

Weed control in sunflower (*Helianthus annuus*) under temperate conditions of Kashmir valley

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Received : September 2005

ABSTRACT

A field experiment was conducted during the rainy (*kharif*) seasons of 2003 and 2004 under irrigated temperate conditions on weed control studies in sunflower (*Helianthus annuus* L.) on silty clay-loam soil of Shalimar, Jammu and Kashmir. Seven weed-control treatments consisted of unweeded check, Pendimethalin 1 kg/ha, Fluchloralin 1 kg/ha, Isoproturon 0.75 kg/ha, 1 hand-weeding at 20 days after sowing, 2 hand-weedings at 20 and 35 days after sowing and weed-free check. Pre-emergence application of Pendimethalin and pre-plant incorporation of Fluchloralin effectively controlled the weeds and resulted in better growth, development and yield of sunflower. Pre-emergence application of Pendimethalin resulted in 75% higher yield and additional returns (Rs 9,195) over weedy check.

Key words : Sunflower, Weed and Crop Related Indices, Yield

Sunflower is an important oilseed crop of India. In Jammu and Kashmir State, oilseed economy is based on brown sarson which is a winter crop and gives low yields due to some unavoidable factors. As such there is a need to diversify the oilseed crop resources of the state. Sunflower, a promising oilseed crop offers great opportunity on account of its wider adaptability to different agro-climatic regions. Though this crop has high yield potential, its yield is very poor due to severe weed competition (Krishnagowda *et al.*, 1985). Wider row spacing and slow initial growth of sunflower provide congenial environment for the growth of weeds. Further, weed problem becomes more serious on account of unavailability of labours at proper time, resulting reduction in yield as well as net monetary return. Under such a situation, adoption of weed-management practice has been proved equally or more than effective as intercultural practice. To study the comparative performance of weed control in sunflower under temperate conditions of Kashmir, the present experiment was laid out.

MATERIALS AND METHODS

An experiment was conducted during the rainy (*kharif*) seasons of 2003 and 2004 at the experimental farm of the Division of Agronomy, SKUAST, Shalimar. The soil was silty-clay loam, medium in organic carbon (0.87%), available nitrogen (300 kg/ha), available phosphorus (17 kg/

ha), and potassium (290 kg/ha). The soil was neutral (pH 7.12). The recommended dose of 60 kg N, 80 kg P₂O₅ and 60 kg K₂O/ha through urea, single superphosphate and muriate of potash, respectively, was uniformly applied. Half dose of N was applied at sowing and remaining top-dressed 25 days after sowing (DAS).

The experiment was laid out in randomized block design with 7 treatments replicated thrice. Seven weed-control treatments consisted of unweeded check (W₁), Pendimethalin 1 kg/ha (W₂), Fluchloralin 1 kg/ha (W₃), Isoproturon 0.75 kg/ha (W₄), 1 hand-weeding (W₅) at 20 DAS, 2 hand-weedings (W₆) at 20 and 35 DAS and weed-free check (W₇). Herbicides Pendimethalin and Isoproturon were applied as pre-emergence (PE), i.e. 2 days after sowing, and Fluchloralin was applied as pre-plant incorporation (PPI) i.e. 1 day before sowing. Weed sampling was done at maximum growth stage at 60 DAS using 0.25 m² quadrat (0.5 cm × 0.5 cm) for taking weed count and biomass.

Observations on yield and its parameters were recorded at harvest. Sunflower 'Morden' was sown on 23 and 5 June during 2003 and 2004, respectively, in rows 45 cm apart using 10 kg seed/ha. Thinning was done at 15 days to maintain 30 cm distance between the plants. The crop was harvested on 19 and 9 September during 2003 and 2004 respectively. The weed persistence index (WPI) was calculated as :

$$WPI = \frac{\text{Dry weight of weed in treated plot}}{\text{Dry weight of weed in control plot}} \times \frac{\text{Weed count in treated plot}}{\text{Weed count in control plot}}$$

RESULTS AND DISCUSSION

Weed flora

The weed flora mainly comprised grassy and broad-leaf weeds. The dominant grassy weeds in crop were *Echinochloa crus-galli* (51.1%), *Digitaria* spp. (12.4.3%), *Setaria* spp. (8.8%) and *Cyperus rotundus* (7.7%) and broad-leaf weeds were *Portulaca* spp. (16.3%), *Amaranthus viridis* (3.8).

Weeds : Weeds were effectively controlled by different weed-management practices. All the herbicidal and manual treatments significantly reduced both the population and biomass of weeds compared to weed-free check (Table 1). The lowest grassy weed count was recorded with the 2 hand-weedings, followed by Pendimethalin 1 kg/ha.

Isoproturon totally controlled the broad-leaf weeds; however, it had negligible effect on grassy weeds. In terms of total weed intensity, weed biomass throughout the crop cycle and the highest weed-control efficiency was recorded under 2 hand-weedings followed by Pendimethalin 1 kg/ha. Similar observations were recorded by Lehga *et al.* (1992). The lowest weed-control efficiency (50.0%) was observed under 1 hand-weeding. Among the herbicides, Pendimethalin 1 kg/ha resulted in the maximum reduction in weed intensity and weed biomass, followed by fluchloralin. As per the visual observation, Isoproturon controlled only broad-leaf weed causing dominance of grassy weeds during both the years.

The lowest weed-persistence index was noted with weed-free treatment followed by 2 hand-weedings. Among the 3 herbicides tested, Pendimethalin recorded the lowest weed-persistence index (0.1), followed by Fluchloralin

Table 1. Effect of weed-control treatments on weed population, total weed intensity, weed biomass, weed-control efficiency, weed-persistence index in sunflower (pooled data of 2003 and 2004)

Treatment	Weed population (No./m ²)		Total weed intensity/ m ²	Weed biomass (g/m ²)	Weed- control efficiency (%)	Weed- persistence index
	Grassy weeds	Broad-leaf weeds				
Control (Unweeded check)	201.9	50.8	15.87 (253)	6.29 (39.17)		1.00
Pendimethalin 1 kg/ha (PE)	64.6	8.8	8.89 (79)	3.70 (13.22)	66.2	0.10
Fluchloralin 1 kg/ha (PPI)	77.1	20.0	9.51 (90)	4.02 (15.68)	60.0	0.14
Isoproturon 0.75 kg/ha (PE)	108.9	0.0	10.29 (105)	4.21 (17.35)	55.7	0.18
1 hand-weding (20 DAS)	112.7	45.5	12.58 (158)	4.43 (19.18)	50.0	0.31
Two hand-weedings (20–35 DAS)	22.7	10.3	5.64 (31)	2.41 (5.35)	86.0	0.02
Weed-free check			0.71 (00)	0.71 (0.0)	100.0	
CD (P=0.05)			1.34	0.39		

Figures in parentheses are original values and outside are transformed to $\sqrt{X + 0.5}$

Table 2. Effect of weed-control treatments on yield attributes, yield and additional returns over control in sunflower

Treatment	Head diameter (cm)		Seeds/ head		Test weight (g)		Grain yield (q/ha)		Additional returns over control (Rs)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control (unweeded check)	10.50	14.88	427.83	594.44	41.52	51.82	8.66	12.53		
Pendimethalin 1 kg/ha (PE)	14.66	18.56	660.94	848.33	54.26	59.92	18.07	19.10	10,850	7,540
Fluchloralin 1 kg/ha (PPI)	14.22	16.22	614.44	709.44	51.51	56.41	16.96	17.99	10,834	7,222
Isoproturon 0.75 kg/ha (PE)	13.60	15.78	483.83	636.67	44.07	52.73	13.46	14.13	6,319	2,151
1 hand-weeding (20 DAS)	13.05	16.17	473.83	680.78	42.61	54.00	12.65	14.50	4,368	2,162
Two hand-weedings (20–35 DAS)	13.77	16.61	520.13	690.33	45.22	55.02	15.32	17.41	7,224	5,296
Weed-free check	14.00	17.95	535.05	749.33	47.97	58.65	15.66	18.09	5,139	4,087
CD (P=0.05)	0.98	1.19	83.49	32.50	4.09	2.65	3.60	2.34		

(0.14). This result confirms the findings of Mishra and Mishra (1997).

Yield and yield attributes

Different weed-control treatments significantly affected the yield and yield attributes over the control (Table 2). Pendimethalin 1 kg/ha recorded significantly maximum number of seeds/head, seed weight/head, 1,000-seed weight and finally seed yield of sunflower. The maximum number of seeds/head was recorded with Pendimethalin, followed by Fluchloralin during 2003 and 2004 respectively. Similarly, the seed yield of sunflower was enhanced significantly by Pendimethalin (18.07 and 19.1 q/ha) which was at par with Fluchloralin as compared with the other treatments during both the years. The lowest yield was recorded with the control. The magnitude of increase in seed yield with Pendimethalin was 108% and 52% more over the control, respectively, in 2003 and 2004. It may be due to control of weeds from the initial growth of sunflower, as appeared from drastic reduction in dry matter of weeds, which helped in better growth of the crop resulting in significant seed yield of sunflower. Jat and Giri (2000) also reported that Pendimethalin recorded maximum yield and yield attributes of sunflower crop because it proves most effective in controlling weeds. In weed-free treatment the yield was less than Pendimethalin and Fluchloralin due to repeated weeding and manipulation of soil which might have affected the soil conditions and ul-

timately growth characteristics of the crop.

Additional returns

Additional returns per ha over the unweeded control was maximum (Rs 10,850 and Rs 7,540/ha) under the treatment Pendimethalin, followed by Fluchloralin and 2 hand-weedings in first and second year. The lowest additional returns (Rs 3,265) were recorded with 1 hand-weeding due to lowest grain yield with this treatment (Table 2).

Thus either pre-emergence application of Pendimethalin 1 kg/ha or pre-plant incorporation of Fluchloralin 1 kg/ha may provide better and cost-effective weed management in sunflower under temperate Kashmir conditions.

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