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Use of Wetting Agent (Surfactant) to Enhance the Phytotoxicity of 2, 4-D for Control of Broad Leaf Weeds in Wheat

A. Tanveer, M. Ayub, R. Ahmad and A. Ali*
Department of Agronomy, *Department of Crop Physiology,
University of Agriculture, Faisalabad, Pakistan

Abstract

A field study was conducted to evaluate the effect of adding a wetting agent to 2, 4-D on weed control in wheat. Triton @ 200 and 250 was used as wetting agent with recommended (1.3 kg ha^{-1}) and reduced rate (1.00 kg ha^{-1}) of 2, 4-D . Weedy check and sole application of 2, 4-D was also included for comparision. Different weed control treatments significantly reduced the weed population compared to weedy check. Appliction of 2, 4-D @ 1.3 kg ha^{-1} added with wetting agent @ 200 ml kg^{-1} of 2, 4-D gave 39 per cent more grain yield than weedy check.

Introduction

Weed infestation is one of the major factors responsible for low yield of wheat in Pakistan. Loses in wheat yield due to weeds may range between 17-25 per cent (Shad, 1987 a). Use of herbicides for timely and effective control of weeds is becoming popular among the wheat growers. The use of wetting agent favours uniform spreading of herbicide solution and brings it into intimate contact with the plant surface. Spray droplets do not remain suspended on hair, scales or other projections and tend to stick to the plant. The waxy cuticle may be solubilized by wetting agent so that plant may absorb the herbicide readily (Ruiter *et al.*, 1990).

According to Malik *et al.* (1985) addition of 0.1 per cent surfactant (selvet) to 2, 4-D increased the percentage of control of all weeds and increased significantly the grain yield. Wiese *et al.* (1986) found that toxicity of 2, 4-D was increased by adding 0.25 per cent non-ionic surfactant for complete control of broad leaved weeds. Shad (1987 b) observed that combined application of metoxuron and isoproturon with surfactant (selvet) proved better in controlling weeds than their sole applications. Walia and Gill (1987) noted that application 0.1 per cent sandovit or 0.25 per cent hyoxide to isoproturon @ 0.75-0.94 kg ha^{-1}, metoxuron @ 1.1-1.2 kg ha^{-1} and methabenzthiazuron @ 1.2-1.5 kg ha^{-1} increased the efficacy of these herbicides. All the treatments increased tiller number, 1000-grain weight and grain yield of wheat.

Balyan *et al.* (1988) reported that tri-allate @1-2kg, metoxuron @1.6kg, pendimethalin @1.5kg, methabenzthiazuron @1.4kg, and diclofop + isoproturon @1.0kg ha^{-1} gave 0-50 per cent control of weeds in wheat. But addition of 1 per cent selvet surfactant to these herbicides resulted in 60 - 91 per cent control. Malik *et al.* (1989) reported increased toxicity of isoproturon, metoxuron and diclofop-methy with 0.1 per cent selvet as surfactant to *Avena fetua, Chenopodium album* and *Vicia sativa*.

The present study was carried out with the objectives to evaluate the potential of using trion as wetting agent to enhance the efficiency of 2,4-D in wheat.

Materials and Methods

A quadruplicated experiment laid out in Randomized Complete Block Design was conducted to study the potential of using trion a wetting agent to enhance the efficiency of 2, 4-D in controlling broad leaved weeds in wheat. The experiment was conducted at Agronomic Research Area, University of Agriculture, Faisalabad. Plot size was 2.5 x 7 m. Wheat variety "Pasban-90" was sown in the second week of November with the help of a single row hand drill in 25 cm apart rows using 100 kg seed ha^{-1} with 115 kg ha^{-1} of diammonium phosphate. Treatments were weedy check, 2, 4-D @ 1.3 kg ha^{-1}, 2, 4-D @ 1.7 kg ha^{-1} + wetting agent @ 200 ml kg^{-1} of 2, 4-D, 2, 4-D @ 1.00 kg ha^{-1} + wetting agent @ 200 ml kg^{-1} of 2, 4-D and 2, 4-D @ 1.00 kg ha^{-1} + wetting agent @ 250 ml kg^{-1} of 2, 4-D. Herbicide thoroughly mixed with wetting agent was sprayed with "Solo" hand sprayer after Ist irrigation when field was still sufficiently wet. Data with respect to number of weeds and spike bearing tillers were recorded at five weeks after spray and at harvesting, respectively. A unit area of one square meter selected at randoms from each plot was used for the purpose. Ten spikes were selected to count average number of grains per spike from each plot.

Data collected were analysed statistically by using Fisher's Analysis of Variance Technique and treatment means were compared at 5 per cent probability level by using Least significant Difference (Steel and Torrie, 1984).

Results and Discussion

Weed flora at the experimental site comprised *Chenopodium album* (Bathu), *Rumex dentatus* (Jangli Palik), *Coronopus didymus* (Jangli Haloon), *Convolvulus arvensis* (Lehli), *Fumaria parviflora* (Shahtra) and *Vicia sativa* (Rawari). *C. album* was the predominant weed.

Table 1 shows that 2, 4-D alone at standard rate and reduced rate with wetting agent reduced significantly the weed population, five weeks after spray. Weed control with different treatments ranged from 92 to 97 per cent. Comparable weed control by 2, 4-D even at reduced rate with the addition of wetting agent could be due to increased toxicity of 2, 4-D by wetting agent which increases wetting, spreading and absorption of herbicides (Ruiter *et al.*, 1990). Improved weed control as a result of herbicides application with wetting agent has also been reported by Malik *et al.* (1985), Wiese *et al.* (1986), Shad

Table 1: Response of different weeds (no m^{-2}) to 2,4-D and wetting agent.

2, 4-D) (kg ha^{-1})	Surfactant (ml kg^{-1} 2,4-D)	*Chenopodium album*	*Rumex dentatus*	*Coronopus didymus*	*Convolvulus arvensis*	*Fumaria pariflora*	*Vicia* sativa	Weed control (%)
Weedy check	-	56.25a	26.25a	54.75a	12.00a	7.3a	11.25a	-
Standard 2, 4-D rate								
1.3	0	4.25b	0.25b	0.25b	2.25b	0.5b	0.75b	95
1.3	200	2.25b	0.75b	0.00b	1.00b	0.0b	1.00b	97
Reduced 2, 4-D rate								
1.0	200	4.75b	1.00b	0.25b	2.50b	0.0b	1.25b	94
1.0	250	4.75b	2.50b	1.50b	2.75b	1.2b	0.75b	92
SE		1.80	1.42	1.25	0.33	0.31	0.55	

Table 2: Response of yield and yield components of wheat to 2, 4-D and wetting agent.

2, 4-D (kg ha^{-1})	Surfactant (ml kg^{-1})2, 4-D	Spike bearing tillers	Grains spike $^{-1}$	1000-grain Weight (g)	Grain yield (t ha^{-1})	Increase in yield over check (%)
Weedy check	-	490c	43.7 b	40.0 b	3.50 c	-
Standard 2,4-D rate						
1.3	0	533ab	48.2 ab	41.0 ab	4.21 b	20
1.3	200	542a	52.7 a	43.0 a	4.85 a	39
Reduced 2,4-D rate						
1.0	200	526bc	49.7 ab	42.5 a	4.64 a	33
1.0	250	520c	51.2 a	41.0 ab	4.14 b	18
S.E.		1.63	1.01	0.22	0.06	

In a column, means having the same letter are not significantly different at 5% probability level.

(1987 b), Walia and Gill (1987) and Balyan *et al.* (1988). The maximum (542.3) spike bearing tillers were recorded in 2, 4-D applied at standard rate of 1.3 kg ha^{-1} + wetting agent @ 200 ml kg^{-1} of 2, 4-D (Table 2). This treatment was statistically similar to sole application of 2, 4-D at standard rate which in turn did not differ significantly from reduced rate of 2, 4-D (1.00 kg ha^{-1}) + wetting agent @ 200 ml kg^{-1} of 2, 4-D. Minimum number of spike bearing tillers (490) was recorded in weedy check which was statistically at par with 2, 4-D applied at reduced rate with wetting agent either @ 200 or 250 ml kg^{-1} of 2, 4-D.

Maximum number of grains per spike (52.75) and 1000-grain weight (43.00 g) was recorded from plots treated with 2,4-D standard rate + wetting agent @ 200 ml kg^{-1} of 2, 4-D. This treatment was statistically similar to all other treatment except weedy check.

Relatively more number of spike bearing tillers, number of grains per spike and 1000-grain weight in 2, 4-D treated plots than weedy check might had resulted from better weed control which shifted the competition for environmental resources towards crop plants for their better growth and development. Walia and Gill (1987) has also reported increased number of tillers and 1000-grain weight by different herbicides with the addition of wetting agent.

The lowest grain yield (3.5 t ha^{-1}) occurred in the weedy check. The yield with 2, 4-D at standard and reduced rate each with wetting agent @ 200 ml kg^{-1} of 2,4-D, yielding 4.85 and 4.64 t ha^{-1} and 39 and 33 per cent more than weedy check, respectively. These were followed by 2, 4-D at standard rate and at reduced rate + wetting agent @ 200 ml kg^{-1} of 2, 4-D, producing 4.21 and 4.14 t ha^{-1} grains.

Lower grain yield in weedy check could be attributed to relatively less number of spike bearing tillers. Wali and Gill (1987) have also reported increased grain yield due to more spike bearing tillers, number of grains per spike and 1000-grain weight resulted from better weed control.

From these results it can be concluded that adding a wetting agent "triton" to a lower rate of 2, 4-D resulted in weed control similar to that of recommended rate of 2,4-D. Thus wetting agent may allow farmers to reduce herbicide dose without sacrificing weed control.

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