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Effect of different Pre-emergence Herbicides on Weed Population, Growth, and Yield-attributing Traits of Vegetable Pea (*Pisum sativum* L.)

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ABSTRACT: To determine the impact of pre-emergence herbicides on the weed population, growth, and yield of garden pea cv. Kashi Nandini, a field experiment was carried out during the Rabi season of 2019–20 at the Horticulture Complex, Maharajpur, Department of Horticulture, J.N.K.V.V. Jabalpur (M.P.). 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). The herbicide T7 (oxyfluorfen at 100 ml/ha) was found to be superior to all other herbicides. The weed count of species is a major challenge of this study. The weed count of species contributes a major role in the weed population and yield estimate of garden peas.

Keywords: Pre-emergence herbicides, weed population, growth and yield attributes.

INTRODUCTION

Garden pea (*Pisum sativum* L.) is an important vegetable in India. In the hills of north India, as opposed to the plains, where it is planted as a winter crop, it is cultivated as a summer vegetable. It is primarily farmed for its soft, green pods, which are abundant in protein, calcium, phosphorus, iron, and vitamins and are consumed as a fresh vegetable. It is required for a human diet. Peas are an excellent source of protein, carbs, minerals, and vitamins A, B, and C. They are also highly nutrient-dense. In contrast, 100 g of dried peas have 16.0 g of moisture, 19.7 g of protein, 56.5 g of carbohydrate, 315 kcal of energy, 75 mg of calcium, 298 mg of phosphorus, 7.05 mg of iron, and 39 g of carotene. Because it is a legume that fixes nitrogen, this crop is beneficial for increasing soil fertility and conserving soil. This crop's early-maturing cultivars perform well with a variety of crop rotation schedules to increase crop diversity. One of the key variables reducing the seed yield and diminishing the yield and quality is competition between weeds and garden peas. This crop has both grassy and broad-leaved weeds, which greatly reduces the commercial crop yield (Singh *et al*., 1991). The crucial time for crop-weed competition in peas is 40 to 60 days after sowing (Bhyan *et al*., 2004). Several major weeds associated with the pea crop include Anagallis arvensis, Avena ludoviciana, Chenopodium album, Convolvus arvensis, Cyprus rotundus, Medicago denticulata, Phalaris minor, Melilotus indica, Rumex spinosis, Stellaria media, and Trigonella polycerata (Vaishya *et al*. 1999). Despite the use of herbicidal weed control in conventional farming, more herbicide-resistant weeds are causing similar weed management problems. Therefore, effective and long-lasting weed control methods must be developed (Mortensen *et al*., 2012).

MATERIAL AND METHODS

The experiment was carried out to determine the impact of pre-emergence herbicides on the growth and yield of garden pea cv. Kashi Nandini during the Rabi season of 2019–20 at the Horticulture Complex, Maharajpur, Department of Horticulture, J.N.K.V.V. Jabalpur (M.P.). The ten treatments are 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 and T10 (Control) were arranged in a three-replicated

random block design. Application rates for the nutrients were 50 kg N, 60 kg P_2O_5, and 60 kg K2O/ha. All fertilizer applications were made as a basal application at the time of seeding. We used urea, muriate of potash, and di-ammonium phosphate as sources for N_2, P_2O_5, N, and N_2. N_2 was generated from urea. The required amount of fertilizer for each plot was weighed and applied at a depth of 7 to 10 cm beneath the seeds. The pea (Kashi Nandini) seed was sown in rows with a spacing of 30 × 10 cm, and soil was then applied at a rate of 80 kg/ha. The seeds were planted at a depth of 3 to 4 cm. At 50% WP, 2 g of carboxin and 1 g of carbendazim were applied to the seeds prior to sowing. It was possible to observe the characteristics of growth, yield, and yield. Each plot had five plants that were picked at random and given usage labels.

RESULT

Weed population

1. Weed count (No. /m^2) species wise

Phalaris minor. Minimum weed density of *Phalarisminor* was observed under treatment T_9 (Hand weeding at 20 & 40 DAS) at 30 DAS (3.77). While maximum weed count per meter square was observed under treatment T_{10} (control) *i.e.* 17.00 at 30 DAS. Other than T_9, treatment T_7 (Oxyfluorfen-100ml/ha) resulted better in weed control as its mean weed count per meter square were and 7.33 at 30 DAS.

Vicia sativa. Maximum value for weed intensity per meter square observed in control plot (T_{10})at 30 DAS with value 44.33. While lowest weed count was recorded in treatment T_9 (Two hand weeding at 20 and 40 DAS) with a value of 10.00 at 30 DAS. Followed by T_7(Oxyflurofen-100 ml/ha).

Parthenium hysterophorus. Result shows that highest capacity of experimental treatment to reduce the weed count per meter square was recorded in treatment T_9 (Two hand weeding at 20 & 40 DAS) with the values 0.33 at 15 DAS and 5.67 at 30 DAS. Although, T_{10} (control) exposes the highest weed count/m^2 area with the value is 5.00 at 15 DAS and 34.7 at 30 DAS. In case of chemical herbicides, treatment T_7 (Oxyfluorfen @ 100 ml/ha) was found effective with weed count/m^2 1.00 at 15 DAS and 6.67 at 30 DAS.Results were in conformity with those of Mandal *et al*. (2015) in urdbean, Gupta *et al.* (2017) in moongbean and Singh *et al.* (2017) in green gram.

2. Total weed fresh weight (g). Mean fresh weight of weeds were recorded highest in treatment T_{10} (Control) at all stages of growth *viz.,* at 15 DAS (56.43 g) and 30 DAS (490.33 g). Lowest data for fresh weight was observed in treatment T_9 (Hand weeding 20 and 40 DAS) at all stages of growth at15 DAS (12.67 g) and 30 DAS (69.50 g) followed by T_7 (Oxyflurofen-100 ml/ha)15 DAS (21.0 g) and 30 DAS (105.33 g) respectively. Results were in conformity with those of Prakash *et al.* (2000) in garden pea.

3. Weed dry weight (g). Resulted that the highest dry weight of weeds was found in treatment control (T_{10}) at all stages of growth (observation days) viz.,15 DAS (11.33 g) and 30 DAS (70.00 g), while, the lowest value was observed in treatment T_9 (Hand weeding at 20 and 40 DAS) at all stages of growth *viz.*, 15 DAS (3.17 g) and 30 Das (14.27 g) followed by treatment T_7 (Oxyfluorfen @ 100 ml/ha) 4.25 & 19.10 g at 15 & 30 DAS, respectively. Results were in conformity with those of Mishra *et al.* (1999) in field pea.

Table 1: Effect of pre-emergence herbicide on weed population of pea (*Pisum sativum* L.).

Treatments	*Phalaris minor* (No./m^2)		*Vicia sativa* (No./m^2)		*Parthenium hysterophorus* (No./m^2)		Weed fresh weight (g)		Weed Dry weight	
	15 DAS	30 DAS	15 DAS	30 DAS	15 DAS	30 DAS	15 DAS	30 DAS	15 DAS	30 DAS
T_1 - (Diquat -2500 ml/ha)	4.33	11.33	24.67	34.67	1.33	23.33	42.97	378.13	8.02	43.40
T_2 - (Diquat -3500 ml/ha)	4.67	10.33	24.00	34.33	1.67	22.67	37.07	352.17	7.43	41.78
T_3- (Diquat -6000 ml/ha)	3.67	10.17	23.00	29.33	1.33	21.67	31.93	317.93	6.95	39.73
T_4 - (Diquat -12000 ml/ha)	3.33	9.00	22.67	29.33	1.00	19.33	29.17	262.00	6.63	34.62
T_5 - (Paraquat-2000 ml/ha)	5.67	12.00	29.33	33.33	2.33	22.67	43.23	384.00	8.08	45.00
T_6 - (Pendimethalin-750 ml/ha)	3.67	13.67	30.33	37.33	2.00	28.33	47.67	425.33	8.50	49.33
T_7 - (Oxyflurofen-100 ml/ha)	2.33	7.33	7.27	22.00	1.00	6.67	21.00	105.33	4.25	19.10
T_8- (Pendimethalin + Imazethapyr 750+50 ml/ha)	1.67	8.67	10.33	28.67	0.67	8.33	26.83	123.50	6.12	23.83
T_9 - (Hand weeding 20 & 40 DAS)	1.33	3.77	4.66	10.00	0.33	5.67	12.67	69.50	3.17	14.27
T_{10} - (Control)	9.33	17.00	36.33	44.33	5.00	34.67	56.43	490.33	11.33	70.00
SE(m)±	0.22	0.2	0.2	0.37	0.17	0.23	0.19	0.13	0.06	0.17
CD at 5% level	0.65	0.6	0.59	1.1	0.51	0.67	0.57	0.39	0.18	0.5

Growth parameters

1. Plant height (cm). The maximum plant height (64.80 cm) was recorded in treatment control (T_{10}) at harvest while the lowest plant height (57.67 cm) was recorded in treatment T_8 (Pendimethalin + Imazethapyr @ 750+50 ml/ha) at harvest. At 20 DAS, the maximum plant height (20.18 cm) was attained in treatment T_9 (hand weeding at 20 & 40 DAS), and the lowest plant height (15.04 cm) was recorded in treatment control (T_{10}). Such result is the conformity with the work of Rana *et al.* (2007) in pea.

2. No. of leaves. Results show that no. of leaves were having a significant effect at 20 DAS. Although at 20 DAS, the maximum no. of leaves was recorded in treatment T_8 **(**Pendimethalin + Imazethapyr @ 750+50 ml/ha**)** (16.67) followed by treatment T_9 (16.60) and treatment T_7 (15.87) which were at par with each other and lowest no. of leaves was recorded in T_{10} (Control)

(12.53). Similar results were also given by Rana *et al.* (2007) in pea.

Yield parameters

No. of Pods /plant. shows that the maximum no. of pods/plant (9.20) was reported in treatment T_9 (Hand weeding at 20 and 40 DAS) followed by 8.33 in treatment T_7 (Oxyflurofen @ 100 ml/ha) and were at par with each other. While the minimum no. of pods/plant (5.58) was recorded in treatment T_{10} (Control). Similar result was corroborated by Rana *et al.* (2007); Munakamwe *et al.* (2008); Mishra (2008) in pea.

No. of seeds/pod. Results shows that the maximum no. of seeds/pod was recorded (7.20) in treatment T_9 (hand weeding at 20 and 40 DAS) followed by 7.17 in treatment T_8 (Pendimethalin + Imazethapyr @ 750 + 50 ml/ha) and 7.10 in treatment T_7 (Oxyflurofen @100 ml/ha) and were at par with each other. While minimum no. of seeds/pod (6.07) was observed in treatment T_{10} (Control). Similar result was corroborated by Munakamwe *et al.* (2008); Mishra (2008) in pea.

Pod yield/plot (kg). Results shows Maximum pod yield (13.15 kg) was recorded in treatment T_9 (Hand weeding at 20 & 40 DAS) followed by 11.52 kg in treatment T_7 (Oxyfluorfen @ 100 ml/ha) and were at par with each other. The lowest value for pod yield (5.78 kg) was observed in treatment control (T_{10}) kg. Remaining treatments under study, the yield ranges from 6.89 kg to 11.00 kg per plot. Similar result was corroborated by Rana *et al.* (2007); Mishra (2008) in pea.

Pod yield (q/ha). Results reveals that maximum pod yield (87.66 q/ha) was obtained in treatment T_9 (hand weeding at 20 & 40 DAS) followed by 76.77 q/ha in treatment T_7 (Oxyfluorfen @ 100 ml/ha) which were at par with each other. While treatment T_{10} (Control) performs least among all treatments 38.55 q/ha. Similar findings were corroborated by Saini and Walia (2012) in onion and Muhammad *et al.* (2014) in pea.

Table 2: Effect of pre-emergence herbicide on growth and yield parameters of pea (*Pisum sativum* L.).

Treatments	Plant height (cm) 20 DAS	No. of leaves 20 DAS	No. of Pods /plant	No. of seeds/pod	Pod yield/plot (kg)	Pod yield (q/ha)
T_1 - (Diquat -2500 ml/ha)	19.36	15.47	7.13	7.03	9.64	64.29
T_2 - (Diquat -3500 ml/ha)	18.71	14.93	6.33	7.00	7.51	50.04
T_3- (Diquat -6000 ml/ha)	19.08	15.13	5.93	6.70	7.49	49.93
T_4 - (Diquat -12000 ml/ha)	19.28	14.20	6.87	6.90	7.11	47.42
T_5 - (Paraquat-2000 ml/ha)	19.35	14.40	5.77	6.23	6.98	46.53
T_6 - (Pendimethalin-750 ml/ha)	17.99	14.00	5.73	6.10	6.89	46.06
T_7 - (Oxyflurofen-100 ml/ha)	20.02	15.87	8.33	7.10	11.52	76.77
T_8- (Pendimethalin + Imazethapyr 750+50 ml/ha)	19.37	16.67	7.80	7.17	11.00	72.98
T_9 - (Hand weeding 20 & 40 DAS)	20.18	16.60	9.20	7.20	13.15	87.66
T_{10} - (Control)	15.04	12.53	5.58	6.07	5.78	38.55
SE(m)±	0.88	0.47	0.49	0.22	0.67	4.53
CD at 5% level	2.61	1.39	1.48	0.66	2.01	13.49

CONCLUSIONS

Based on the results of the study, it is concluded that minimum weed density/m^2 were obtained in weed free T_9 (two hand weeding at 20 and 40 DAS) followed by Oxyfluorfen @ 100 ml/ha. Among the all pre-emergence application of herbicides, application of T_7 (Oxyfluorfen @ 100 ml/ha) was most effective for control of weeds in vegetable pea but some weed species like Parthenium hysterophorus were suppressed at 20 DAS by Diquat @ 6000 ml/ha and Diquat @ 12000ml/ha. Performance of control treatment was recorded non effective in growth and yield of pea at any stage of crop duration. T_7 (Oxyfluorfen @ 100ml/ha) was found superior in rest of all other herbicides.

FUTURE SCOPE

In future studies, observations like different spacing, levels of herbicidal application, and best cultivars for any particular area should be performed.

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