Indian J. Agron. **40** (1) : 51–54 (March 1995)

Chemical weed control in Japanese barnyard millet (*Echinochloa frumentacea*)

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Received: January 1993

ABSTRACT

A field experiment was conducted with barnyard millet (*Echinochloa frumentacea* Link) during the rainy (*kharif*) season of 1990 and 1991 under rainfed condition. Application of 2,4-D Na-salt @ 1.0 kg a.i./ha as post-emergence at 15 days after sowing gave the maximum grain (15.73 q/ha) and straw (83.50 q/ha) yields of the millet. The maximum weed-control efficiency (74.4%) and monetary returns (Rs 3,357.70/ha) were also obtained with 2,4-D Na-salt applied @ 1.0 kg a.i./ha.

Japanese barnyard millet (*Echinochloa frumentacea* Link) is an important crop in Uttar Pradesh hills for food and fodder. One of the severe problems encountered in cultivation of barnyard millet during the rainy (*kharif*) season is the more number of weeds. Due to scarcity of manpower at critical period of crop–weed competition, the manual weeding is not possible. Under such a situation herbicide application is therefore essential for timely weed control and optimizing the yield level of barnyard millet (Gupta, 1984). Hence an experiment was conducted to study chemical weed control in Japanese barnyard millet.

MATERIALS AND METHODS

The field experiment was conducted at Ranichauri, Tehri Garhwal, during the rainy (*kharif*) season of 1990 and 1991 under rainfed conditions. Treatments consisting of 2 rates, each of 2,4-D Na-salt (as post-emergence at 15 days after sowing) and isoproturon, oxyfluorfen, pendimethalin and ethyl ester (as pre-emergence) along with hand-weeding (twice) and unweeded check were laid out in randomized block design with 3 replications. The experimental site was situated at 1,800 m mean sea-level on north facing. Texture of soil was silty clay-loam with medium depth. The soil of experimental field was acidic in reaction with pH 5.3–5.5, low in available nitrogen (N 145–150 kg/ha), phosphorus (P_2O_5 16–18 kg/ha) and rich in available potash (K_2O 370–380 kg/ha). Climate of the region is humid temperate with mean annual rainfall of 1,263.8 mm. Total rainfall during crop season was 572.5 and 695.7 mm in 1990 and 1991 respectively. Japanese barnyard millet 'VL 29' was sown in rows 30 cm apart on 18 and 30 June and harvested on 22 and 16 November in 1990 and 1991 respectively. Recommended dose of fertilizers, i.e. 40 kg N and 20 kg P_2O_5/ha, were applied through urea and Mussooriephos. Full dose of phosphorus and half of N were applied basal at the time of sowing and remaining

Table 1. Effect of herbicides on weed-dry weight, weed-control efficiency and yield-contributing characters of Japanese barnyard millet

Treatment (a.i.)	Weed-dry weight (g)				Weed-control efficiency (%)				Grain weight/ ear (g)		1,000-grain weight (g)	
	50 DAS		75 DAS		50 DAS		75 DAS					
	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991
2,4-D Na-salt 0.75 kg/ ha (post-em.)	18.8	16.0	17.2	32.0	63.0	73.3	71.3	63.6	3.8	4.6	4.1	3.6
2, 4-D Na-salt 1.0 kg/ha (post-em.)	16.0	12.0	16.0	21.2	68.5	80.0	73.3	75.9	5.3	5.5	4.0	4.1
Isoproturon 0.5 kg/ha (pre-em.)	20.0	37.2	20.0	62.8	60.6	38.0	66.7	28.6	3.7	4.0	3.1	3.6
Isoproturon 1.0 kg/ha (pre-em.)	18.8	26.8	32.0	49.2	63.0	55.3	46.7	44.1	4.8	4.9	3.6	3.4
Oxyfluorfen 0.075 kg/ha (per-em.)	17.2	32.0	54.8	76.0	66.1	46.7	8.7	13.6	3.7	3.6	4.0	3.8
Oxyfluorfen 0.10 kg/ha (pre-em.)	22.8	24.0	30.8	56.0	55.1	60.0	48.7	36.4	4.1	3.3	4.1	3.4
Pendimethalin 0.5 kg/ha (pre-em.)	40.0	38.8	49.2	65.2	21.3	35.3	18.0	25.9	4.8	4.0	3.6	3.2
Pendimethalin 0.75 kg/ha (pre-em.)	21.2	24.0	53.2	70.8	58.3	60.0	11.3	19.6	3.1	3.9	3.6	3.4
Ethyl ester 0.75 kg/ha (pre-em.)	36.0	22.8	29.2	73.2	29.1	62.0	51.3	16.8	4.8	4.0	4.0	3.2
Ethyl ester 1.0 kg/ha (per-em.)	29.2	30.8	25.2	42.8	42.5	48.7	58.0	51.4	4.1	4.5	4.1	3.9
Hand-weeding twice	24.0	8.0	17.2	25.2	52.8	86.7	71.3	71.4	5.2	5.3	4.1	3.9
Unweeded check	50.8	60.0	60.0	88.0					2.9	3.1	3.7	3.4
CD (P = 0.05)	16.8	10.8	12.0	28.8					0.8	1.0	NS	NS

Pre-em., Pre-emergence; Post-em., post-emergence at 15 days after sowing; DAS, days after sowing

half of N was top-dressed at tillering stage. Weed study was made at 50 and 75 days after sowing. Observations on weed count were recorded by throwing a quadrat in each plot randomly. Weed-control efficiency was calculated as suggested by Umrani and Bio (1982).

Plant stand study was made from 2 central rows and data on growth and yield attributes were recorded from 5 random plant in each treatment.

RESULTS AND DISCUSSION

The major weeds found in experimental plot were *Galinsoga parviflora* Cav., wild buckwheat *(polygonum capitatum* nutsedge (*Cyperus rotundus* L.), crab grass (*Digitaria ciliaris* and bermuda grass *Cynodon dactylon* Pers.). Dry weight of weeds at both the stages significantly reduced due to the spray of all the herbicides (Table 1). Minimum dry weight of weeds was recorded with 2,4-D Na-salt 1.0 kg a.i./ha as post-

Table 2. Effect of herbicides on yield and economics of Japanese barnyard millet

Treatment (a.i.)	Grain yield (q/ha)		Straw yield (q/ha)		Net return (Rs/ha)	
	1990	1991	1990	1991	1990	1991
2, 4-D Na-salt 0.75 kg/ha (post-em.)	15.71	10.78	69.63	60.22	2,902.30	1,815.40
2, 4-D Na-salt 1.0 kg/ha (post-em.)	16.34	15.11	76.67	90.32	3,200.60	3,514.80
Isoproturon 0.5 kg/ha (pre-em.)	11.20	8.89	53.67	60.77	1,477.60	1,486.70
Isoproturon 1.0 kg/ha (pre-em.)	13.22	12.22	60.05	74.33	1,819.80	2,165.40
Oxyfluorfen 0.075 kg/ha (pre-em.)	7.15	8.44	33.22	53.22	397.00	1,166.00
Oxyfluorfen 0.10 kg/ha (pre-em.)	7.00	7.89	31.94	50.22	297.90	841.40
Pendimethalin 0.5 kg/ha (pre-em.)	9.80	7.55	47.27	48.99	1,167.90	743.00
Pendimethalin 1.0 kg/ha (pre-em.)	8.86	7.00	35.13	46.11	459.40	379.80
Ethyl ester 0.75 kg/ha (pre-em.)	11.20	8.00	57.50	58.55	1,534.30	1,192.80
Ethyl ester 1.0 kg/ha (pre-em.)	13.85	13.00	61.33	80.33	2,035.80	2,558.80
Hand-weeding twice	16.95	14.11	83.04	82.99	2,778.50	2,469.90
Unweeded check	5.14	4.44	24.27	35.11	12.40	111.60
CD (P = 0.05)	2.09	2.39	13.34	13.53		

Pre-em., Pre-emergence; Post-em., post-emergence at 15 days after sowing

emergence during both the years. Herbicides like oxyfluorfen 0.075 kg a.i./ha, pendimethalin at both the rates during both the years and ethyl ester 0.75 kg a.i./ha in 1991 had no significant effect on dry weight of weeds.

Almost all the herbicides showed beneficial effect on weed-control efficiency. During 1990, the weed-control efficiency was higher (68.5%) with 2,4-D Na salt 1.0 kg a.i./ha, whereas during 1991 it was higher (86.7%) with hand-weeding at 50 days after sowing. However, at 75 days after sowing the weed-control efficiency was maximum (73.3 and 75.9%) with the sprays of 2,4-D Na-salt 1.0 kg a.i./ha during both the years, followed by 2 hand-weedings. On mean basis also, the maximum weed-control efficiency (74.4%) was recorded with 2,4-D Na-salt 1.0 kg a.i./ha as post-emergence.

Effect of yield and yield attributes

Application of herbicides had significant effect on grain weight/ear during both the years (Table 1). The maximum grain weight (5.3 and 5.5 g) was recorded with 2,4-D Na-salt 1.0 kg a.i/ha, followed by hand-weeding during both the years. However, grain weight/ear was minimum with oxyfluorfen and pendimethalin during both the years and proved at par with the unweeded check. The 1,000-grain weight was found unaffected by the application of different herbicides during both the years.

Different herbicides including hand-weeding significantly increased the grain yield over the unweeded check (Table 2). Among the different herbicides 2,4-D Na-salt @ 1.0 kg a.i./ha as post-emergence recorded the highest grain yield during 1990 and 1991. On mean basis also, the application of 2,4-D Na-salt @ 1.0 kg a.i./ha proved superior to rest of the herbicides. The straw yield was also the highest under 2, 4-D Na-salt @ 1.0 kg a.i./ha as post-emergence, followed by hand-weeding. The straw yields recorded under treatments of oxyfluorfen and pendimethalin were lowest, which might be due to their phytotoxic effect on the crop.

Economics of different weed-control treatments showed that the highest net profit of Rs 3,357.50/ha was obtained with the use of 2,4-D Na-salt @ 1.0 kg a.i./ha as post-emergence, followed by hand-weeding (Rs 2,624.20/ha). The minimum net profit was, however, recorded under the unweeded check (Table 2). Application of oxyfluorfen @ 0.1 kg a.i./ha and pendimethalin at both rates gave lowest net profit (Rs 419.60–549.65/ha), which was not proved economic to the farmers.

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