

WEED MANAGEMENT IN FIELD PEA (*PISUM SATIVUM* L.)

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ABSTRACT

An experiment was conducted to evaluate the efficacy of different weed management practices using pre-plant incorporation (Chlorimuron-ethyl), pre-emergence (Pendimethalin and combination of Pendimethalin + Imazethapyr) and Post-emergence (Quizalofop ethyl and Imazethapyr) herbicides and their mixtures along with hand weeding and unweeded check in fieldpea under irrigated conditions for three consecutive years during *rabi* 2011-12 to 2013-14. The experiment field was infested with major weeds viz., *Ameranthus viridis* (37.90 %) and *Chinopodium album* (34.95 %). The higher seed yield was found in hand weeding twice at 20 and 40 DAS (3798 and 3464 kg/ha during year II and III, respectively). Similarly, pooled seed yield (3500 kg/ha) was higher in hand weeding twice at 20 and 40 DAS. Among the herbicidal treatments, Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence recorded higher seed yield (3475 kg/ha) due to lower dry weight of weeds (0.36 g/m²), higher weed control efficiency (95.76 %) at 30 DAS and lower weed index (0.70 %). The use of hand weeding twice at 20 and 40 DAS or herbicide combination Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence in chemical approach therefore recommended for better yield of fieldpea.

INTRODUCTION

India is deficient in pulse production rather than India is the 5th largest producer of peas in the world. Fieldpea or dry pea (*Pisum sativum* L.) is the one of the most important *rabi* season pulse crop in India covering 0.96 million hectare area with 0.92 million tons production (Anonyms, 2014). Its cultivation mainly confined to northern and central parts of the country where it is well known with common name 'matar'. The major growing states are Uttar Pradesh and Madhya Pradesh that contribute about 75 % of total production. Pea is commonly used in human diet throughout the world and it is rich in protein (21-25 %), carbohydrates, vitamin A and C, Ca, phosphorous and has high levels of amino acids lysin and tryptophan (Bhat *et al.*, 2013). It is used as a vegetable, fresh, frozen or canned in the off season and also grown to produce dry peas like the split pea. The dry grains are consumed in various forms such as chat, chhola, dal, flour and in other culinary preparations (Mishra, 2014). Its cultivation maintains soil fertility through biological nitrogen fixation in association with symbiotic *Rhizobium* prevalent in its root nodules and thus plays a vital role in fostering sustainable agriculture (Negi *et al.*, 2006).

Amongst agronomic factors known to augment crop production appropriate weed management is considered to be important. Poor weed management is one of the important factor for low yield. Slow growth at initial stages of the crop favors recurrent flushes of weeds, weeds have the characteristics of quick germination and fast seedling growth, on account of which they exploit the habitat very efficiently and do not allow the crop plant to make a complete seizure of

the land in the early stage of crop growth. Which compete with crop for essentials of growth and cause heavy reduction in its seed yield (Punia *et al.*, 2011), the magnitude of losses caused by weeds, however, depends largely on weed flora and intensity in the field. In agriculture, weed causes more damage as compared to insects and diseases but due to hidden loss by weeds in crop production, it has not drawn much attention of agriculturist. Thus, to avoid weed competition, through manually, mechanically or in combination weeding at 30 and 45 DAS is generally recommended and adopted by most of the farmers. But due to rapid industrialization, increased literacy and migration towards cities, availability of labour is declining day by day. Besides this, with the adoption and cost is increasing at the rapid rate and most of the farmers fail to carry out agricultural operations timely. Thus, to combat this situation there is need to evolve weed management practices and use of herbicides offer an excellent and economic opportunities (Vaghasia *et al.*, 2015). The objective of present experiment was to evaluate the efficacy of some pre and post-emergence herbicides alone and in combination for effective weed control and higher seed yield in fieldpea.

MATERIALS AND METHODS

The present investigation was conducted at Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during *rabi* season 2011-12, 2012-13 and 2013-14. The soil of experimental site was loamy sand in texture with 7.46 pH, low in organic carbon (0.21 %), low in available nitrogen (156 kg ha⁻¹), medium in available P₂O₅ (45 kg ha⁻¹) and available K₂O (199.5 kg ha⁻¹). Fieldpea

variety Dantiwada Fieldpea 1 (DF 1) was sown at last week of October with line sowing method in randomized block design with ten treatments and three replications. The experiment consist of ten treatments *viz.*, T₁: Quizalofop ethyl @ 50 g /ha at 30 days after sowing, T₂: Quizalofop ethyl @ 60 g /ha at 30 days after sowing, T₃: Imazethapyr @ 50 g /ha at 30 days after sowing, T₄: Imazethapyr @ 75 g /ha at 30 days after sowing, T₅: Chlorimuron ethyl @ 4.0 g /ha at pre plant incorporation, T₆: Pendimethalin @ 1.0 kg/ha as pre emergence, T₇: Pendimethalin + Imazethapyr @ 0.75 kg/ha at pre emergence, T₈: Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence, T₉: Hand weeding twice at 20 and 40 days after sowing and T₁₀: Weedy check. Recommended dose of fertilizers Nitrogen (20 kg ha⁻¹) and P₂O₅ (40 kg ha⁻¹) were applied as basal through urea and DAP, respectively. Herbicides were applied with their respective doses as per treatments, pre-emergence herbicide was sprayed at 1 day after sowing and post-emergence herbicide sprayed at 30 days after sowing. Spraying was done with flat fan nozzle with knapsack sprayer using 500 liter water per hectare. Weed flora and dry weight of weeds were taken using quadrat of 0.25 m² size at 30 days after sowing. Collected weed samples were oven dried at 70°C for three days and dry weight of weeds were recorded one day after removal from oven, and expressed in g m⁻². Weed data were subjected to square root transformation ("x + 0.5) for uniformity before statistical analysis (Steel and Torrie, 1982). Yield attributing characters, seed and vine yield recorded as per standard practices and presented for subsequent analysis. Rests of the agronomical practices were carried out as per recommendation adhering to the schedule. The weed control efficiency (WCE) and weed index (WI) for each treatment was worked out on the basis of formulas (Kondap and Upadhyay, 1985 and Gill and Kumar, 1969, respectively).

$$WCE(\%) = \frac{DWC - DWT}{DWC} \times 100$$

Where, DWC = Dry weight of weeds in unweeded control

plot DWT = Dry weight of weeds in treated plot

$$WI(\%) = \frac{X - Y}{X} \times 100$$

Where,

X = Maximum yield from the treatment

Y = Yield from the treated plot for which WI to be worked out

RESULTS AND DISCUSSION

Effect on weeds

The dominant weed flora in the experimental field was *Chinopodium album* (34.95 %), *Ameranthus viridis* (37.90 %), *Cyprus rotundus* (14.19 %), *Tribulus terrestris* L. (7.67 %), *Boerhavia diffusa* (2.34 %), *Phyllanthis niruri* (1.76 %) and *Leucas aspera* (1.17 %). Significantly lowest dry weight of weeds was found in hand weeding twice at 20 and 40 DAS (0.00) which was followed by the application of pendimethalin + imazethapyr @ 1.0 kg/ha at pre emergence (0.36 g/m²) and application of pendimethalin + imazethapyr @ 1.0 kg/ha at pre emergence also recorded higher weed control efficiency (95.76 %) and lower weed index (0.70 %) at 30 DAS.

At all the stages, hand weeding twice at 20 and 40 DAS (T₉) gave the best management of monocot and dicot weeds than other treatments because initially weeds were controlled by interculturing and hand weeding carried out at 20 DAS and whatever weeds emerged later were effectively removed by subsequent interculturing and hand weeding carried out at 40 DAS. Effective control of weeds through cultural practices was also reported by (Rajput and Kushwah, 2004) and (Goud *et al.* (2013). Pendimethalin + Imazethapyr @ 0.75 kg/ha at pre emergence (T₇) at earlier stage was found more effective for controlling the monocot and dicot weed population. In the long run, this pre-mixture was found more effective for controlling monocot weeds as well as dicot weeds. This might be due to the broad spectrum control of weeds because of combination of two herbicides with different mode of action

Table 1: Effect of different weed control treatments on seed yield, vine yield, weed control efficiency and weed index in fieldpea

Treatment	Seed yield (kg ha ⁻¹)				Vine yield (kg ha ⁻¹)	WCE (%)	Weed index (%)	Weed dry matter 30 DAS (g/m ²)
	2011-12	2012-13	2013-14	pooled				
T ₁ :Quizalofop ethyl @ 50 g /ha at 30 DAS	2654	3274	2889	2939 ^{ab}	3439	25.89	16.03	1.87 (2.99)
T ₂ :Quizalofop ethyl @ 60 g /ha at 30 DAS	2606	3346	2871	2941 ^{ab}	3572	48.23	15.98	1.62 (2.11)
T ₃ :Imazethapyr @ 50 g /ha at 30 DAS	3025	3429	3205	3220 ^a	3819	75.85	8.01	1.75 (2.56)
T ₄ :Imazethapyr @ 75 g /ha at 30 DAS	2838	3406	3075	3106 ^{ab}	3876	67.08	11.25	1.37 (1.36)
T ₅ : Chlorimuron ethyl@ 4.0 g /ha at pre plant incorporation	2692	1994	1032	1906 ^c	2470	90.22	48.94	0.93 (0.99)
T ₆ :Pendimethalin @ 1.0 kg/ha as pre emergence	3258	3459	3240	3319 ^a	4061	90.33	5.17	1.25 (1.07)
T ₇ :Pendimethalin + Imazethapyr @ 0.75 kg/ha at pre emergence	3165	3606	3208	3326 ^a	4036	93.29	4.96	1.24 (1.04)
T ₈ : Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence	3358	3662	3407	3475 ^a	4258	95.76	0.7	1.22 (0.36)
T ₉ :Hand weeding twice at 20 and 40 DAS	3237	3798	3464	3500 ^a	4386	95.04	0	0.71 (0.00)
T ₁₀ :Weedy check	2106	2886	2720	2571 ^b	2975	0	26.55	2.18 (4.24)
SEm ±	160.5	134.61	180.48	92.17	130.15	-	-	0.08
C. D. (0.05 %)	477	400	536.2	261.34	369.01	-	-	0.23
C. V. (%)	9.61	7.1	10.87	9.16	10.62	-	-	15.16
Y × T	-	-	-	452.66	639.15	-	-	0.39

*Figures in the parenthesis are original values. Weed dry matter at 30 DAS is subjected to transformed values to square root ("x + 0.5).

Table 2: Effect of different weed control treatments on growth and yield attributes in fieldpea (pooled data of three years)

Treatment	Plant height (cm)	No. of branches/plant	No. of pods/plant	Pod length (cm)	No. of seeds/pod	100 seed weight(g)
T ₁ : Quizalofop ethyl @ 50 g/ha at 30 DAS	69.16	2.4	19.47	5.86	5.11	17.09
T ₂ : Quizalofop ethyl @ 60 g/ha at 30 DAS	65.02	2.47	20.11	5.79	5.07	16.97
T ₃ : Imazethapyr @ 50 g/ha at 30 DAS	63.28	2.54	21.13	5.89	5.11	17.49
T ₄ : Imazethapyr @ 75 g/ha at 30 DAS	66.09	2.56	20.89	5.89	5.33	17.08
T ₅ : Chlorimuron ethyl @ 4.0 g/ha at pre plant incorporation	34.38	1.44	15.5	5.24	4.66	16.5
T ₆ : Pendimethalin @ 1.0 kg/ha as pre emergence	70.71	2.91	24.16	5.82	5.52	17.64
T ₇ : Pendimethalin + Imazethapyr @ 0.75 kg/ha at pre emergence	69.4	2.76	25.1	6.03	5.53	17.92
T ₈ : Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence	70.32	3.18	26.51	6.12	5.67	18.11
T ₉ : Hand weeding twice at 20 and 40 DAS	71.67	3.06	26.99	6.01	5.86	18.17
T ₁₀ : Weedy check	69.11	2.09	15.91	5.63	5.02	16.76
SEm ±	1.51	0.11	0.6	0.09	0.12	0.14
C. D. (0.05 %)	4.28	0.32	1.71	0.24	0.34	0.41
C. V. (%)	6.97	13.32	8.37	4.39	6.83	2.48
Y × T	4.42	0.55	2.96	0.42	NS	0.7

and decreasing residual effect of pendimethalin and prolonged residual effect of imazethapyr. This difference might be due to the effectiveness of herbicide towards different weed species. The similar trend was found by (Ram *et al.*, 2012), (Jha and Soni, 2013) in case of pendimethalin + imazethapyr (pre-mixed).

Effect on crop

All the weed control treatments significantly improved the yield and yield attributing parameters over unweeded control. The results of the present experiment showed that the plant height, number of pods per plant, number of seeds per plant and 100 seed weight of fieldpea were recorded higher at harvest under hand weeding at 20 and 40 days after sowing due to weed free environment and less competition provides better growth to crop and these growth and yield attributing parameters significantly remained at par with Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence (Table 2). In case of number of branches per plant and pod length was recorded higher in the herbicidal application of Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence which was statically at par with hand weeding at 20 and 40 days after sowing (Table-2). The higher fieldpea seed yield during the study period was found in hand weeding twice at 20 and 40 DAS (3798 and 3464 kg/ha during year II and III, respectively). Similarly, pooled mean of seed yield (3500 kg/ha) was higher in hand weeding twice at 20 and 40 DAS. Among the herbicidal treatments, Pendimethalin + Imazethapyr @ 1.0 kg/ha at pre emergence recorded higher seed yield (3475 kg/ha). However, this was at par with application of Pendimethalin + Imazethapyr @ 0.75 kg/ha at pre emergence (3326 kg/ha) and Pendimethalin @ 1.0 kg/ha as pre emergence (3319 kg/ha) and hand weeding twice at 20 and 40 DAS also recorded higher vine yield (4386 kg/ha) (Table -1).

Whereas application of chlorimuron ethyl @ 4.0 g/ha at pre plant incorporation recorded the lowest yield attributes, seed and vine yield of fieldpea may be the phytotoxic effect on crop. Removal of weeds at early stage in the season reduced crop weed competition at the lowest possible limit and provided

almost weed free environment. Due to controlling weeds, higher growth and yield parameters of fieldpea were probable reasons for higher seed yield in hand weeding twice at 20 and 40 days after sowing treatment. These results are in accordance with the findings of (Yadav *et al.*, 2011) and (Soltani *et al.*, 2012). The pre-emergence application of pendimethalin + imazethapyr (pre-mixed) gave excellent control and suppression of weeds in the season was probably effective against secondary weed emergence at 10 to 15 DAS stage onwards due to persistent of imazethapyr for long period. The weed management schedule having low weed biomass and higher weed control efficiency would provide favorable situation for maximization of fieldpea yield potential. Results were conformity with the finding of (Yadav *et al.*, 2011) and (Jha and Soni, 2013).

In the light of the results obtained from the present investigation, it is concluded that, hand weeding twice at 20 and 40 DAS and in chemical approach application of Pendimethalin + Imazethapyr @ 0.75 kg/ha at pre emergence is better for effective weed control and securing higher yield of fieldpea.

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