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Weed management in field pea (*Pisum sativum* L.)

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ABSTRACT

An experiment was conducted at Junagarh Agricultural University, Gujarat to judge the profitability and suitability of different weed management in field pea under clay soil. Experiments with 12 different treatment combination indicates that depend upon the availability of labour, profitability of rabi field pea could be achieved through 2 hand weeding and intercultural operation at 20 and 40 days after sowing. The study also reveals that application of pendimethalin @ 0.75 kg ha^{-1} or oxyfluorofe @ 0.18 kg ha^{-1} also suitable for the purpose.

Keywords: Field pea, *Pisum sativum*, weed, herbicide

Pulses are considered as life blood of agriculture as they occupy a unique position almost in all cropping systems as main, catch, cover, green manure, intercrop and its inclusion in crop rotation, thereby, keep the soil alive and productive. India is the largest producer and consumer of pulses in the world, contributing around 25% of the total global production. Field pea (*Pisum sativum* L.) is primarily used for human consumption or as a livestock feed. Field pea is a seed legume commonly used throughout the world in human cereal grain diets. Field pea has high levels of amino acids, lysine and tryptophan, which are relatively low in cereal grains. Weeds are big constraints in crop production and responsible for heavy yield losses. The available herbicides *viz*., pendimethalin, oxyfluorfen, imazethapyr and quizalofop-ethyl are able to check the emergence and growth of annual grasses and broad-leaved weeds. This study was carried out to evaluate the relative efficacy of different pre- and post-emergence herbicides when applied alone or in combination with cultural operation in field pea.

MATERIALS AND METHODS

The field experiment was conducted in the farm of Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat in *rabi* season of 2012-13 to evaluate weed management in field pea. The experimental soil was clayey in texture and slightly alkaline in reaction with pH 8.0 and EC 0.56 dS m^{-1}. It was medium in available nitrogen (278 kg ha^{-1}), available phosphorus (36.8 kg ha^{-1}) and available potash (221 kg ha^{-1}). The range of mean maximum and minimum temperature during the crop growth and development period was 29.4 to 39.7^{0}C and 9.2 to 21.7^{0}C, respectively. The range of average relative humidity, bright sun shine, wind speed and daily evaporation was 26.0 - 57.0%, 3.0 - 10.4 h, 3.1 - 6.6 km h^{-1} and 4.5 - 9.0 mm, respectively. The experiment comprised 12 treatments *viz.*, T_1: Pendimethalin 0.75 kg ha^{-1} as pre-emergence, T_2: Pendimethalin 0.75 kg ha^{-1} as pre-emergence followed by (*fb*) hand weeding (HW) and interculturing (IC) at 30 days after sowing (DAS), T_3: Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence, T_4: Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS, T_5: Imazethapyr 75 g ha^{-1} as post emergence at 25 DAS, T_6: Quizalofop 40 g ha^{-1} as post-emergence at 25 DAS, T_7: Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* Imazethapyr 75 g ha^{-1} as post-emergence at 25 DAS, T_8: Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* Quizalofop 40 g ha^{-1}as post-emergence at 25 DAS, T_9: HW and IC at 20 DAS, T_{10}: HW and IC at 20 and 40 DAS, T_{11}: Weed free, and T_{12}: Unweeded control were replicated thrice in randomized block design. The field pea variety 'Gujarat Dantiwada Field Pea-1' was sown on November 27, 2012 at row spacing of 45 cm using seed rate of 50 kg ha^{-1}. The gross and net plot size was 4.5 x 3.6 m and 3.6 x 2.7 m, respectively. The entire dose of fertilizer *i.e.* 20-40 kg N-P_2O_5 ha^{-1} was applied as basal application in form of diammonium phosphate and urea at just before sowing in the furrows. The crop was raised as per the standard package of practices. Interculturing operation was carried out in inter row space through bullock-drawn implement and simultaneous removal of weeds manually in intra row space. All the herbicide were applied with manually operate knapsack sprayer fitted with flood jet nozzle at a spray volume of 500 l ha^{-1}. Weed count were recorded at 30 DAS, 60 DAS and at harvest and were subjected to $\sqrt{x + 0.05}$ transformation, while dry weight of weeds was recorded at harvest. Weed index (WI) and weed control efficiency (WCE) were worked out using following formulae suggested by Gill and Kumar (1969) and Kondap and Upadhyay (1985).

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$$WI = \frac{Y_{WF} \times Y_T}{Y_{WF}} \times 100$$

Where, Y_{WF} and Y_T are the yield from weed-free plot and yield from treated plot, respectively.

$$WCE\% = \frac{DW_C - DW_T}{DW_C} \times 100$$

Where, DW_C = Dry matter accumulation of weeds in unweeded control, DW_T = Dry matter accumulation of weeds in treated plot.

RESULTS AND DISCUSION

Experimental field was infested with monocot weeds *viz., Brachiaria* spp., *Indigofera glandulosa* L., *Asphodelus tenuifolius* L. Cav. and *Dactyloctenium aegyptium* Beauv, dicot weeds *viz., Digera arvensis* Forsk, *Chenopodium album* L., *Physalis minima* L., *Portulaca oleracea* L., *Euphorbia hirta* L. and *Leucas aspera* (Willd.) Spreng, and sedge weed *Cyperus rotundus* L.

The results revealed that different weed management practices exerted significant influence on growth and yield of field pea (Table 1). The treatment T_{11} (weed free) significantly enhanced growth and yield attributes *viz*., plant height, plant spread, branches plant^{-1}, root nodules plant^{-1}, pods plant^{-1}, seeds pod^{-1}, seed weight plant^{-1} and 100-seed weight, and ultimately increased seed and stover yields, however it was found statistically at par with the treatments T_{10} (HW and IC at 20 and 40 DAS), T_2 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS), T_4 (Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS) and T_8 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* Quizalofop 40 g ha^{-1} as post-emergence at 25 DAS), whereas the treatment T_{12} (Unweeded check) registered significantly the lowest growth and yield of the crop. The crude protein content of seed remained unaffected under different weed management treatments. Effective control of weeds through manual weeding in the treatments T_{11} (Weed free) and T_{10} (HW and IC at 20 and 40 DAS) as well as integration of pre-emergence herbicide with manual weeding under the treatments T_2 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence fb HW and IC at 30 DAS) and T_4 (Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence fb HW and IC at 30 DAS) and sequential application of pre- and post-emergence herbicides under the treatments T_7 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* Imazethapyr 75 g ha^{-1} as post emergence at 25 DAS) and T_8 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* Quizalofop 40 g ha^{-1} as post-emergence at 25 DAS) resulted into less weed-crop competition throughout the growth stage of crop and created favourable environment for plant growth. Thus, enhance availability of nutrients, water, light and space, which might have accelerated the photosynthetic rate, thereby increasing the supply of carbohydrates leading to increase in growth and yield. These findings are in agreement with those of Ved *et al.* (2000), Singh and Angiras (2004), Ram *et al.* (2011), Rana *et al.* (2013) and Patro *et al.* (2014).

Table 1: Growth, yield and quality of field pea under different weed management practices

Treatment	Plant height (cm)	Plant spread (cm)	Branches plant^{-1}	Root nodules plant^{-1}	Pods plant^{-1}	Seeds pod^{-1}	Seed weight plant^{-1} (g)	100-seed weight (g)	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})	Seed protein (%)
T_1	103.3	12.0	2.9	3.7	26.7	4.9	8.8	15.6	13.0	19.0	20.4
T_2	111.2	13.1	3.4	4.3	30.7	5.5	10.6	16.1	14.8	21.4	20.9
T_3	103.1	11.9	2.9	3.9	24.2	4.8	7.9	15.3	12.1	18.6	20.2
T_4	109.4	12.9	3.1	4.7	30.3	5.3	10.4	16.4	14.6	20.8	20.8
T_5	102.8	11.8	2.9	3.7	22.3	4.7	7.7	15.0	12.0	18.2	20.0
T_6	102.8	11.5	2.8	3.9	21.5	4.7	7.6	14.8	11.3	17.4	19.8
T_7	105.4	12.2	3.0	3.3	29.1	5.1	9.1	16.1	13.2	19.8	20.5
T_8	105.7	12.6	3.0	3.0	29.7	5.1	10.2	16.3	13.5	20.4	20.6
T_9	104.7	12.1	3.0	3.2	27.0	5.1	8.9	15.7	13.1	19.7	20.5
T_{10}	111.6	13.2	3.3	5.3	32.7	6.1	11.1	16.7	15.1	22.2	21.0
T_{11}	118.0	15.3	3.6	6.0	34.3	6.2	12.3	17.0	16.3	22.9	21.2
T_{12}	96.7	10.4	2.5	2.7	21.4	4.3	7.1	14.4	10.9	16.0	19.2
SEm(±)	**3.1**	**0.7**	**0.2**	**0.2**	**1.4**	**0.2**	**1.0**	**0.5**	**1.0**	**0.7**	**0.6**
LSD (0.05)	**8.9**	**2.0**	**0.5**	**0.5**	**4.0**	**0.7**	**3.0**	**1.5**	**2.9**	**2.0**	**NS**

Different weed management treatments manifested their significant effect on weed count recorded at 30 DAS, 60 DAS and at harvest (Table 2). All the weed management treatments significantly reduced the weed population compared to weedy check (T_{12}). Next to the weed free (T_{11}), the treatment T_{10} (HW and IC at 20 and 40 DAS) recorded significantly the lowest population of monocot, dicot and sedge weeds, which remained statistically at par with the treatments T_2 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS) and T_4 (Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS). Dry weight of weeds was significantly influenced due to different weed management practices (Table 2). Besides the weed free (T_{11}), the lowest dry weight of weeds was observed under the treatment T_{10} (HW and IC at 20 and 40 DAS), though it was found statistically *at par* with the treatment T_2 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS). Significantly the highest dry weight of weeds was observed under the treatment T_{12} (Weedy check). Reduction in dry weight of weeds under the treatments T_{10} (HW and IC at 20 and 40 DAS) and T_2 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS) over weedy check (T_{12}) was 86.27 % and 85.98 %, respectively. This might be attributed to the effective control of weeds under these treatments, which reflected in less number of weeds and ultimately lower weed biomass. In addition to this, dense crop canopy might have suppressed weed growth and ultimately less biomass. The weedy check (T_{12}) recorded significantly the highest dry weight of weeds owing to uncontrolled condition favoured luxurious weed growth leading to increased weed dry matter.

A perusal of data presented in table 2 indicates that besides the weed free (T_{11}), maximum WCE was obtained under the treatment T_{10} (HW and IC at 20 and 40 DAS), followed by treatment T_2 (Pendimethalin 0.75

Table 2: Intensity and dry weight of weeds under different weed management practices in field pea

Treatment	Monocot weeds m^{-2}			Dicot. weeds m^{-2}			Sedge weeds m^{-2}			Dry weight ($q\ ha^{-1}$)	WI (%)	WCE (%)
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest			
T_1	2.34 (5.00)	2.72 (7.00)	2.80 (7.33)	2.34 (5.00)	2.60 (6.33)	2.95 (8.00)	2.76 (7.33)	3.01 (8.67)	3.28 (11.00)	3.27	20.2	71.7
T_2	1.43 (1.57)	1.64 (2.33)	1.46 (1.67)	1.22 (1.00)	1.34 (1.33)	1.81 (2.33)	2.00 (3.67)	2.34 (5.00)	2.73 (7.00)	1.62	9.2	85.9
T_3	2.67 (6.67)	3.08 (9.00)	2.96 (8.33)	2.59 (6..33)	2.96 (8.33)	3.12 (9.33)	3.18 (9.67)	3.44 (11.33)	3.48 (11.67)	4.10	25.3	64.4
T_4	1.46 (1.72)	1.86 (3.00)	1.56 (2.00)	1.34 (1.33)	1.46 (1.67)	2.11 (4.33)	2.02 (3.67)	2.61 (6.33)	2.96 (8.33)	2.18	10.3	81.1
T_5	2.73 (7.03)	2.96 (8.33)	3.11 (9.17)	2.91 (8.00)	3.19 (9.67)	3.33 (11.00)	3.13 (9.33)	3.34 (10.67)	3.53 (12.00)	3.65	26.2	68.3
T_6	2.81 (7.53)	3.08 (9.00)	3.13 (9.33)	3.34 (10.67)	3.38 (11.00)	3.43 (13.67)	3.62 (12.67)	3.76 (13.67)	3.72 (13.33)	4.28	30.7	62.9
T_7	1.86 (3.00)	2.26 (4.67)	2.53 (6.00)	2.71 (7.00)	2.85 (7.67)	2.72 (9.00)	2.78 (7.33)	2.85 (7.67)	3.29 (10.33)	2.87	18.7	75.1
T_8	1.74 (2.67)	2.11 (4.00)	1.86 (3.00)	2.61 (6.33)	2.00 (3.67)	2.24 (10.00)	2.91 (8.00)	2.67 (6.67)	3.02 (08.67)	3.30	16.9	71.4
T_9	2.22 (4.50)	2.54 (6.00)	2.67 (6.67)	1.46 (1.67)	2.66 (6.67)	2.84 (8.00)	2.00 (4.00)	3.08 (9.00)	3.28 (10.33)	2.13	19.4	81.5
T_{10}	1.37 (1.40)	1.34 (1.33)	1.56 (2.00)	1.41 (1.50)	1.56 (2.00)	2.02 (4.33)	1.56 (2.00)	2.11 (4.00)	2.47 (5.67)	1.58	7.4	86.3
T_{11}	0.71 (0.00)	0.71 (0.33)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.88 (0.67)	0.71 (0.00)	0.88 (0.33)	1.05 (0.67)	0.00	0.0	100.0
T_{12}	5.18 (26.67)	5.78 (33.33)	5.99 (35.67)	5.18 (26.67)	5.14 (26.00)	5.24 (29.00)	4.73 (22.0)	5.23 (27.33)	5.27 (27.67)	11.53	33.3	0.0
SEm(±)	**0.21**	**0.20**	**0.16**	**0.17**	**0.17**	**0.22**	**0.24**	**0.19**	**0.20**	**0.26**		
LSD (0.05)	**0.62**	**0.57**	**0.48**	**0.51**	**0.49**	**0.64**	**0.69**	**0.57**	**0.59**	**0.77**		

Note: *Figures in the parenthesis indicates the square root transformed value.*

kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS). Similarly, next to the weed free (T_{11}), minimum WI was obtained with the treatment T_{10} (HW and IC at 20 and 40 DAS), closely followed by T_2 (Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS) and T_4 (Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence fb HW and IC at 30 DAS). This might be due to elimination of weeds by manual weeding and herbicides. The combined effect on dry weight of weeds and seed yield under these treatments might have been responsible for excellent weed indices. These findings are in close conformity with those reported by Negi *et al*. (2001), Bharat and Dawson (2005), Bharat *et al.* (2006), Tewari *et al.* (2008) and Kumar and Singh (2014).

It can therefore be concluded that effective management of weeds with profitable production of *rabi* field pea on clayey soil under south Saurashtra Agro-climatic conditions can be obtained by keeping the crop weed free throughout crop period or adopting 2 HW and IC at 20 and 40 DAS. Alternatively, application of Pendimethalin 0.75 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS or Oxyfluorfen 0.18 kg ha^{-1} as pre-emergence *fb* HW and IC at 30 DAS can be employed according to availability of labourers.

REFERENCE

Bharat, R. and Dawson, J.O.Y. 2005.Effect of herbicides either alone or with manual weeding on weeds in field pea (*Pisum sativum* L.). *Env. Eco.,* **23**: 459-63.

Bharat, R. Dawson, J. and Singh, S.S. 2006.Effect of different weed control methods on weed density, weed dry weight and yield of field pea (*Pisum sativum* L.) cv. Rachna. *Env. Eco.,* **24**: 839-42.

Gill, G.S. and Kumar, V. 1969. Weed index a new method for reporting weed control trails. *Indian J. Agron.,* **16**: 96-98.

Kondap, S.M. and Upadhyay, U.C. 1985. *A Practical Manual of Weed Control.* Oxford and IBH Publ. Co., New Delhi.

Kumar, P. and Singh, R.K. 2014. Effect of agri-horti systems and weed management practices on densityand biomass of weeds in mungbean in Eastern Uttar Pradesh. *J. Crop Weed,* **10**: 152-56.

Negi, S.C., Rana, M.C. and Rana, R.S. 2001. Chemical weed control in peas in dry temperate zone of Himachal Pradesh. *Agric. Sci. Digest,* **21**: 135-36.

Patro, H., Alim, M.A., Nanda, S.S. and Behura, A.K. 2014. Integration of chemical and cultural methods for weed management in *kharif* groundnut. *J. Crop Weed,* **10**: 461-65.

Ram, B.; Punia, S.S.; Meena D.S. and Tetarwal J.P. 2011.Bio-efficacy of post emergence herbicides to manage weeds in field pea. *J. Food Leg.,* **24**: 254-57.

Rana, M.C.; Manu, N.; Rana, S.S. and Sharma G.D. 2013. Influence of post-emergence herbicides on weeds and productivity garden pea under mild hill conditions of Himachal Pradesh. *Indian J. Agron.*, **58**:226-30.

Singh, H. and Angiras, N.N. 2004. Weed management studies in garden pea (*Pisum sativum* subsp. *Hortens* L.). *Indian J. Weed Sci.*, **36**:135-37.

Tewari, A.N.; Tripathi, A.K.; Sanjay, S. and Batham, A.K. 2008. Weed management in field pea with special reference to wild safflower. *Indian J. Weed Sci.,* **40**:140-43.

Ved, V.; Pandey, A.K.; Singh, R.D. and Mani, V.P. 2000. Integrated weed management in garden pea under mid hills of North West Himalayas. *Indian J. Weed Sci.*, **32**: 7-11.