

Crop-Weed Competition Studies in Gardenpea (*Pisum sativum*) under Mid-Hill Conditions of North-West Himalayas

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ABSTRACT

A set of eight treatments comprising weedy and weed-free conditions upto 30, 60 and 90 days after sowing and upto harvest was evaluated at the experimental farm, Hawalbagh of Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora during winter (**rabi**) seasons of 1999-2000 and 2000-01 to find out the critical period of crop-weed competition in gardenpea [*Pisum sativum* (L.) sub sp. *hortense* Asch and Graebn]. Weed competition index increased with an increase in duration of weedy condition ranging from 1.4 to 34.7 during winter 1999-2000 and 5.4 to 48.7 during winter 2000-01. On the other hand, increase in weed-free period from sowing to harvest decreased weed competition index to 2.0 from 34.7 during winter 1999-2000 and 3.3 from 48.7 during winter 2000-01. Weed-free condition beyond 60 days after sowing did not bring significant improvement in green pod yield. The highest additional net returns (Rs. 6,374/ha) and additional net returns/rupee invested (0.64) were recorded where the plots were kept weed-free upto 60 days after sowing. The critical period for crop-weed competition was observed to be between 30-60 days after sowing when the crop should be kept free from weeds to prevent the potential yield loss and to economize weeding in gardenpea.

INTRODUCTION

Among the several factors responsible for low yield of winter legumes, competition due to weeds is the important one. Uncontrolled weed growth in pea has been reported to cause yield reductions from 37.3 to 64.4% (Kundra *et al.*, 1993; Tewari *et al.*, 1997; Banga *et al.*, 1998). Gardenpea is an important off-season vegetable, which is widely grown as cash crop during winter and summer in north-west Himalayan region. Farmers get more profit from summer crop because of very high selling prices owing to their great demand and scarcity in the market during that period. Slow initial growth, wider spacing and fairly good application of FYM alongwith inorganic fertilizers provide congenial environment for weeds. Removal of weeds throughout the crop season may not be beneficial and economical. It is, therefore, utmost important to know the critical period of crop-weed competition to optimize herbicide use or adopt integrated weed management practices. Information on this aspect particularly in hills of Uttaranchal is meagre. Hence, the present investigation was undertaken to find out the critical period for crop-weed competition in gardenpea.

MATERIALS AND METHODS

Field experiment was conducted during winter

seasons of 1999-2000 and 2000-01 at Experimental Farm, Hawalbagh (29°36' N latitude, 79°40' E longitude, 1250 m above msl) of Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora, Uttaranchal. The soil of the experimental site was sandy loam, neutral in reaction, medium in available N (410.5 kg/ha), P (21.7 kg/ha) and K (202.3 kg/ha). Eight treatments comprising the weedy and weed-free conditions up to 30, 60 and 90, days after sowing and upto harvest were evaluated in randomized block design with three replications. The gardenpea variety 'VL Ageti Matar 7' was planted in rows 30 cm apart on November 14 and December 16 during winter 1999-2000 and 2000-01, respectively, using 80 kg seed/ha. Well decomposed FYM @ 10 t/ha was applied uniformly at the time of field preparation. In addition, the crop was fertilized with 20 kg N, 26 kg P and 33.33 kg K/ha as basal dose. Required amount of N, P and K nutrients was supplied through urea, single superphosphate and muriate of potash, respectively. Weed removal as per treatment was done with the help of local weeding tool 'Kutla'. The recommended cultural practices and plant protection measures were followed to raise the healthy crop. Two quadrates of 25 x 25 cm were placed randomly in each plot and weeds within the quadrates were removed and after drying in hot air oven (70±1°C for 72 h), weed dry weight was recorded. In case of initial weed-free treatments, total dry matter accumulation of weeds was recorded only at harvest.

However, in case of weed infested treatments, it was at their respective period of completion. Effects of crop-weed competition on yield and yield attributes were also recorded.

RESULTS AND DISCUSSION

Weed Flora

The predominant weed species infesting the crop were : *Polygonum plebejum*, *Anagallis arvensis*, *Stellaria media*, *Melilotus indica*, *Fumaria parviflora*, *Galinsoga parviflora* and *Avena ludoviciana*. The other weeds were : *Oxalis latifolia*, *Vicia sativa* and *Medicago denticulata*.

Effect on Dry Weight of Weeds

Dry weight of weeds was significantly

Table 1. Dry weight of weeds, green pod yield and weed competition index as influenced by crop-weed competition

Treatment	Weedy dry weight (g/m ²)			Green pod yield (t/ha)			Weed competition index		
	1999-2000	2000-01	Mean	1999-2000	2000-01	Mean	1999-2000	2000-01	Mean
Weedy period (DAS)									
0-30	9.6	13.3	11.4	10.18	5.26	7.72	1.4	5.3	3.4
0-60	102.4	165.6	134.0	8.05	3.96	6.01	21.9	28.7	25.3
0-90	150.0	229.6	189.8	7.06	2.89	4.97	31.6	48.0	39.8
Upto harvest	200.6	280.2	240.4	6.74	2.85	4.80	34.7	48.7	41.7
Weed-free period (DAS)									
0-30	189.4	255.8	226.6	8.39	3.78	6.08	18.7	32.0	25.4
0-60	83.2	120.2	101.7	9.79	5.26	7.52	5.1	5.3	5.2
0-90	24.0	41.9	32.9	10.11	5.37	7.74	2.0	3.3	2.7
Upto harvest	0	0	0	10.32	5.56	7.94	-	-	-
LSD (P=0.05)	65.7	80.4	-	1.36	1.19	-	-	-	-

Effect on Yield Attributes

Yield attributes viz., number of pods/plant, pod weight/plant, pod length, number of grains/pod, total soluble solids and shelling percentage were influenced significantly due to different weed-free and weedy periods in both the years. Values of all the yield attributes increased with increase in duration of weed-free condition and decreased with increased weedy period. However, this increase and decrease in all the yield attributes was significant upto 60 days after sowing due to increase in weed-free and weedy period, respectively. Maximum values for all above attributes were recorded in plots kept weed-free till harvest (Table 2) which resulted in

influenced due to crop-weed competition period in both the years. It decreased with increase in duration of weed-free condition, whereas the weeds dry matter accumulation increased with increase in weedy duration (Table 1). However, decrease or increase in dry matter accumulation of weeds was significant upto 60 days after sowing due to increase in duration of weed-free and weedy condition, respectively. The lowest dry weight was recorded in the plots which were kept weed-free upto harvest and was statistically at par with the plots kept weed-free upto 90 days after sowing and weedy till 30 days after sowing. These results are in close conformity with the findings of Singh *et al.* (1991). Weed competition index increased as the duration of weedy condition was extended. On an average, weed competition index was maximum when weeds were allowed to grow upto harvest (41.7) compared to weed-free condition till harvest. Ved Prakash *et al.* (2000) also reported similar results.

significant improvement in yield over weedy upto 60, 90 days after sowing and upto harvest. Remarkable improvement in yield and yield attributes due to weed control treatments over weedy check was also reported by Rana (2002). Tripathi *et al.* (1991) and Ved Prakash *et al.* (2000) also reported similar results. The minimum values for all the yield attributes, however, were registered in the weedy plots upto harvest.

Effect on Green Pod Yield

Green pod yield increased with increase in duration of weed-free condition and decreased with increased weedy duration during both the years (Table

Table 2. Yield attributes as influenced by crop-weed competition

Treatment	No. of pods/plant		Pod weight/plant (g)		No. of grains/pod		Pod length (cm)		T. S. S.		Shelling (%)							
	1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01	1999-2000	2000-01						
Weedy period (DAS)																		
0-30	14.8	7.9	11.4	41.0	21.0	31.0	6.5	5.9	6.2	8.0	6.9	7.5	23.4	19.2	21.3	47.1	42.8	45.0
0-60	13.6	6.2	10.0	37.0	18.0	27.5	5.8	5.4	5.6	7.6	6.3	7.0	21.3	18.4	19.9	42.3	40.0	41.2
0-90	12.4	5.9	9.2	34.0	16.0	25.0	5.6	5.0	5.3	7.4	6.1	6.8	19.6	18.1	18.9	41.8	39.0	40.4
Upto harvest	11.8	5.6	8.7	32.5	14.8	23.7	5.4	5.0	5.2	7.3	6.1	6.7	19.4	18.0	18.7	41.6	38.5	40.0
Weed-free period (DAS)																		
0-30	13.0	6.0	9.5	36.0	17.8	26.9	5.7	5.3	5.5	7.5	6.5	7.0	21.0	18.4	19.7	42.0	39.0	40.5
0-60	14.4	7.3	10.9	41.4	20.9	31.2	6.3	5.8	6.1	7.9	6.8	7.4	23.1	19.1	21.1	45.3	42.9	44.1
0-90	14.6	7.5	11.1	42.0	21.0	31.5	6.4	5.9	6.1	8.0	6.9	7.5	23.5	19.5	21.5	47.0	42.9	45.0
Upto harvest	14.8	8.0	11.4	42.0	22.0	32.0	6.5	6.0	6.2	8.1	7.0	7.6	23.6	19.6	21.6	47.5	43.0	45.3
LSD (P=0.05)	1.3	1.2	-	3.3	2.4	-	0.5	0.4	-	0.3	0.2	-	2.0	0.6	-	3.0	2.7	-

1). Decrease in green pod yield with delayed weed removal was attributed to increased weed competition as progressive increase in dry matter accumulation by weeds was observed (Table 1). Weedy condition up to 30 days after sowing only had no significant competition with crop and produced green pod yield at par with that of whole season weed-free condition which was due to low magnitude of weed infestation. However, the green pod yield reduced significantly when weedy period increased from 30 days after sowing to 60 days after sowing. Weed-free condition upto 60 days after sowing and thereafter, unchecked weed growth till harvest yielded at par with that of whole season weed-free condition. Bhyan *et al.* (2004) also reported similar results in pea. The green pod yield reduced by 1.4, 21.9, 31.6, 34.7% during 1999-2000 and 5.3, 28.7, 48.0 and 48.7 % during 2000-01 due to uninterrupted weed growth upto 30, 60, 90 days after sowing and harvest, respectively, compared to weed-free condition upto harvest. Banga *et al.* (1998) and Tripathi *et al.* (2001) have also reported 59.5 to 64.4 and 77.2% yield reduction, respectively, in pea due to season long crop-weed competition. On the other hand, enhancement in green pod yield due to weed-free condition upto 30, 60, 90 days after sowing and harvest over full season weedy condition was 32.5, 84.4, 88.3 and 94.8% during 1999-2000 and 24.5, 45.3, 50.0 and 53.2% during 2000-01, respectively. This was understandably due to the reduced crop-weed competition and improvement in yield attributes (Table 2) in these treatments. Ved Prakash and Pandey (2001) also reported similar results in fieldpea. However, the highest green pod yield was obtained when the plots were kept weed-free upto harvest which was significantly higher than the yield obtained under the

weedy plots upto 60, 90 days after sowing and harvest and weed-free plots upto 30 days after sowing during both the years. Weed-free condition beyond 60 days after sowing could not bring further significant improvement in green pod yield. It appears that the crop required initial weed-free period of 60 days and weeds emerging after 60 days of sowing had no adverse effect on the crop. Similar results have also been reported by Tripathi *et al.* (2001).

Monetary Returns

Additional mean gross returns compared to plots kept weedy upto harvest increased with increase in duration of weed-free conditions and decreased with increased weedy period (Table 3). In case of additional mean net returns and net returns/rupee invested, they increased with increase in duration of weed-free period upto 60 days after sowing and decreased with increased weedy period. The additional net returns over weedy check ranged from Rs. 6938 to 6374/ha being highest under weed-free upto 60 days after sowing and lowest under weedy upto 90 days after sowing. Weed-free conditions beyond 60 days after sowing could not enhance the additional net returns and net returns/rupee invested mainly because of higher labour cost involved in repeated manual weeding for maintaining weed-free conditions upto harvest. Ved Prakash *et al.* (2000) also reported lower benefit : cost ratio under repeated manual weeding. The additional net returns and net returns/rupee invested decreased markedly when the plots were kept weedy beyond 30 to 90 days after sowing. It might be due to drastic reduction in green pod yield because of severe crop-weed competition. The highest additional

Table 3. Monetary returns as influenced by crop-weed competition

Treatment	Additional green pod yield (t/ha)	Additional gross returns (Rs./ha)	Treatment cost (Rs./ha)	Additional mean net return (Rs./ha)	Additional net returns/rupee invested
Weedy period upto					
30 DAS	2.92	17538	14000	3538	0.25
60 DAS	1.46	8784	10000	-1216	- 0.12
90 DAS	0.18	1062	8000	-6938	- 0.87
Harvest	-	-	-	-	-
Weed-free period upto					
30 DAS	1.30	7800	5200	2600	0.50
60 DAS	2.73	16374	10000	6374	0.64
90 DAS	2.95	17670	14000	3670	0.26
Harvest	3.14	18852	15200	3652	0.24

net returns/rupee invested (0.60) was recorded where the plots were kept weed-free upto 60 days after sowing, whereas it was lowest (-0.87) under the plots where weeds were not removed till 90 days after sowing.

Thus, the results show that to realize the potential green pod yield and higher monetary returns of gardenpea, crop should be kept weed-free upto initial 60 days after sowing, which is more crucial from crop-weed competition point of view.

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