



# EFFECT OF SEVERAL WEED MANAGEMENT PRACTICES ON WEEDS AS WELL AS CROP PLANTS IN LENTIL (*Lens culinaris* Medik.)

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## ABSTRACT

An experiment had been performed in the 'Crop Research Centre' of Uttarakhand University, Dehradun during the Rabi season of the year 2021-22. Under this observation, effect of different weed control practices on different weeds in lentil crop was observed. The design chosen for the experiment was Randomized Block Design with three replications as well as eight treatments. The treatments involved cultural practices solely, sole chemical practices as well as integration of cultural and chemical practices. The chemicals used were Atrazine, Pendimethalin and Isoproturon. The best results were obtained in the treatment where most effective chemical as well as cultural practice was integrated that is Pendimethalin + one hand weeding. Cultural practice alone was also at par to the Pendimethalin + one hand-weeding but it is time-taking, laborious and not feasible practically for larger land-holdings.

## KEYWORDS

Atrazine, Isoproturon, Pendimethalin, Post-emergence, Pre-emergence.

## INTRODUCTION

The cultivated variety of lentil is considered that it had its origin and domestication firstly in West Asian region and had been introduced later to the Indo- Gangetic plain during the period of about 2000 BC (Cubero, 1981). Lentil had also expanded swiftly to areas like Central and South Europe, Egypt, Ethiopia, the Mediterranean basin, India, Afghanistan, China Pakistan as well as towards new world involving Argentina, Ibero-America, Mexico, Colombia, Chili lately along with most latterly to Canada (Cokkizgin and Munqez, 2013).

Lentils (*Lens culinaris* Medik.) are one out of all the oldest cultivated plants of humanity and it has been conjectured as first being cultivated as well as domesticated in the Crescent-shaped fertile land in the Near Eastern regions (Sonnante *et al.*, 2009).

The seed grains of lentil possess a considerable amount of protein, vitamins, and minerals, which have been considered foremost for the health of humans (Boye, 2013; Grusak, 2009; Urbano *et al.*, 2007, Bhatt, 1988).

Management of weeds in lentil has always been a prime problem for the producers/farmers growing lentil (Yenish *et al.*, 2009; Brand *et al.*, 2007). Lentils have commonly been thought to be as a crop which is feebly competent against the weed plants because it is a short-heighted plant as well as due to its poor initial season stamina (Yenish *et al.*, 2009; Brand *et al.*, 2007). The decrease in the lentil yield almost upto 80 per cent correlated to the weed plants has been observed (Brand *et al.*, 2007). Therefore, this has always been very crucial to control the weed population in lentil for maximization of the yield of the crop (Yenish *et al.*, 2009; Brand *et al.*, 2007).

Therefore the observation has been undertaken to find an effective way to control weeds and reduce crop loss in Lentil.

## MATERIALS AND METHODS

An experiment had been conducted in the Rabi season of the year 2021-22 in the 'Crop Research Centre' of the agricultural field of 'School of Agriculture', Uttarakhand University, Arcadia Grant, Premnagar, Dehradun, Uttarakhand which is located at

30°33' north latitude and 77°94' east longitude. The place is located at 597 meters above sea level. The texture of the soil is Sandy Clay loam type. The percentage of sand, silt and clay are 53.40%, 25.40% and 21.30% respectively. The N content was analysed to be 297.8kg/ha. P was observed to be 13.8 kg/ha and K was 237.5kg/ha. The pH of the soil was almost neutral that was 7.4. The organic carbon (%) was 0.83%. The design of experiment was Randomised Block Design with 3 replications as well as 8 treatments. The treatments used were Control or T<sub>1</sub>, Two hand-weeding or T<sub>2</sub>, Atrazine @ 1kg a.i./ha as T<sub>3</sub>, Atrazine + one hand-weeding as T<sub>4</sub>, Pendimethalin @ 1L a.i./ha as T<sub>5</sub>, Pendimethalin + one hand-weeding as T<sub>6</sub>, Isoproturon @ 1 kg a.i./ha as T<sub>7</sub>, Isoproturon + one hand-weeding as T<sub>8</sub>. VL Masoor 103 variety had been used. The total area under experiment was 126 m<sup>2</sup>. Along with seeds the recommended dose of fertilizers that is 20:40:20 kg/ha of N:P:S was also provided to the soil as basal application. The row to row spacing was 22.5cm. irrigation had not been provided artificially as rainfall was sufficient during the crop season.

## RESULTS AND DISCUSSION

**Table 1: Effect of weed control practices on dry matter of individual weeds (g m<sup>-2</sup> 60 DAS)**

Treatments	<i>Elymus repens</i>	<i>Chenopodium album</i>	<i>Parthenium hysterophorous</i>	<i>Anagallis arvensis</i>
T <sub>1</sub> (CONTROL)	14.50	17.20	10.00	17.70
T <sub>2</sub> (2 Hand weeding)	4.13	3.83	3.40	3.70
T <sub>3</sub> (Atrazine (PE) @ 1kg a.i. per hectare)	5.30	5.36	4.33	5.27
T <sub>4</sub> (Atrazine (PE) + 1 Hand weeding)	4.40	3.96	3.93	3.96
T <sub>5</sub> (Pendimethalin PoE @ 1kg a.i. per hectare)	5.40	5.53	4.50	5.20
T <sub>6</sub> (Pendimethalin (PE) + 1 hand weeding)	3.40	3.20	2.90	3.46
T <sub>7</sub> (Isoproturon (PoE) @ 1kg a.i. per hectare)	5.56	5.60	5.30	5.70
T <sub>8</sub> (Isoproturon (PoE) + 1 Hand weeding)	4.50	4.23	4.26	4.16
SEm±	0.10	0.03	0.18	0.04
CD (P≥0.05%)	0.45	0.16	0.65	0.10

**Table2: Effect of weed control practices on dry matter of individual weeds (g m<sup>-2</sup> 90DAS)**

Treatments	<i>Elymus repens</i>	<i>Chenopodium album</i>	<i>Parthenium hysterophorus</i>	<i>Anagallis arvensis</i>
T <sub>1</sub> (CONTROL)	27.60	20.86	11.96	21.76
T <sub>2</sub> (2 Hand weeding)	4.53	4.33	3.63	4.40
T <sub>3</sub> (Atrazine (PE)@ 1kg a.i. per hectare)	5.50	5.30	4.53	5.60
T <sub>4</sub> (Atrazine (PE) + 1 Hand weeding)	4.70	4.70	3.66	4.50
T <sub>5</sub> (Pendimethalin PoE @ 1kg a.i. per hectare)	5.80	5.60	4.76	5.73
T <sub>6</sub> (Pendimethalin (PE) + 1 hand weeding)	3.80	3.96	2.93	3.80
T <sub>7</sub> (Isoproturon (PoE) @ 1kg a.i. per hectare)	6.16	6.76	4.90	5.93
T <sub>8</sub> (Isoproturon (PoE) + 1 Hand weeding)	4.93	5.76	3.90	4.76
SEm±	0.04	0.07	0.01	0.01
CD (P≥0.05%)	0.10	0.14	0.20	0.19

Out of all the treatments applied, the best control of weed dry matter in all the weeds is observed in T<sub>6</sub> which is Pendimethalin + one hand-weeding. T<sub>2</sub> which is Two hand-weeding is also observed to be at par statistically with T<sub>6</sub>. Pre-sowing of herbicide treatment significantly reduces the dry weight of weeds. In accordance with Ahmed *et al.* 1996, the application of pre-sowing herbicide as well as the cultural practices are similarly and much more efficient in reduction of the weeds dry weight (Gupta and Rao, 2013).

**Table 3: Effect of weed control practices on weed biomass and Weed Control Efficiency (WCE) %.**

Treatments	Weed biomass 90 DAS (Kg/ha)	WCE (%)
T <sub>1</sub> (CONTROL)	763.3	0
T <sub>2</sub> (2 Hand weeding)	349.96	52.54
T <sub>3</sub> (Atrazine (PE) @ 1kg a.i. per hectare)	392.46	48.58
T <sub>4</sub> (Atrazine (PE) + 1 Hand weeding)	369.93	51.52
T <sub>5</sub> (Pendimethalin PoE @ 1kg a.i. per hectare)	405.43	46.87
T <sub>6</sub> (Pendimethalin (PE) + 1 hand weeding)	329.83	56.78
T <sub>7</sub> (Isoproturon (PoE) @ 1kg a.i. per hectare)	432.53	43.33
T <sub>8</sub> (Isoproturon (PoE) + 1 Hand weeding)	401.40	47.40
SEm±	12.06	1.57
CD (P≥0.05%)	6.08	2.19

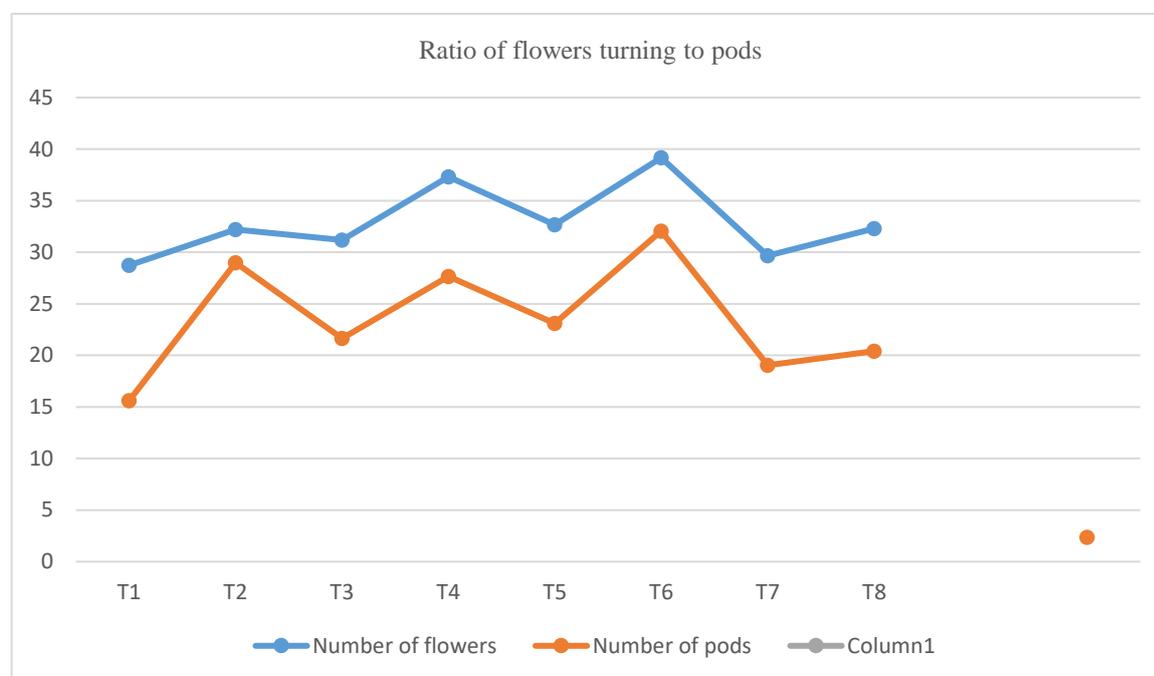
Weed biomass as well as weed control efficiency is observed at the harvest. Weed biomass refers to the weight of total weeds occurring in the field in terms of kilograms per hectare. Efficiency of weed control is the percentage of control of weeds obtained in various treatments. It is determined by subtracting the weed biomass of treatment from the weed biomass of Control divided by biomass of control and multiplied by 100. The WCE would be highest in the treatment where weed biomass is lowest.

Weed control efficiency would be highest in treatments having cultural practices combined with chemicals, as confirmed by **Bhattarai et al. 2018**. The efficiency of weed control was highest in the T<sub>6</sub> (Pendimethalin + One hand-weeding).

Weed biomass was observed to be the lowest in the treatment of T<sub>6</sub> (Pendimethalin + One hand-weeding). The second-lowest was noted to be T<sub>2</sub> which is Two hand-weeding. This has been confirmed by **Ahmed et al. 1996** that PE herbicide application and hand-weeding lead to a reduction of weed biomass.

**Table: 4 Effect of various weed control practices on the flowers number as well as flowers successfully converted to pods**

Treatments	Number of flowers	Number of pods
T <sub>1</sub> (CONTROL)	28.73	15.60
T <sub>2</sub> (2 Hand weeding)	32.20	29.00
T <sub>3</sub> (Atrazine (PE) @ 1kg a.i. per hectare)	31.20	21.66
T <sub>4</sub> (Atrazine (PE) + 1 Hand weeding)	37.30	27.66
T <sub>5</sub> (Pendimethalin PoE @ 1kg a.i. per hectare)	32.66	23.09
T <sub>6</sub> (Pendimethalin (PE) + 1 hand weeding)	39.16	32.06
T <sub>7</sub> (Isoproturon (PoE) @ 1kg a.i. per hectare)	29.66	19.06
T <sub>8</sub> (Isoproturon (PoE) + 1 Hand weeding)	32.30	20.40
SEm ±	2.80	1.87
CD (P ≥0.05%)	2.93	2.37



Flowering is an important stage in the life cycle of any crop. The number of flowers in any plant directly represents the yield which is to be obtained from that particular crop. More the number of flowers, more will be the number of pods, hence the yield. Flowering stage is very sensitive stage in any crop, as any adversity, biotic or abiotic, can hamper the yield badly. The observation was taken when the flowering was complete (95 DAS). The highest number of flowers was observed in T<sub>6</sub> which is Pendimethalin + One hand-weeding followed by T<sub>2</sub> (Two hand-weeding) and T<sub>4</sub> which is Atrazine + One hand-weeding. The minimum flowering was observed in T<sub>1</sub> which is Control or Weedy Check.

The number of pods was observed before harvesting from the 5 tagged plants. It is an important yield attribute as more the number of pods, the more will be the yield. The maximum number of pods were observed in T<sub>6</sub> (Pendimethalin + One hand weeding) followed by T<sub>2</sub> (2 hand-weeding) and T<sub>4</sub> (Atrazine + One hand-weeding). The minimum number of pods was found in T<sub>1</sub> which is Control.

The flowering stage starts after 60 DAS and it may be delayed if the environmental conditions are not so favorable. The period of vegetative growth in lentil crop gets extended in unfavorable environmental conditions like higher rainfall, water stagnation in the field etc. the number of flowers is also affected due to the environmental as well as chemical factors as observed by **Kobru, 2009**. The number of flowers turning to pods also depends on factors like application of chemicals, amount of rainfall after flowering etc. In case if the chemical applied is phytotoxic to the plant, the flowers would die and won't convert into pods.

**Table: 5 Effect of various weed control methods over economic attributes of lentil**

Treatments	Gross return per hectare (Rs)	Total cost per hectare (Rs)	Benefit (Rs)	Benefit-Cost ratio B:C
T <sub>1</sub> (CONTROL)	48540	24379	24161	1.99
T <sub>2</sub> (2 Hand weeding)	56560	25179	31381	2.24
T <sub>3</sub> (Atrazine (PE) @ 1kg a.i. per hectare)	54530	24969	29561	2.18
T <sub>4</sub> (Atrazine (PE) + 1 Hand weeding)	55720	25369	30351	2.19
T <sub>5</sub> (Pendimethalin PoE, @ 1kg a.i. per hectare)	54880	26689	28191	2.05
T <sub>6</sub> (Pendimethalin (PE) + 1 hand weeding)	56999	27089	29910	2.10
T <sub>7</sub> (Isoproturon (PoE) @ 1kg a.i. per hectare)	53250	25289	27961	2.10
T <sub>8</sub> (Isoproturon (PoE) + 1 Hand weeding)	54630	25689	28941	2.12

The highest gross return was observed in T<sub>6</sub>, which is Pendimethalin + One hand-weeding T<sub>2</sub> is at par to it T<sub>2</sub>. The lowest gross return was observed in T<sub>1</sub> which is Control. The total cost of cultivation was lowest in T<sub>1</sub> or Control and the highest cost of cultivation is found to be in T<sub>4</sub> (Atrazine + One hand-weeding) and T<sub>6</sub> (Pendimethalin + One hand-weeding). The benefit was highest in T<sub>2</sub> (Two hand-weeding) followed by T<sub>6</sub> (Pendimethalin + One hand-weeding) as well as the minimum benefit had been computed in T<sub>1</sub> which is Weedy check or Control. The cost-benefit ratio (C: B) is highest in 2 hand-weeding (T<sub>2</sub>) and lowest in T<sub>1</sub> which is control. T<sub>2</sub> and T<sub>4</sub> are at par to one-another. Though the gross benefit was highest in T<sub>6</sub>, the C:B ratio was better in T<sub>2</sub> and T<sub>4</sub> as the cost-benefit ratio depends on the gross benefit as well as the gross input. As the cost of input increases, the C:B ratio decreases.

## CONCLUSION

In the above field observation done at Uttaranchal University under Dehradun conditions, the conclusion has been made that for control of weeds, integration of chemical as well as cultural practices is necessary. Neither cultural nor chemical alone is sufficient for better and effective control of weeds. Most efficient results are observed in the combination of both that is T<sub>6</sub> (Pendimethalin + one hand weeding).

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