Indian Journal of Weed Science **53**(3): 281–284, 2021

Print ISSN 0253-8040 Online ISSN 0974-8164

Weed management in garden cress (*Lepidium sativum* L.) in Rajasthan, India

Harphool Singh, Indu Bala Sethi*, Suresh Kumar, Mahesh Jajoria, Lokesh Kumar Jat, Niranjan Kumar Braod and Suresh Muralia

S.K.N. Agriculture University, Jobner, Jaipur, Rajasthan 303329, India

**Email: indubalasethia2012@gmail.com*

Article information

DOI: 10.5958/0974-8164.2021.00051.4

Type of article: Research article

Received : 27 May 2021
Revised : 18 September 2021
Accepted : 21 September 2021

KEYWORDS
Chandrashoor
Fenoxaprop-p-buty
Imazethapyr
Medicinal plant
Post-emergence
Quizalofop-p-ethyl
Weed management

ABSTRACT

The field experiment was conducted during winter seasons *(Rabi)* of 2018-19 and 2019-20 at Agricultural Research Station, Navgaon (Alwar), S.K.N Agriculture University, Jobner, Jaipur (Rajasthan) India, to identify effective and economic weed management practices in standing Chandrashoor (*Lepidium sativum* Linn.) crop. The soil of experimental field was sandy loam in texture, low in organic carbon, low in available nitrogen, medium in phosphorus and potassium with alkali in pH. The experiment was laid out in a randomized block design with seven treatments and replicated thrice. The crop was sown as per the package of practices recommended for zone IIIB of Rajasthan. The treatments tested incudes: post-emergence application (PoE) of quizalofop-p-ethyl 50 g/ha, fenoxaprop-p-butyl 100 g/ha, imazethapyr 75 g/ha, imazethapyr (35%) + imazamox (35%) (ready-mix) 100 g/ha, imazethapyr (2%) + pendimethalin (30%) (ready-mix) 2.5 kg/ha; weedy check and weed free. The fenoxaprop-p-butyl 100g/ha PoE recorded significantly higher seed yield of 678 kg/ha in 2018-19 and 693 kg/ha in 2019-20 due to greater weed suppression and lowest weed index. It was at par with quizalofop-p-ethyl 50 g/ha PoE at 30 DAS. However, weed free, by hand weeding twice, recorded higher seed yield and was significantly superior economically over the rest of the weed management treatments.

INTRODUCTION

Chandrashoor (*Lepidium sativum* L.) is also known as asalio and garden cress and it belongs to family Brassicaceae. In India, the common names of garden cress seed include common cress (English), halim (Bengali), aseliyo (Gujrati), chansur (Hindi), allibija, kapila, (Kannada), alian (Kashmiri) asali (Malayalam), ahaliva, haliv (Marathi), allivirai (Tamil) and adityalu, aadalu (Telugu). There are diploid (2n=16) and tetraploid (2n=32) forms of chandrashoor. The species is a native of Ethiopia and is said to have been introduced to Europe and Asia. Chandrashoor seed has been used in curing many health-related complications by our ancients. Chandrashoor plant is erect, glabrous, annual, herbaceous growing up to the height of about 15–60 cm. It is propagated by seeds. It is a fast-growing crop that can be ready to eat within 7 days of sowing the seed. It is most commonly eaten in the seedling form.

The plant is the source of edible oil that can be used for lighting. It is grown in Ethiopia for the edible oil obtained from its seed. Chandrashoor is presently cultivated all over the world. It is considered as an important medicinal crop in India (Raval and Pandya 2011) and is mainly cultivated in U.P., Rajasthan, Gujarat, Maharashtra, and Madhya Pradesh (The Wealth of India, 1962) as winter crop for seeds. Chandrashoor seed has been used in curing many health-related complications by our ancients. It has been used in the treatment of many health problems such as hypertension, kidney diseases, prevention of cancer and mild glycemia. Chandrashoor seed are widely used to heal fractures. Its seed also possesses wide range of antioxidant. Fatty acids of chandrashoor seed oil helps in preventing coronary heart diseases. The chandrashoor seeds are galactagogue, laxative and diuretic. Seeds contain phyto-chemicals that resemble estrogen action. Hence it is used in treating amenorrhoea and irregular menstrual cycles. It is fed to lactating mothers for improving breast milk production. Seed paste is used as poultice to relieve pain, worm infestation in wounds and useful in skin disorders associated with itching. The mucilage obtained from the seeds is used against intestinal irritations. The leaves are used as diuretic and to treat liver diseases. It is also used as salad for treating anaemia (Ghante *et al.* 2011).

The recent studies on incidence of insect pests on medicinal plants are available (Sanjta and Chauhan 2018). But the research on weeds and weed management in medicinal plants is meagre even though it is well known that weeds compete with the medicinal crops for all the inputs which are given for the crop growth and play a significant role in reducing their productivity. The site with very heavy weed infestation in the fields was considered as a challenging site by National Medicinal Plant Board (NMPB 2015). NMPB (2009) suggested, for all the medicinal plants, ensuring a weed free environment to young plants by effectively controlling initial flush of weeds by under taking weeding and hoeing cycles. The weed free environment creation using manual weeding will be costly due to non-availability and increased cost of labour. Thus, herbicide usage for control of weeds was tested and proved successful in many crops. and is now gaining importance in Indian agriculture (Rao and Chauhan 2015). Chemical weed control is a better supplement to conventional methods and forms an integral part of the modern crop production (Rao and Nagamani 2010). Thus, use of herbicides is one of the options available with the farmers to eliminate crop weed competition at early growth stage of chandrashoor. Hence, the present study was carried out to identify effective and economic weed management practices in standing crop of chandrashoor.

MATERIALS AND METHODS

A field experiment was conducted during winter seasons *(Rabi)* of 2018-19 and 2019-20 at Agricultural Research Station, Navgaon (Alwar), S.K.N Agriculture University, Jobner, Jaipur (Rajasthan) India**.** The soil of experimental field was sandy loam in texture, low in organic carbon, low in available nitrogen, and medium in phosphorus and potassium with alkali in pH. The experiment was laid out in a randomized block design replicated thrice with eight treatments: quizalofop-p-ethyl 50 g/ha, fenoxaprop-p-butyl 100 g/ha, imazethapyr 75 g/ha, imazethapyr (35%) + imazamox (35%) (ready-mix) 100g/ha, imazethapyr (2%) + pendimethalin (30%) (ready-mix) 1.0 kg/ha as post-emergence application (PoE) at 30 DAS; weedy check and weed free by hand weeding twice. The crop was grown as per the package of practices recommended for zone IIIB of Rajasthan. The seeds were sown 8 kg/ha at 30 x 15 cm spacing at a depth of 5 cm below the soil surface. Chandrashoor, local selection was sown at the end of the October of two consecutive years with the fertilizer dose 80:60:40 kg/ha of N, P and K. The half dose of N and full dose of P and K was applied as basal and remaining dose of N was applied with first irrigation. Herbicides were sprayed with knapsack sprayer using flat fan nozzle with 600 liters of water/ ha. Weed density (number per square meter) recorded just before the execution of first-hand weeding or before the application of post-emergence herbicides during both years by using a quadrat of size 0.5 x 0.5 m (0.25 m^2). Weed dry matter (weed biomass) of all the weed species (grasses, broad-leaved weeds and sedges) was recorded just before the execution of first-hand weeding or before application of post-emergence herbicides within an area of quadrat of 0.5 x 0.5 m (0.25 m^2) were cut closed to ground surface, separated species wise and sun dried for first 4-5 days thereafter placed into an oven at $70\pm1\ ^{O}C$ temperatures till a constant weight was obtained. Later on, weed dry weight was measured by balance. The dry weight of weeds was expressed as weed biomass (g/m^2).

RESULTS AND DISCUSSION

Weed flora

The weed flora in the experimental field consisted of grasses: *Cynodon dactylon, Asphodelus tenuifolius, Phalaris minor, Spergula arvensis;* sedge: *Cyperus rotundus* and broad-leaved weeds: *Chenopodium murale, Chenopodium album, Melilotus indica, Anagallis arvensis, Pluchea lanceolata, Convolvulus arvensis, Phyllanthus niruri, Cirsium arvense, Launaea asplenifolia, Coronopus didymus, Rumex dentatus*. The weed flora was more pronounced during second year of study due to adequate soil moisture.

The herbicides significantly reduced the weed density (no./m^2). The lowest total weed density was recorded with imazethapyr + pendimethalin at 1.0 kg/ha (24) being at par with imazethapyr + imazamox at 100 g/ha PoE (26) followed by imazethapyr at 75 g/ha as PoE (30) and significantly superior over fenoxaprop-p-butyl 100g/ha (59) and quizalofop-p-ethyl 50 g/ha (52). Similar results were observed of weed biomass (g/m^2), which was significantly lower in imazethapyr + pendimethalin at 1.0 kg/ha (3.22) closely followed by imazethapyr + imazamox 100g/ha PoE (10.41) followed by imazethapyr 75 g/ha as PoE (47.25), followed byfenoxaprop-p-butyl 100 g/ha (55.75) and quizalofop-p-ethyl at 50 g/ha (60.56).

The highest weed control efficiency (80%) was attained with the application of imazethapyr + pendimethalin 1.0 kg/ha PoE, which was closely

followed by imazethapyr + imazamox at 100 g/ha PoE andimazethapyr 75 g/ha PoE (**Table 2**). Weed index indicates the loss of yield caused by weeds under particular treatment as compared to weed free plot. The minimum loss in yield *i.e.* weed index was with post-emergence herbicides *i.e.* fenoxaprop-p-butyl (17.55 and 17.34 during 2018-19 and 2019-20, respectively) followed by quizalofop-p-ethyl (24.30 and 24.50 during 2018-19 and 2019-20, respectively) compared to weed free plot. The loss of yield, as measured in terms of weed index, was recorded maximum under weedy check due to heavy infestation of weeds, while application of imazethapyr + pendimethalin, imazethapyr + imazamox, imazethapyr also recorded reduction in yield due to phytotoxic effect of these herbicide on chandrashoor plants as compared to other post-emergence herbicides.

Chandrashoor growth, yield attributes and yield

At harvest stage the maximum plant height was recorded in weed free, but it was at par with fenoxaprop-p-butyl 100 g/ha (57.12) and quizalofop-p-ethyl 50 g/ha (**Table 2)**. Significantly higher seed yield was recorded in plots treated with fenoxaprop-p-butyl 100 g/ha and quizalofop-p-ethyl 50 g/ha (678 and 622 kg/ha, respectively in 2018-19 and 693 and 633 kg/ha, respectively in 2019-20) (**Table 3**). Significantly highest harvest index was recorded with fenoxaprop-p-butyl 100 g/ha and quizalofop-p-ethyl 50g/ha (25.80 and 25.51%, respectively in 2018-19 and 25.89% and 25.41%, respectively in 2019-20). Similar trend was also found with respect to the stover yield. It might be due to lesser infestation of weeds that encourage proper translocation of photosynthates from source to sink. Such condition may increase the seed production ratio in total produce.

Table 1. Effect of weed management treatments on weed density and biomass in standing chandrashoor crop

Treatment	Weed density (no./m^2)						Weed biomass (g/m^2)					
	Before spray			7 Days after spray			Before spray			7 Days after spray		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Quizalofop-p-ethyl (50 g/ha) PoE	12.63 (159.0)	12.44 (154.7)	12.53 (156.8)	7.22 (51.7)	7.08 (49.7)	7.15 (50.7)	8.64 (74.4)	8.54 (72.4)	8.59 (73.4)	7.86 (61.5)	7.73 (59.6)	7.79 (60.6)
Fenoxaprop-p-butyl 100 g/ha PoE	13.11 (171.7)	12.86 (165.3)	12.99 (168.5)	7.75 (59.7)	7.67 (58.3)	7.71 (59.0)	8.77 (76.6)	8.62 (73.9)	8.70 (75.2)	7.59 (57.1)	7.41 (54.4)	7.50 (55.7)
Imazethapyr 75 g/ha PoE	12.82 (164.0)	12.56 (157.3)	12.69 (160.7)	5.52 (30.0)	5.45 (29.3)	5.49 (29.7)	9.08 (82.1)	8.96 (79.8)	9.02 (81.0)	6.99 (48.7)	6.81 (45.8)	6.88 (47.2)
Imazethapyr + imazamox 100 g/ha PoE	12.94 (167.0)	12.87 (165.3)	12.90 (166.2)	5.18 (26.3)	5.15 (26.0)	5.16 (26.2)	8.33 (69.3)	8.06 (64.8)	8.21 (67.1)	3.39 (11.2)	3.13 (9.6)	3.26 (10.4)
Imazethapyr + pendimethalin 1.0 kg/ha PoE	13.15 (172.3)	12.98 (168.7)	13.06 (170.5)	4.98 (24.3)	4.91 (23.7)	4.95 (24.0)	8.53 (72.4)	8.29 (68.4)	8.42 (70.4)	1.99 (3.5)	1.86 (3.0)	1.93 (3.2)
Weed free (using hand weeding twice)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Weedy check	12.99 (168.3)	12.89 (166.0)	12.94 (167.2)	10.93 (119.0)	10.90 (118.3)	10.92 (118.7)	9.76 (94.8)	9.49 (89.5)	9.62 (92.2)	9.57 (91.2)	9.23 (85.0)	9.40 (88.1)
LSD (p=0.05)	0.51	0.82	0.56	0.33	0.34	0.31	0.64	0.54	0.38	0.65	0.68	0.48

Original values given in parentheses was subjected to square root $(\sqrt{x+1})$ transformation before analysis

Table 2. Effect of weed management practices on weed index, weed control efficiency and crop plant height in chandrashoor crop

Treatment	Weed index		Weed control efficiency				Plant height (cm) at harvest		
			Before spray		After spray				
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2019-20	2018-19	Pooled
Quizalofop-p-ethyl (50 g/ha) PoE	24.30	24.50	5.54	6.83	56.58	58.03	95.00	97.59	96.30
Fenoxaprop-p-butyl 100 g/ha PoE	17.55	17.34	-1.98	0.40	49.86	50.70	96.33	98.30	97.32
Imazethapyr 75 g/ha PoE	88.51	88.46	2.57	5.22	74.79	75.21	69.33	71.47	70.40
Imazethapyr + imazamox 100g/ha PoE	81.41	81.42	0.79	0.40	77.87	78.03	63.67	66.84	65.26
Imazethapyr + pendimethalin 1.0 kg/ha PoE	87.83	87.43	-2.38	-1.61	79.55	80.00	74.00	75.43	74.72
Weed free (using hand weeding twice)	0.0	0.0	100.00	100.00	100.00	100.00	96.67	102.93	99.80
Weedy check	54.72	52.67	0.00	0.00	0.00	0.00	92.67	94.36	93.51
LSD (p=0.05)	-	-	-	-	-	-	8.40	8.37	8.16

Table 3. Effect of weed management treatments on yield attributes and yield of chandrashoor crop

Treatment	Grain yield (kg/ha)			Stover yield (kg/ha)			Harvest index (%)		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Quizalofop-p-ethyl (50 g/ha) PoE	622	633	627	1825	1840	1832	25.51	25.41	25.54
Fenoxaprop-p-butyl 100 g/ha PoE	678	693	685	1947	1970	1958	25.80	25.89	25.91
Imazethapyr 75 g/ha PoE	94	97	96	318	331	325	22.79	22.71	22.75
Imazethapyr + imazamox 100 g/ha PoE	153	156	154	446	456	451	25.43	25.38	25.41
Imazethapyr + pendimethalin 1.0 kg/ha PoE	100	105	103	308	336	322	24.41	23.44	24.09
Weed free (using hand weeding twice)	822	838	830	2069	2092	2081	28.49	28.67	28.58
Weedy check	372	397	384	1173	1218	1196	24.11	24.64	24.37
LSD (p=0.05)	60.94	65.16	48.49	138.75	135.85	127.54	3.53	3.70	2.84

Table 4. Economics of weed management treatments in standing chandrashoor crop

Treatment	Cost of cultivation (x10^3 `/ha)		Gross returns (x10^3 `/ha)			Net returns (x10^3 `/ha)			B:C ratio		
	2018-19	2019-20	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Quizalofop-p-ethyl 50 g/ha PoE	34.01	34.55	62.20	63.27	62.73	33.15	33.67	33.41	2.14	2.14	2.14
Fenoxaprop-p-butyl 100 g/ha PoE	34.28	34.83	67.78	69.27	68.52	38.46	39.40	38.93	2.31	2.32	2.32
Imazethapyr 75 g/ha PoE	34.32	34.86	9.43	9.67	9.55	-19.92	-20.24	-20.08	0.32	0.32	0.32
Imazethapyr + imazamox 100g/ha PoE	35.64	36.19	15.27	15.57	15.42	-15.41	-15.66	-15.54	0.50	0.50	0.50
Imazethapyr + pendimethalin 1.0 kg/ha PoE	38.54	39.09	10.00	10.50	10.25	-23.58	-23.63	-23.61	0.30	0.31	0.30
Weed free (using hand weeding twice)	45.20	46.40	82.22	83.83	83.03	48.59	49.37	48.98	2.44	2.43	2.44
Weedy check	33.06	33.58	37.22	39.67	38.44	9.13	11.05	10.09	1.32	1.39	1.36
LSD (p=0.05)	0.00	0.00	6.10	6.52	4.85	6.10	6.52	4.85	0.3	0.3	0.3

Economics

The lowest cost of cultivation was in weedy check treatment (₹ 33055/ha during 2018-19 and ₹ 33578/ha during 2019-20) as no weed control measure was undertaken and it was highest in weed free treatment. Weed free treatment recorded higher gross returns (₹ 48589/ha during 2018-19 and ₹ 49365/ha during 2019-20). Among herbicide treatments, higher gross return was observed with fenoxaprop-p-butyl 100 g/ha PoE (₹ 67778/ha during 2018-19 and ₹ 69267/ha during 2019-20) followed by quizalofop-p-ethyl 50 g/ha PoE (₹ 62200/ha during 2018-19 and ₹ 63267/ha during 2019-20) when compared to other herbicide treatments. Fenoxaprop-p-butyl 100 g/ha PoE resulted in higher net returns (₹ 48589/ha during 2018-19 and ₹ 49365/ha during 2019-20) followed by quizalofop-p-ethyl 50 g/ha PoE (₹ 38457/ha during 2018-19 and ₹ 39399/ha during 2019-20) when compared to other herbicide treatments. The highest B:C was also recorded with fenoxaprop-p-butyl 100g/ha PoE treatment (2.31 during 2018-19 and 2.32 during 2019-20) followed by quizalofop p ethyl at 50 g/ha PoE as compared to rest of the treatments (**Table 4)**. Therefore, fenoxaprop-p-butyl 100 g/ha PoE and quizalofop-p-ethyl 50 g/ha PoE may be used for managing weeds in chandrashoor, when labour availability is scarce, as they proved to be safe to chandrashoor and gave higher chandrashoor yield with higher net income.

REFERENCES

Annonymus. 1962. *The wealth of India - A Dictionary of Indian Raw Materials and Industrial Products, Council of Ccientific and Industrial Research*, New Delhi. Pp. 70-73.

Ghante MH, Badole, SL and Bodhankar SL. 2011. Health benefits of Garden Cress (*Lepidium sativum* Linn.) Seed Extracts. Chapter 62. pp. 521-525. In: *Nuts and Seeds in Health and Disease Prevention*. (Eds. Preedy VR, Watson RR, Vinood B and Patel VB). Academic Press. NMPB. 2015. Central sector scheme on conservation, development and sustainable management of medicinal plants. National Medicinal Plants Board (NMBP), Department of AYUSH, Ministry of Health and Family Welfare, Govt. of India, New Delhi.

NMBP. 2009. *Good Agricultural Practices for Medicinal Plants*. National Medicinal Plants Board (NMBP), Department of AYUSH, Ministry of Health and Family Welfare, Govt. of India, New Delhi.

Rao AN and Chauhan BS. 2015. *Weeds and Weed Management in India - A Review*. pp. 87-118. In: Weed Science in the Asian Pacific Region. Indian Society of Weed Science, Hyderabad. ISBN 9788193197806.

Rao AN and NagamaniA. 2010. Integrated Weed Management in India–Revisited. *Indian Journal of Weed Science* **42**(3): 1–10.

Raval ND and Pandya TN. 2011. Pharmacognostic study of *Lepidium sativum* Linn (Chandrashura). *AYU* **32**(1): 116–119. DOI: 10.4103/0974-8520.85742.

Sanjta, S. and Chauhan, U. 2018. Incidence and diversity of thrips and its associated natural enemies in medicinal plants. *Journal of Medicinal Plants Studies* **6** (1): 1–2.