

Effectiveness of sodium chloride and 2,4-D in controlling Parthenium hysterophorus L. and other weeds in late sown wheat.

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Abstract

Sodium chloride was slightly toxic to wheat plants. The toxicity symptoms were restricted to leaf tips and margin in the form of scorching, which persisted for a short period of time. The degree of phytotoxicity of sodium chloride to Parthenium hysterophorus L. increased as the strength of sodium chloride solution increased. Ten percent sodium chloride solution severely scorched the foliage whereas 20% and 30% solution burnt the leaves. 2,4-D at 0.5 kg a.i./ha was slightly toxic to Parthenium spp. Sequential application of sodium chloride and 2,4-D controlled Parthenium spp. better than application of sodium chloride alone. Population of Chenopodium album L. was lower in plots treated with sodium chloride followed by 2,4-D as well as in 2,4-D treated plots. Sodium chloride was not effective in controlling Cyperus rotundus L. Among the chemical weed control treatments, application of 10% sodium chloride solution followed by 2,4-D at 0.5 kg a.i./ha was most effective and had low weed weight. Plots received the same treatments recorded the highest grain yield.

Introduction

In the sixties, the dominating weed in wheat in India used to be Chenopodium album L. Later in seventies and eighties Avena fatua L. and Phalaris minor Retz. have been reported to be problem weed in many typical wheat growing regions of India. It has been observed that Parthenium hysterophorus L., which used to be a road side or fallow land weed, has crept into the cultivated land and is now growing along with different crops. Though this noxious weed is considered as a Kharif season weed, it grows well in Rabi season to (Trivedi and Tiwari, 1986). Studies revealed that Parthenium toxins inhibits the growth of wheat plants (Sukhada and Kanchan, 1978).

Several herbicides have been tried to control the weed under non-crop situations with different degree of success (Balu *et al.* 1978; Trivedi and Tiwari, 1986). Sodium chloride has also been successfully used in controlling the weed under non-crop situations (Trivedi and Tiwari, 1985; Dwivedi *et al.* 1987).

In recent years Parthenium has been observed to be one of the major weeds in the late sown wheat crop at Allahabad Agricultural Institute farm land. Its density is increasing gradually. Therefore, the study was carried out to find the effects of 2,4-D (2,4-dichlorophenoxyacetic acid) and sodium chloride on Parthenium and associated weeds in late sown wheat.

Materials and methods

The experiment was conducted in late sown wheat (var. Sonalika) grown at the Agronomy Research Plot of Allahabad Agricultural Institute, Allahabad, India. Wheat was sown on January 7, 1989, with 20 cm row spacing. The crop was fertilized with 100 kg N₂, 60 kg P₂O₅ and 40 kg K₂O per hectare. Fifty kilograms of nitrogen per hectare and full quantity of phosphorus and potash was applied as basal dose. The remaining amount of nitrogen was top dressed 30 days after sowing (DAS).

Weed control treatments were sodium chloride 10, 20 and 30% solution; Na salt of 2,4-D at 0.5 kg a.i./ha; sodium chloride 10, 20 and 30% solution were

each followed by Na salt of 2,4-D at 0.5 kg a.i./ha; hand weeding and untreated check. The experiment was laid out in randomised block design with nine treatments in three replications.

Sodium chloride was applied 35 DAS and 2,4-D 40 DAS by hand compressed sprayer with floodjet fan type nozzle having the delivery rate of 333 litres/ha. Hand weeding was done once at 30 DAS.

Observation on visual rate of toxicity on wheat plants and weeds was taken 10 days after herbicide spray. Weed count was also recorded 20 days after herbicide spray with the help of 0.1 sqm size quadrat. Two samples were taken from each plot. Weed samples were oven dried at 80°C for recording dry weed weight.

Results and discussion

The major weeds in the experimental field were Chenopodium album L., Parthenium hysterophorus L., Cynodon dactylon (L.) Pers., Cyperus rotundus L. The other broadleaf weeds present were Anagallis arvensis L., Convolvulus arvensis L., Fumaria parviflora Lamk., Launaea asplenifolia (D.C.) Hook.F., Melilotus indica (L) All., and Vicia hirsuta (L.) S.F. Gray.

Sodium salt of 2,4-D applied at 0.5 kg a.i./ha by itself did not cause any visual toxicity to wheat plants. Sodium chloride solution of 10% and 20% strength was slightly toxic, whereas 30% solution was more toxic to wheat plants. The toxic symptoms were restricted to leaf tips and margin in the form of scorching (Table 1).

Sodium chloride was toxic to Parthenium. The degree of toxicity increased as the strength of sodium chloride solution increased from 10% and 20%. Ten percent sodium chloride severely scorched the foliage whereas 20% solution burnt the leaves. Toxicity caused to the weed by 30% sodium chloride was same like that of 20% solution.

2,4-D at 0.5 kg a.i./ha was also toxic to Parthenium. In the weed control treatments where sodium chloride spray was followed by 2,4-D application, the phytotoxic symptoms to Parthenium was aggravated as compared to application of sodium chloride alone. Application of 10% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha severely affected the weed. In the other two treatments where application of 20% and 30% sodium chloride was followed by 2,4-D at 0.5 kg a.i./ha, the Parthenium was killed (Table 1).

2,4-D at 0.5 kg a.i./ha caused sever phytotoxicity to Chenopodium. It was not affected by 10, 20 and 30% sodium chloride. Neither sodium chloride nor 2,4-D, were toxic to Cynodon. Cyperus rotundus was not affected by any of the chemical weed control treatments except application of 30% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha. The treatment caused slight scorching (Table 1).

Minimum number of Parthenium was observed in plots treated with 30% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha. In plots treated with 10% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha, 20% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha and 30% sodium chloride alone, the population of Parthenium was also low. Application of sodium chloride followed by 2,4-D controlled Parthenium better than application of sodium chloride alone. Population of Parthenium was maximum in untreated check plots (Table 2).

Ten, 20 and 30% sodium chloride alone did not show any marked reduction in population of Chenopodium as compared to untreated check. Plots treated with sodium chloride followed by 2,4-D as well as in 2,4-D treated plots, population of Chenopodium was lower. Hand weeded plots had least number of

Chenopodium. None of the treatments show any marked effect on Cynodon except in hand weeded plots where population of the weed was least. Population of Cyperus rotundus was least in plots treated with 2,4-D at 0.5 kg a.i./ha as well as in plots treated with 10% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha. Sodium chloride was not effective in controlling Cyperus rotundus. Highest population of the weed was in untreated check plots (Table 2).

Minimum weed weight was obtained in hand weeded plots and maximum in untreated check plots. Among the chemical weed control treatments, application of 10% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha was most effective and had low weed weight (Table 3).

The highest number of effective tillers was in plots treated with 10% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha and minimum was in untreated check plots (Table 3).

The highest grain yield was recorded in plots treated with 10% sodium chloride followed by 2,4-D at 0.5 kg a.i./ha (Table 3). This is attributed to best control of major weed species (Table 2), low toxicity to wheat plants (Table 1) which resulted in higher number of effective tillers. Lowest grain yield was obtained in untreated check plots.

References

1. Balu, S., A.V. Rajan and S. Sankaran. (1978). Study on the control of Parthenium hysterophorus L. at different stages of its growth. Abst. of papers. All India Weed Science Conf., Tamil Nadu Agric. Univ., Coimbatore, Feb. 3 and 4, 1978. p. 44.
2. Dwivedi, R.N., C.S. Patel and R.K. Tarat. (1987). Chemical control of Parthenium hysterophorus L. Indian J. Weed Sci .19 (1 & 2): 99-100.
3. Sukhade. D. Kanchan. (1978). Agrophysiological impact of the allelopathic influence of Parthenium hysterophorus L. Abst. of papers. All India Weed Science Conf. Tamil Nadu Agric. Univ., Coimbatore, Feb. 3 and 4, 1978. p. 44-45.
4. Trivedi, K.K. and J.P. Tiwari (1985) Control of winter population of Parthenium hysterophorus L. Abst. of papers. Ann. Conf. ISWS. 1984. Gujarat Agric. Univ., Anand, April 4-5. 1984. p.93.

Table 1. Phytotoxic effect of weed control treatments on wheat and associated weeds.

Treatment ^a	Visual toxicity rating ^b				
	Wheat	Parthenium hysterophorus	Chenopodium album	Cynodon dactylon	Cyperus rotundus
Sodium Chloride 10%	1	2	0	0	0
Sodium Chloride 20%	1	3	0	0	0
Sodium Chloride 30%	2	3	0	0	0
2,4-D (0.5kg a.i./ha)	0	2	4	0	0
Sodium Chloride 10% fb ^c					
2,4-D (0.5kg a.i./ha)	1	4	4	0	0
Sodium Chloride 20% fb					
2,4-D (0.5kg a.i./ha)	1	5	4	0	0
Sodium Chloride 30% fb					
2,4-D (0.5kg a.i./ha)	2	5	4	0	0
Hand weeding	0	0	0	0	0
Unweeded check	0	0	0	0	0

a- a.i. = active ingredient. b- Rated on a scale of 0-5 where 0= no toxicity and 5 = complete kill. c- fb = followed by.

Table 2. Effect of weed control treatments on Parthenium hysterophorus and associated weeds in wheat.

Treatment ^a	Weeds (No./0.2 sq m)			
	Parthenium hysterophorus	Chenopodium album	Cynodon dactylon	Cyperus rotundus
Sodium Chloride 10%	9	8	1	23
Sodium Chloride 20%	7	9	2	25
Sodium Chloride 30%	6	9	-1	25
2,4-D (0.5kg a.i./ha)	10	5	2	17
Sodium Chloride 10% fb ^b				
2,4-D (0.5kg a.i./ha)	6	5	2	17
Sodium Chloride 20%fb				
2,4-D (0.5kg a.i./ha)	6	6	2	18
Sodium Chloride 30% fb				
2,4-D (0.5kg a.i./ha)	5	5	3	19
Hand weeding	7	4	1	22
Untreated check	26	9	3	26

a- a.i. = active ingredient. b- fb = followed by.

Table 3. Effect of weed control treatments on dry weed weight, effective tillers and grain yield of wheat.

Treatment ^a	Dry	Effective	Grain
	weed weight (g/0.2 sq. m)	tillers (No./m row length)	Yield (g/ha)
Sodium Chloride 10%	26.7	63	20.6
Sodium Chloride 20%	25.5	55	19.8
Sodium Chloride 30%	23.9	55	18.4
2,4-D (0.5kg a.i./ha)	19.3	58	19.4
Sodium Chloride 10% fb ^b			
2,4-D (0.5kg a.i./ha)	15.7	70	24.5
Sodium Chloride 20% fb			
2,4-D (0.5kg a.i./ha)	18.1	55	15.7
Sodium Chloride 30% fb			
2,4-D (0.5kg a.i./ha)	18.9	61	19.8
Hand weeding	9.2	65	21.5
Untreated check	33.1	53	16.0
C.D. at 5%			3.2

a- a.i. = active ingredient b- fb = followed by.