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Full Length Research Paper

Effect of weed-crop competition on growth and yield of garden cress (*Lepidium sativum* L.)

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A field experiment to find out the effect of weed-crop competition duration that is, zero competition, competition for 40, 50, 60, 70 and 80 days after emergence and competition throughout the growing season on the growth and yield of *Lepidium sativum* L. was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad. The dominant weeds were *Phalaris minor*, *Anagallis arvensis*, *Chenopodium album*, *Convolvulus arvensis* and M*edicago denticulata*. Maximum density and dry weight of the weeds were recorded in plots with competition throughout the season and the minimum was observed in weed-crop competition for 40 days after emergence. The maximum seed yield was recorded in plots where weeds were not allowed to grow throughout the growing season. The increase in yield was mainly due to greater plant height, number of branches per plant and number of seed per plant. The minimum was recorded in plots where weeds were allowed to compete with the crop throughout the growth period of crop. For obtaining higher yield of the garden, cress weeds may be controlled before 40 days after emergence as it was the critical period of competition.

Key words: Garden cress, weeds, competition duration, growth, yield.

INTRODUCTION

Garden cress (*Lepidium sativum* L.) locally known as Haloon belonging to family Brassicaceae which is native to Southwest Asia and spread to Western Europe. The young leaves were used for salads. The seeds are used as aphrodisiac, edible oil was also obtained from the seeds. It has some medicinal properties as an antiscorbutic, incites coitus and stimulates the appetite. Some Arab scholars have attributed garden cress reputation among Muslims to the fact that it was directly recommended by the Prophet. It is a low yielding crop and the causes of its low yield are sowing on marginal land, low and imbalanced use of fertilizer, improper sowing method and weed infestation etc. Weed competition has become a major constraint in limiting yield of any crop. Weeds compete with crop for space, light, moisture and nutrients, and reduce the crop yield by 17 to 25% (Shad, 1987). During the crop growth period there is a certain time known as critical period of weed-crop competition when crop plants are most sensitive to be affected by weeds. Critical period of weed-crop competition was determined between 30 to 60 DAS in wheat (Ahmad and Sheikh, 2003). As the interval between crop and weed emergence increases there is less likelihood that the weeds will impact yields (Kells, 1999). Critical period of competition varies from crop to crop depending on weed emergence time, weed type, weed density and management practices. It is important to determine critical period of weed-crop competition to plan effective weed control. The present study has, therefore, been designed to determine critical duration of weed-crop competition to plan an effective weed control and to asses yield losses by weeds in garden cress.

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MATERIALS AND METHODS

A field experiment to evaluate the effect of different weed-crop competition duration on the growth and yield of *L. sativum* L. was conducted at student farm, Department of Agronomy, University of Agriculture, Faisalabad during the year 2005 to 2006. The experiment was laid out in RCBD with four replications having net plot size measuring 5 × 1.8 m. The crop was sown in November,

2006 with a single row hand drill in 30 cm apart rows using seed rate 25 kg ha^{-1}. Plant to plant distance of 10 cm was maintained by thinning extra plants at early growth stages. The fertilizer was applied at the rate of 57 kg nitrogen ha^{-1} and 25 kg phosphorus ha^{-1}. Sources of nitrogen and phosphorus were urea and diammonium phosphate (DAP), respectively. Whole of phosphorus and half of nitrogen was side dressed with a single row hand drill at sowing while remaining half of nitrogen was top dressed at the time of 2nd irrigation. The treatments comprised of different weed-crop competition periods that is, zero competition, competition for 40, 50, 60, 70 and 80 days after emergence and competition throughout the growing season. Weeds were removed manually with a hand hoe from respective plots after prescribed duration and kept weed free till harvest.

Individual and total weed density and biomass were recorded from randomly selected area of one square meter at different places from each plot. Ten plants were selected at random to record plant height, fresh and dry weight per plant, number of branches per plant and number of seeds per plant. Five thousand seeds were taken from the yield of each treatment and were weighed separately using an electric balance for recording 1000-seed weight. Biological and seed yields were recorded on per plot basis and were converted to kg ha^{-1}. Data collected on growth and yield parameters of the crop were analyzed statistically by using Fisher's analysis of variance technique. Least significant difference (LSD) test at 0.05 probability levels was employed to compare the treatment means (Steel et al., 1997).

RESUTS AND DISCUSSION

Density of weeds (m^{-2})

Phalaris minor density was significantly affected by weed-crop competition durations (Table 1). There was a progressive increase in number of *P. minor* plants as weed-crop competition duration was increased. The maximum *P. minor* density (85.50) was found in plots where the weeds were allowed to compete throughout the season. Weed were absent in weed free plots because weeds were removed frequently. Minimum number of *P. minor* plants (73.75) was found in weed-crop competition duration of 40 days after emergence. *Chenopodium album* density was significantly affected by different weed-crop competition durations. The maximum number of *C. album* plants (9.75) was found in weedy check. The difference between weedy check and competition for 80 days after sowing were not significant. As the competition duration increased, the number of *Anagallis arvensis* also increased. The maximum *A. arvensis* density (8.25) was found in plots where *A. arvensis* plants were allowed to compete with crop for 80 days after emergence. However, the difference among weedy check, 70 and 80 days after sowing were not significant. The difference among the competition periods of 40, 50 and 60 days after emergence were not significant. Significantly higher *Convolvulus arvensis* density (6.50) was found in plots where *C. arvensis* was allowed to compete with crop throughout the growing season. The minimum number of *C. arvensis* (0.75) was found in competition duration of 40 days after emergence. *Medicago denticulate* plants were increased with the increase in competition duration period. Weedy check produce significantly more plants of *M. denticulate* than all other competition periods. The competition periods of 50 days after emergence have statistically same number of plants to competition period of 40 and 60 days after sowing.

Total weed density increased significantly with the increase in competition duration and increase was significant at each increase in duration period. The maximum (117.5) and minimum (82.75) weed density was obtained in plots with competition through out the season and for 40 days after emergence, respectively. Weedy check showed the maximum weed density because there was longer period available for weeds to germinate and weeds continued to germinate throughout the growth period. These results are in accordance with Tunio et al. (2004). Weed free plots showed minimum density because weeds were eradicated by repeated hand hoeing (Table 1).

Dry weight of weeds (g m^{-2})

Dry weight of *C. album*, *A. arvensis*, *C. arvensis* and *M. denticulate* was increased with the increase in competition period, being maximum (178.55) in weedy check and the minimum was in weed free plots and the trend was almost similar for all the weeds (Table 2). The maximum dry weight of weeds in weedy check might have been due to higher weed density (Table 1) and longer growth period resulting in more accumulation of photosynthates and greater biomass. Akhtar et al. (2000) also found that by increasing weed crop competition duration increased weed biomass.

Growth and yield parameters of garden cress

Effect of different weed-crop competition durations on number of plants per plot was non-significant. The uniform plant population can be attributed to use of uniform seed rate having same test weight and viability. In addition to this plant to plant distance was also maintained by thinning at early growth stages. Maximum plant height (118.8 cm) was observed in plots kept weed free throughout the growing period. This was statistically at par with competition duration of 40 days after emergence, while the minimum plant height (107.4cm) was observed in plots where weeds were allowed to compete with crop throughout the season but it was statistically similar with the competition durations of 80 days after emergence. These results are supported by (Martinkova and Honken, 2001). They reported decrease in plant height of maize with increase in competition duration. There is significant effect of weed-crop competition durations on number of branches per plant. A gradual and progressive decrease in number of branches per plant was recorded with increasing competition duration. Maximum number of branches (16.25) per

Table 1. Effect of competition duration on individual and total weed density in *Lepidium sativum* L.

Weed crop competition	Density of *P. minor* (m^2)	Density of *C. album* (m^2)	Density of *A. arvensis* (m^2)	Density of *C. arvensis* (m^2)	Density of *M. denticulata*	Total weed density (m^2)
Zero competition	00.00^{e}	00.00^{c}	00.00^{c}	00.00^{f}	0.00^{f}	00.00^{g}
WCC for 40 DAE	73.75^{d}	3.00^{d}	3.50^{b}	0.75^{ef}	1.75^{e}	82.75^{f}
WCC for 50 DAE	78.00^{c}	3.00^{d}	4.75^{b}	1.50^{de}	2.25^{de}	89.50^{e}
WCC for 60 DAE	81.75^{b}	4.75^{c}	4.25^{b}	3.50^{bc}	3.00^{cd}	97.25^{d}
WCC for 70 DAE	82.25^{b}	7.25^{b}	7.00^{a}	2.75^{cd}	3.50^{c}	102.75^{c}
WCC for 80 DAE	84.00^{ab}	9.00^{a}	8.25^{a}	4.50^{b}	5.25^{b}	111.00^{b}
Competition throughout the season	85.50^{a}	9.75^{a}	8.00^{a}	6.50^{a}	7.75^{a}	117.50^{a}
LSD	2.397	12.20	1.255	1.471	0.887	2.47

Table 2. Effect of competition duration on weeds dry weight (g m^{-2}) in *Lepidium sativum* L.

Weed crop competition	Dry weight of *P. minor* (g m^{-2})	Dry weight of *C.* album (g m^{-2})	Dry weight of *A. arvensis* (g m^{-2})	Dry weight of *C. arvensis* (g m^{-2})	Dry wt. of *M. denticulate* (g m^{-2})	Total dry weight of weeds (g m^{-2})
Zero competition	00.00^{g}	00.00^{e}	00.00^{d}	00.00^{e}	0.00^{c}	00.00^{f}
WCC for 40 DAE	12.73^{f}	9.63^{b}	0.88^{c}	6.68^{c}	0.77^{c}	30.69^{e}
WCC for 50 DAE	30.59^{e}	6.25^{cd}	1.47^{bc}	5.68^{cd}	1.05^{bc}	45.04^{d}
WCC for 60 DAE	49.67^{d}	4.38^{d}	1.62^{bc}	2.05^{de}	1.83^{abc}	59.55^{d}
WCC for 70 DAE	60.80^{c}	8.93^{bc}	2.15^{b}	3.45^{cde}	2.22^{abc}	77.55^{c}
WCC for 80 DAE	100.9^{b}	15.10^{a}	4.47^{a}	22.75^{a}	3.55^{ab}	146.77^{b}
Competition throughout the season	149.4^{a}	6.13^{cd}	5.04^{a}	13.76^{b}	4.22^{a}	178.55^{a}
LSD	5.484	3.132	0.769	4.381	2.557	2.946

plant was found in weed free treatment (zero competition). This was statistically at par with competition duration of 40 days after emergence and significantly different from rest of the treatments. The probable reason for higher number of branches per plant in short competition durations was the less time available for competition of resources between crop and weeds. Weeds were removed and plants achieved good growth rate and maximum assimilates may be formed which allowed good vegetative growth and higher number of branches per plant in return while minimum number of branches per plant was probably due to longer competition duration between crop and weeds and resources were not fully utilized by crop. The data on number of seeds per plant indicate significant effect of weed-crop competition durations on number of seeds per plant. Weed free treatment (zero competition) produce maximum number of seeds per plant (1030). The minimum number of seeds per plant (540) was obtained in plots where competition was through out the growing season. Absence of weeds in zero competition might have enabled the crop to make best use of growth resources that resulted in more number of seeds per plant. These results

Table 3. Effect of weed-crop competition on yield and yield components of *Lepidium sativum* L.

Weed crop competition	No of plants per plot	Plant height (cm)	No. of branches per plant	No. of seeds per plant	1000 seed weight (g)	B. yield (kg ha^{-1})	Seed yield (kg ha^{-1})	H.I. (%)
Zero Competition	304.0	118.8^{a}	16.25^{a}	1030^{a}	1.570	3750	305.9^{a}	8.27^{a}
WCC for 40 DAE	303.50	117.9^{ab}	15.0^{ab}	933.3^{b}	1.560	3750	298.3^{b}	7.81^{a}
WCC for 50 DAE	306.80	116.60^{bc}	14.0^{bc}	702.3^{c}	1.565	3750	233.5^{c}	6.25^{b}
WCC for 60 DAE	302.50	116.00^{c}	13.25^{c}	576.3^{d}	1.555	3611	227.7^{d}	6.33^{b}
WCC for 70 DAE	302.50	112.90^{d}	12.75^{c}	563.8^{e}	1.530	3611	222.2^{e}	6.24^{b}
WCC for 80 DAE	304.50	108.20^{e}	12.75^{c}	560.5^{e}	1.510	3472	214.3^{f}	6.19^{b}
Competition throughout the season	301.80	107.40^{e}	10.75^{d}	540.0^{f}	1.467	3472	201.6^{g}	5.83^{b}
LSD	-	1.931	1.372	6.537	-	-	4.316	1.144

are in accordance with Shafaat (1982). He found that increase in weed competition duration decreased the number of grains per ear. The data on 1000-seed weight was not influenced significantly (Table 3) by weed-crop competition durations and it ranged from 1.467 to 1.570 g. Biological yield was not influenced significantly by competition durations. The maximum (3750 kg ha^{-1}) and minimum (3472 kg ha^{-1}) biological yield was noted in zero competition and competition throughout the growing season.The data pertaining to seed yield of *L. sativum* reveal that seed yield was significantly affected by weed-crop competition durations. A linear decrease in seed yield was observed by increasing duration of weed-crop competition. Maximum seed yield of 305.9 kg ha^{-1} was obtained where there was no weed-crop competition and it was significantly higher than all the other treatments. The minimum seed yield (201.6 kg ha^{-1}) was recorded in full season competition. The decrease in seed yield with increasing weed-crop competition duration was due to decrease in the yield components like number of branches per plant and number of seed per plant. These results are supported by those of Ahmad and Shaikh (2003) and Welsh et al. (1999). They found that wheat yield decreased as the weed infested duration increased.

The harvest index was affected significantly by weed-crop competition. Maximum harvest index value was observed in weed free plots which were statistically similar with weed-crop competition for 40 days after emergence. Both these treatments were higher than all the treatments. Minimum harvest index was found in weed free plots. These results are in line with those of Sarwar (1994). He reported that harvest index was the highest in weed free plots and was lowest at high weed density.

Conclusion

It can be concluded from the results that for obtaining higher yield of *L. sativum* L. the weeds may be controlled before 40 days after emergence of the crop as it is found to be the critical period of weed crop competition.

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