1	46.2	44.6	56.2	56.1	55.8	54.6	56.5	00.0	769.13	372.13	51.62
Arelon (Isoproturon) @ 1.50 kg/ha + SSP	36.9	20.0	29.0	39.3	40.3	37.4	40.0	28.6	00.0	695.00	442.25	36.32
Arelon (Isoproturon) @ 1.50 kg/ha + water shower after spray application	96.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	20.0	738.37	28.13	96.20
Envoy (Cyanazine + MCPA) @ 2 kg/ha + Sand	00.0	92.6	57.8	67.6	71.4	73.9	81.3	75.0	62.2	683.13	580.25	15.06
Envoy (Cyanazine + MCPA) @ 2 kg/ha + Gypsum	00.0	66.7	56.7	51.7	51.4	55.1	92.3	70.3	83.0	703.50	610.00	13.29
Envoy (Cyanazine + MCPA) @ 2 kg/ha + SSP	00.0	92.0	67.0	44.3	44.9	67.8	78.9	53.3	70.0	678.37	565.25	16.68
Envoy (Cyanazine + MCPA) @ 2 kg/ha + Water shower after spray application	00.0	100.0	89.8	81.4	88.4	93.8	100.0	100.0	100.0	681.50	552.00	19.00
One hand weeding	67.9	60.0	79.0	73.5	75.9	84.4	44.4	66.7	82.4	675.87	208.50	69.17
Weedy check	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	752.50	787.25	

* Total weeds 15 days before herbicide application

** Total weeds 15 days after herbicides application

Phalaris minor = 5646.85 = 79.24%

Dicot weeds = 1479.25 = 20.76%.

Table 2. Effect of methods of application of herbicides on yield and yield components of wheat.

Treatments	Fertile tillers per unit area (m^2)	Number of spikelets per spike	Number of Grains per spike	1000-grain weight (gm)	Yield (Q/ha)	Increase over control (%)
Arelon (Isoproturon) @ 1.50 kg/ha + Sand	262.0_{ab}	16.8_{bc}	36.1_{c}	38.2_{bc}	32.8_{b}	44.6
Arelon (Isoproturon) @ 1.50 kg/ha + Gypsum	258.5_{bc}	16.6_{cd}	36.0_{c}	38.3_{bc}	31.1_{c}	36.9
Arelon (Isoproturon) @ 1.50 kg/ha + SSP	241.7_{de}	15.9_{ef}	33.5_{d}	40.0_{a}	27.8_{de}	22.6
Arelon (Isoproturon) @ 1.50 kg/ha + water shower after spray application	276.9_{a}	17.8_{a}	39.5_{a}	39.1_{abc}	37.7_{a}	66.1
Envoy (Cyanazine + (MCPA) @ 2 kg/ha + Sand	236.1_{e}	15.5_{fg}	32.0_{f}	37.9_{c}	25.9_{f}	14.1
Envoy (Cyanazine + MCPA) @ 2 kg/ha + Gypsum	234.1_{e}	15.3_{g}	31.8_{f}	38.8_{bc}	25.2_{f}	11.1
Envoy (Cyanazine + MCPA) @ 2 kg/ha + SSP	237.5_{de}	15.7_{efg}	31.3_{g}	39.4_{ab}	26.4_{ef}	16.3
Envoy (Cyanazine + MCPA) @ 2 kg/ha + water shower after spray application	248.3_{cd}	16.1_{de}	32.8_{e}	38.6_{bc}	28.8_{d}	26.7
One hand weeding	266.1_{ab}	17.1_{b}	37.2_{b}	38.8_{abc}	34.2_{b}	50.5
Weedy check.	211.2_{f}	14.6_{h}	29.2_{h}	38.3_{bc}	22.7_{g}	–

Any two means not sharing a letter in common, differs significantly.

Table 3. Marginal analysis of the undominated herbicides application methods response data.

Treatments	Net benefit (Rs.)	Variable cost (Rs.)	Marginal increase in net benefit (Rs.)	Marginal increase in variable cost (Rs.)	MRR (%)
Arelon (Isoproturon) @ 1.50 kg/ha water shower after spray application	8048.66	553.20	501.61	203.20	2.47 = 247%
One hand weeding	7547.05	350.60	2088.06	350.00	5.97 = 597%
Arelon (Isoproturon) @ 1.50 kg/ha + Sand	6989.23	565.60		*	
Arelon (Isoproturon) @ 1.50 kg/ha + Gypsum	6476.81	702.00			
Envoy (Cyanazine + MCPA) @ 2 kg/ha + water shower after spray application	6183.69	490.00			
Arelon (Isoproturon) @ 1.50 kg/ha + SSP	5727.46	751.60			
Envoy (Cyanazine + MCPA) @ 2 kg/ha + Sand	5556.55	502.40			
Envoy (Cyanazine + MCPA) @ 2 kg/ha + SSP	5476.04	688.40			
Control	5458.99	–			
Envoy (Cyanazine + MCPA) @ 2 kg/ha + Gypsum	5274.58	638.80			

* MRR is not calculated for the values which give reduction in net benefits.

more productive tillers which was at par with hand weeding. The data regarding the spikelets per spike (Table 2) indicate that there is considerable variation in the treatments. Spray application of Arelon @ 1.50 kg ha^{-1} followed by shower appeared to be better method. The differences among other treatments were not large enough. Any how, all of them tend to prove better than control. The data presented in table 2 reveal that maximum number of grains/ spike (39.5) was produced by water shower after spray application of Arelon @ 1.50 kg ha^{-1} followed by hand weeding (31.2) and minimum (29.1) was observed in weedy check. The results are in line with the findings of Verma and Chaturvedi (1985). There was considerable difference in 1000-grain weight (Table 2) but there was no definite trend. Anyhow, Arelon mixture with SSP, Arelon spray application followed by shower, Envoy mixture with SSP and hand weeding produced relatively heavy grains. The increase in grain weight in these treatments is probably due to (i) reduced weed competition and (ii) availability of higher amounts of phosphorus in SSP mixture.

The use of herbicides and their application methods (Table 2) increased the yield considerably which ranged from 11.1 to 66.1% over control. Arelon spray followed by shower has come out to be very effective method with maximum grain yield of 37.7 q ha^{-1}. Hand weeding and Arelon mixed with sand were the next best treatments. The increase in wheat yield by chemical weed control methods is well documented by O'Sullivan and Vanden Born (1980), Verma and Chaturvedi (1985) and Bhan (1987).

Economic analysis of data (Table 3) show that water shower after spray application of Arelon @ 1.50 kg ha^{-1} was the most economical treatment which led to maximum net benefits. It was followed by one hand weeding. Envoy + SSP @ 2 kg ha^{-1} was not useful whereas other herbicidal treatments were beneficial because the net benefits were more than control treatment.

The observations from this study suggest that in situations where either the sprayer is not available or it is difficult for the farmer to calibrate precise rate, he may use sand dust, gypsum or fertilizer for the application of the herbicides. It may also be of interest in dry areas that the herbicides may be sprayed in dry condition followed by a light shower.

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