Indian J. Weed Sci. **36** (1 & 2) : 96-98 (2004)

Efficacy of Herbicides with and without Surfactants to Control Horseweed (*Erigeron canadensis*) in Natural Grasslands

Suresh Kumar, N. N. Angiras and Vinay Pooner
Department of Agronomy
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062 (H. P.), India

ABSTRACT

Glyphosate at 0.5 kg ha^{-1}+surfactant (0.1%) and glyphosate at 1.0 kg ha^{-1} provided most effective control of *Erigeron canadensis* but was toxic to the grasses in natural grasslands. Significantly higher herbage yield was recorded by 2, 4-D Na at 0.75 kg ha^{-1}+surfactant (0.1%) and 2, 4-D (EE) 1.25 kg ha^{-1}.

INTRODUCTION

Horseweed (*Erigeron canadensis*), an annual herb of family Compositeae, is a new introduction in Himachal Pradesh and has been found to invade apple orchards, grasslands, pastures, wastelands and abandoned fields at an alarming rate under mid and high hills of the State. The infestation of this weed in high hills temperate wet zone has been reported for last 6-8 years, whereas invasion in mid hills sub-humid zone is 4 to 6 years old. Like *Lantana* and *Chromolaena,* this weed is not grazed or eaten by animals. The immediate need is to check the spread of this weed before it reaches every nook and corner of the State. Information regarding its control is scanty, hence, an experiment was undertaken to find out the efficacy of herbicides with and without surfactant for controlling this weed in natural grasslands.

MATERIALS AND METHODS

A field experiment was conducted during 1999-2000 and 2000-01 at Research Farms of Department of Agronomy (1999-2000) and Department of Tea Husbandry & Technology (2000-01), CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur to find out the effective herbicide with and without surfactant for controlling horseweed in natural grasslands. The area represents mid hill wet temperate zone of the State. The soil of the experimental site was silty clay loam in texture with pH 5.6. The experiment was laid out in randomised block design with three replications. The treatments consisted of glufosinate 0.5 kg ha^{-1}, glufosinate 0.25 kg ha^{-1}+surfactant (Uphar) 0.1%, glyphosate 1.0 kg ha^{-1}, glyphosate 0.50 kg ha^{-1}+surfactant (0.1%), 2, 4-D (Na) 1.25 kg ha^{-1}, 2, 4-D (Na) 0.75 ha^{-1}+surfactant (0.1%), 2, 4-D (EE) 1.25 kg ha^{-1}, 2, 4-D (EE) 0.75 kg ha^{-1}+surfactant (0.1%), atrazine 1.5 kg ha^{-1}, atrazine 1.0 kg ha^{-1}+surfactant (0.1%), paraquat 0.60 kg ha^{-1}, hand weeding and weedy check (Table 1). Since the emergence of weed was observed to be in two major flushes in a year, the experiment was laid out separately for the control of the weed i. e. during fall (August-September) sprayed in October and next flush of emergence in spring (March-April) sprayed in May every year, respectively. In hand weeding treatment, weeding was done at the time of applying other herbicidal treatments in October in fall emerged and in May in spring emerged horseweed, during both the years of experimentation when the horseweed plants were at 5-6 leaf stage. All the herbicides were sprayed with knapsack sprayer fitted with flat fan nozzle at spray volume of 650 l ha^{-1}. The observations on horseweed were recorded in September and July. When the life cycle of the weed was over, data on

Table 1. Effect of treatments on *E. canadensis* and herbage yield of grasses in spring

Treatment	Dose (kg ha^{-1})	*E. canadensis* (No. m^{-2})		Dry wt. of *E. canadensis* (g m^{-2})		Fresh herbage yield (t ha^{-1})		Dry herbage yield (t ha^{-1})	
		1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01
Glufosinate	0.50	45	47	113.3	114.0	11.7	11.4	5.6	5.4
Glufosinate+Surf. (0.1%)	0.25	39	40	101.6	102.0	13.2	12.8	7.1	7.0
Glyphosate	1.00	9	10	38.7	39.4	11.1	11.0	5.6	5.5
Glyphosate+Surf. (0.1%)	0.50	15	12	43.0	42.6	10.8	10.8	5.4	5.4
2, 4-D (Na)	1.25	21	23	46.5	49.5	14.7	14.5	7.5	7.4
2, 4-D (Na)+Surf. (0.1%)	0.75	20	24	48.8	51.7	15.3	15.2	7.7	7.6
2, 4-D (EE)	1.25	27	28	83.8	86.2	15.3	14.8	7.7	7.2
2, 4-D (EE)+Surf. (0.1%)	0.75	40	38	86.1	88.5	14.0	13.8	7.0	6.9
Atrazine	1.50	37	39	73.8	76.3	15.1	15.0	7.6	7.4
Atrazine+Surf. (0.1%)	1.00	35	35	46.3	49.2	17.3	14.2	7.2	7.1
Paraquat	0.60	57	58	67.2	69.8	11.5	11.3	5.9	5.9
Hand weeding	-	56	54	42.7	45.2	18.7	17.9	9.3	9.2
Weedy	-	85	81	120.4	122.4	12.3	11.9	6.8	6.7
LSD (P=0.05)	-	5.6	6.1	5.15	5.23	0.37	0.38	0.46	0.46

Surf.=Surfactant.

Table 2. Effect of treatments on *E. canadensis* and herbage yield of grasses in spring

Treatment	Dose (kg ha^{-1})	*E. canadensis* (No. m^{-2})		Dry wt. of *E. canadensis* (g m^{-2})		Fresh herbage yield (t ha^{-1})		Dry herbage yield (t ha^{-1})	
		1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01
Glufosinate	0.50	15.6 (241)	13.3 (177)	78.7	75.9	4.7	4.6	2.3	2.3
Glufosinate+Surf. (0.1%)	0.25	15.3 (233)	11.2 (125)	72.7	75.2	4.8	4.8	2.4	2.4
Glyphosate	1.00	1.4 (1)	1.4 (1)	3.1	2.7	3.6	3.5	1.7	1.6
Glyphosate+Surf. (0.1%)	0.50	1.4 (1)	1.8 (3)	4.5	3.9	3.3	3.6	1.6	1.6
2, 4-D (Na)	1.25	11.9 (141)	11.2 (125)	42.6	46.4	4.8	4.9	2.4	2.3
2, 4-D (Na)+Surf. (0.1%)	0.75	13.3 (177)	10.3 (105)	60.2	59.2	5.1	5.2	2.5	2.6
2, 4-D (EE)	1.25	12.5 (155)	13.3 (177)	75.3	72.4	4.5	4.4	2.2	2.2
2, 4-D (EE)+Surf. (0.1%)	0.75	11.2 (125)	11.4 (129)	50.9	54.4	3.9	4.1	1.9	1.9
Atrazine	1.50	15.5 (239)	15.8 (248)	115.4	118.4	4.6	4.6	2.3	2.2
Atrazine+Surf. (0.1%)	1.00	9.4 (88)	10.6 (112)	113.3	112.4	4.5	4.5	2.2	2.3
Paraquat	0.60	16.2 (263)	15.6 (241)	85.6	88.6	4.3	4.3	2.2	2.1
Hand weeding	-	19.3 (371)	19.1 (362)	88.6	90.2	5.7	5.6	2.9	2.8
Weedy	-	20.4 (416)	19.7 (388)	176.6	170.4	2.7	2.9	1.4	1.4
(LSD) P=0.05)	-	1.10	1.41	4.65	5.47	0.13	0.16	0.27	0.31

Values in parentheses are the means of original values. Surf.–Surfactant.

fresh herbage yield were recorded and computed on hectare basis.

RESULTS AND DISCUSSION

Spring and Fall Emerged Horseweed

In general, all the treatments resulted in significantly lower dry matter accumulation and density of horseweed as compared to weedy check (Tables 1 and 2). Glyphosate at 1.0 kg ha^{-1} being statistically at par with glyphosate 0.50 kg ha^{-1}+surfactant (0.1%) recorded significantly lowest dry matter and density of horseweed in spring as well as fall emerged (Tables 1 and 2). 2, 4-D (Na) at 1.25 kg ha^{-1} and 2, 4-D (Na) 0.75 kg ha^{-1}+ surfactant (0.1%) being statistically alike were the next best herbicide treatments in reducing the population and dry matter accumulation of the weed.

Atrazine at 1.50 kg ha^{-1} and atrazine 1.0 kg ha^{-1}+surfactant (0.1%) were the next best for controlling horseweed and controlled only newly emerged plants and plants beyond that stage were not controlled effectively. Paraquat at 0.6 kg ha^{-1} and glufosinate at 0.25 kg ha^{-1}+surfactant (0.1%) were also effective in reducing the population of horseweed but because of their contact action, plants regenerated at later stages. Glyphosate 1.0 kg ha^{-1} resulted in highest weed control efficiency on last observation date (September) in spring as well as in fall emerged horseweed. This treatment was closely followed by glyphosate 0.5 kg ha^{-1}+surfactant (0.1%), hand weeding and 2, 4-D (Na) 1.25 kg ha^{-1} with respect to weed control efficiency and control rating. Addition of surfactant was effective in reducing the herbicide dose.

Effect on Herbage Yield

Significantly highest fresh and dry herbage yields of grasses were recorded in hand weeded plots. Among different herbicides 2, 4-D (Na) 0.75 kg ha^{-1}+surfactant (0.1%) and 2, 4-D (EE) 1.25 kg ha^{-1} remaining statistically alike recorded significantly higher fresh and dry herbage yield (Tables 1 and 2). Reduced plant population and decreased dry matter of horseweed in these treatments might have resulted in lower competition, as a result recorded higher yield of grasses.

Though glyphosate with and without surfactant resuled in rather complete kill of the weed in spring and fall season, yet the fresh and dry herbage yields were significantly lower due to its being phytotoxic on grasses and initially complete kill of the associated grasses was recorded. Only grasses which emerged at later stages resulted in production of herbage yield.

It can be concluded that glyphosate 1.0 kg ha^{-1} and glyphosate 0.5 kg ha^{-1}+surfactant (0.1%) were the most effective against *E. canadensis* but toxic to the grasses. 2, 4-D (Na) 0.75 kg ha^{-1}+ surfactant (0.1%) was effective for controlling the weed and getting higher fresh and dry herbage yield in natural grasslands.