



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(8): 2735-2737
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www.thepharmajournal.com

Received: 08-05-2023

Accepted: 11-06-2023

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Effect of pre-emergence herbicides on growth and yield attributes of vegetable pea (*Pisum sativum* L.)

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Abstract

A field experiment was conducted during the *Rabi* season of 2019–20 at the Horticulture Complex, Maharajpur, Department of Horticulture, J.N.K.V.V. Jabalpur (M.P.) to evaluate the effect of pre-emergence herbicides on the growth and yield of garden pea cv. Kashi Nandini. The ten treatments viz. T₁ (Diquat @ 2500 ml/ha), T₂ (Diquat @ 3500 ml/ha), T₃ (Diquat @ 6000 ml/ha), T₄ (Diquat @ 12000 ml/ha), T₅ (Paraquat dichloride @ 2000 ml/ha), T₆ (Pendimethalin @ 750 ml/ha), T₇ (Oxyfluorfen @ 100 ml/ha), T₈ (Pendimethalin 30% EC + Imazethapyr 2% EC @ 750+50 ml/ha), T₉ (two hand weeding at 20 and 40 DAS) and T₁₀ (Control). T₇ (Oxyfluorfen @ 100ml/ha) was found superior to the rest of all other herbicides.

Keywords: Pre-emergence herbicides, growth yield attributes, vegetable pea, *Pisum sativum* L.)

Introduction

Garden pea (*Pisum sativum* L.) is an important vegetable in India. It is grown as a summer vegetable in the hills of north India, as opposed to the plains, where it is grown as a winter crop. It is primarily grown for its soft, green pods, which are a high source of protein, calcium, phosphorus, iron, and vitamins, and for consumption as a fresh vegetable. It is necessary for a human diet. Peas are incredibly nutrient-dense and a great source of protein, carbohydrates, minerals, and vitamins A, B, and C. In comparison, dry peas contain moisture of 16.0 g, protein of 19.7 g, carbohydrate of 56.5 g, energy of 315 Kcal, calcium of 75 mg, phosphorous of 298 mg, iron of 7.05 mg, and carotene of 39 g per 100 g of edible portion. Major states in India where peas are grown include Uttar Pradesh, Madhya Pradesh, Bihar, Haryana, and Rajasthan. This crop is helpful for enhancing soil fertility and soil conservation because it is a legume that fixes nitrogen. Early-maturing cultivars of this crop also work well with various crop rotation regimens for crop diversity. The competition between weeds and garden peas is one of the main factors affecting the seed yield and lowering the yield and quality. Both grassy and broad-leaved weeds are present in this crop, significantly reducing commercial crop yield (Singh *et al.*, 1991) ^[11]. 40 to 60 days after sowing is the important period for crop-weed competition in pea (Bhyan *et al.*, 2004) ^[1]. *Anagallis arvensis*, *Avena ludoviciana*, *Chenopodium album*, *Convolvus arvensis*, *Cyprus rotundus*, *Medicago denticulata*, *Phalaris minor*, *Melilotus indica*, *Rumex spinosis*, *Stellaria media*, and *Trigonella poly cerata* are significant weeds connected to the pea crop (Vaishya *et al.* 1999) ^[13]. The emergence of more herbicide-resistant weeds is causing similar weed management issues, despite the use of herbicidal weed control in traditional farming. As a result, innovative and long-lasting weed management techniques need to be created (Mortensen *et al.* 2012) ^[15].

Pendimethalin, applied pre-emergence at a rate of 1.0 kg ha⁻¹, was successful in reducing the density and dry matter production of weeds, which increased field pea yield characteristics and seed output. The maximum seed production of 2174 and 1436 kg ha⁻¹ was obtained in field peas as a result of the effects of several herbicides that are effective in controlling weeds.

Material and Methods

The experiment was conducted during the *Rabi* season of 2019–20 at the Horticulture Complex, Maharajpur, Department of Horticulture, J.N.K.V.V. Jabalpur (M.P.) to evaluate the effect of pre-emergence herbicides on the growth and yield of garden pea cv. Kashi Nandini. The ten treatments viz. T₁ (Diquat @ 2500 ml/ha), T₂ (Diquat @ 3500 ml/ha), T₃ (Diquat @ 6000 ml/ha), T₄ (Diquat @ 12000 ml/ha), T₅ (Paraquat dichloride @ 2000 ml/ha), T₆ (Pendimethalin @ 750 ml/ha), T₇ (Oxyfluorfen @ 100 ml/ha), T₈ (Pendimethalin 30% EC +

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Imazethapyr 2% EC @ 750+50 ml/ha), T₉ (two hand weeding at 20 and 40 DAS) and T₁₀ (Control). were laid out in Randomized Block Design replicated three. The nutrients were applied at 50 kg N, 60 kg P₂O₅, and 60 kg K₂O/ha. At the time of seeding, all fertilizer applications were made as a basal application. Di-ammonium phosphate, urea, and muriate of potash were employed as sources for N₂, P₂O₅, N, and N₂. Urea served as the source for N₂. Each plot's necessary amount of fertilizer was weighed and poured underneath the seeds at a depth of 7 to 10 cm. The pea (Kashi Nandini) seed was sowed in lines with a spacing of 30×10 cm and then covered with soil at a rate of 80 kg/ha. A depth of 3 to 4 cm was used for the seeding. Before planting, seeds were treated with 2 g of carboxin and 1 g of carbendazim at 50% WP. The properties of growth, yield, and yield were observed. Five plants were chosen at random from each plot and labeled for usage.

Result

Growth parameters

1. Plant population (No./m²)

Plant population per meter square was recorded at 14 DAS and 90 DAS. maximum plant population was recorded in treatment T₉ (Hand weeding at 20 & 40 DAS) with a value of 27.00 and 24.67, respectively. While the lowest value of 17.00 was recorded in treatment T₄ (Diquat @ 12000 ml/ha) at 14 DAS and 12.67 at 90 DAS recorded in T₁₀ (Control). Similar fluctuations in plant populations at various growth stages were reported by Rana *et al.* (2007) [8] in pea and Chauhan *et al.* 2019 [4] in chickpea.

2. No. of branches

Results show that the maximum no. of branches was observed in treatment T₂ (Diquat @ 3500 ml/ha) at 40 DAS while the minimum no. of branches (6.27) was recorded in treatment T₁₀ (control) at 40 DAS. The highest no. of branches at 20 DAS was recorded in treatment T₉ (hand weeding at 20 & 40 DAS) while the lowest value (4.20) was observed in treatment T₁₀ (Control). At 40 DAS, no. of branches reported in treatment T₉ (hand weeding at 20 & 40 DAS) (9.27) were found to be at par with T₂ (Diquat @ 3500 ml/ha) (9.32). among the herbicidal treatments, the two herbicides (Pendimethalin + Imazethapyr and Oxyfluorfen) were found equally effective in the formation of higher no. of branches per plant and proved significantly superior to weedy check Chauhan *et al.* 2019 [4]. Reduced competition between weeds and crop plants helped in growing more no. of branches in the weed-free plot while the lowest no. of branches were found in the weedy check plot. Similar results were reported by Muhammad *et al.* (2012) [17] in pea.

3. Days to initiation flowering (days)

Results revealed that minimum days to flower initiation (32.67 days) was observed in treatment T₅ (Paraquat @ 2000 ml/ha) followed by T₁ (Diquat -2500 ml/ha), T₂, T₇, T₄, T₉, T₃, T₆& T₈ in increasing order. Maximum days taken to commence the flowering (35.33) were recorded in treatment T₁₀ (Control). The result was non-significant for initiation

days taken to blooming. These results are in conformity with Kebede *et al.* (2015) [7] in common bean. Application of Pendimethalin at various doses have been found effective and recommended for weed control for higher yields and quality of peas (Singh *et al.* 2003) [10].

4. Days to 50% flowering (days)

It is clear that maximum days taken to achieve 50% flowering was recorded in treatment T₁₀ (Control) with a value of 40.33 days while minimum days were taken by treatment T₅ (Paraquat @ 2000 ml/ha) (38.33 days). The result was non-significant for days to 50% flowering in garden pea. The days to 50% flowering in weed free condition was significantly earlier than other treatments under study, as it indicates that number of days taken to flowering was significantly delayed due to weed infestation throughout the crop growth over other treatments (Kebede *et al.* 2015 in common bean) [7].

Yield Parameters

1. Pod length (cm)

Results show that maximum pod length (8.19 cm) was recorded in treatments T₇ (Oxyfluorfen @ 100 ml/ha) and T₉ (Hand weeding at 20 and 40 DAS) both treatments. While, minimum pod length (7.24 cm) was found in treatment T₁₀ (Control). Similar results were given by Rana *et al.* (2007) [8] in pea, Chandrakar *et al.* (2016) [2] and Deva and kolhe (2018) [5] in chickpea.

2. Average Pod weight (g)

Results revealed that maximum weight of pod (5.75 g) was recorded in treatment T₉ (Hand weeding at 20 and 40 DAS) followed by 5.53 g in Treatment T₇ (Oxyfluorfen @ 100 ml/ha). while lowest average weight of pod (4.22 g) was recorded in treatment T₁₀ (Control). The results were also reported by Deva and kolhe (2018) [5] in chickpea.

3. Pod yield/plot (kg)

Maximum pod yield (13.15 kg) was recorded in treatment T₉ (Hand weeding at 20 & 40 DAS) followed by 11.52 kg in treatment T₇ (Oxyfluorfen @ 100 ml/ha) and were at par with each other. Lowest value for pod yield (5.78 kg) was observed in treatment control (T₁₀) kg. Remaining treatments under study, yield ranges from 6.89 kg to 11.00 kg per plot. Similar results were shown by Patra (1999) [18] in soybean, Mishra (2008) [14] in pea and Rana *et al.* (2019) [9] in pea.

Economics

The maximum net return was found in treatment T₉ (two-hand weeding at 20 and 40 DAS) at Rs. 74825.00/ha, while the minimum was recorded in treatment T₁₀ (Control) at Rs. 15200.00/ha. Treatment T₇ (Oxyfluorfen @ 100 ml/ha, Rs. 71665.00/ha) was recorded to acquire the highest net return in chemical herbicides. The B:C ratio was found superior in treatment T₇ (Oxyfluorfen @ 100 ml/ha) (2.68) followed by treatment T₈ (Pendimethalin + Imazethapyr @ 750+50 ml/ha) (2.59) and T₉ (two hand weeding at 20 and 40 DAS) (2.49). The lowest B:C ratio was recorded in treatment T₁₀ (Control) (1.38).

Table 1: Evaluation of pre-emergence herbicide on growth, yield and cost-benefit ratio of pea (*Pisum sativum* L.)

Treatments	Plant population (No./m ²)		No. of branches		Days of flowering		Pod length (cm)	Average pod weight (g)	Pod yield/plot (kg)	B:C ratio
	14 DAS	90 DAS	20 DAS	40 DAS	Initial	50%				
T ₁ - (Diquat -2500 ml/ha)	26.33	18.67	4.53	9.00	33.00	39.00	7.95	5.5	9.64	2.26
T ₂ - (Diquat -3500 ml/ha)	20.67	16.33	4.40	9.32	33.00	39.00	7.98	5.28	7.51	1.74
T ₃ - (Diquat -6000 ml/ha)	19.33	15.67	4.27	9.07	33.67	39.67	7.80	5.37	7.49	1.70
T ₄ - (Diquat -12000 ml/ha)	17.00	14.33	4.40	8.80	33.33	39.00	7.95	5.22	7.11	1.52
T ₅ - (Paraquat-2000 ml/ha)	19.33	15.33	4.27	8.17	32.67	38.33	7.60	4.83	6.98	1.66
T ₆ - (Pendimethalin-750 ml/ha)	18.00	13.67	4.33	6.47	34.33	39.67	7.58	4.45	6.89	1.64
T ₇ - (Oxyfluorfen-100 ml/ha)	25.67	23.33	4.40	9.20	33.00	39.00	8.19	5.53	11.52	2.68
T ₈ - (Pendimethalin + Imazethapyr 750+50 ml/ha)	25.67	22.33	4.53	9.07	35.00	40.00	8.08	5.37	11.00	2.59
T ₉ - (Hand weeding 20 & 40 DAS)	27.00	24.67	4.80	9.27	33.33	38.67	8.19	5.75	13.15	2.49
T ₁₀ - (Control)	26.33	12.67	4.20	6.27	35.33	40.33	7.24	4.22	5.78	1.38
SE (m)±	2.39	2.46	0.16	0.31	0.63	0.47	0.18	0.3	0.67	-
CD at 5% level	7.1	7.32	NS	0.94	NS	NS	0.54	0.9	2.01	-

Conclusion

On the basis of present investigation, Performance of control treatment was recorded non effective in growth and yield of pea at any stage of crop duration. T₇ (Oxyfluorfen @ 100 ml/ha) was found superior in rest of all other herbicides. Benefit cost ratio was obtained higher in Oxyfluorfen @ 100ml/ha followed by Pendimethalin + Imazethapyr @ 750+50 ml/ha.

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