EFFECT OF WEED-CROP COMPETITION ON GROWTH AND YIELD OF GARDEN CRESS

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ABSTRACT

A field experiment to evaluate the effect of weed-crop competition duration i.e. Zero competition and competition for 40, 50, 60, 70 and 80 days after emergence and throughout the growing season on the growth of weeds and yield of Lepidium sativum *L. was conducted during 2005-06 at the Agronomic Research Area, University of Agriculture, Faisalabad, Pakistan. The dominant weeds were Phalaris minor, Anagallis arvensis, Chenopodium album, Convolvulus arvensis and Medicago denticulata. Maximum density and dry weight of weeds were recorded in plots with competition throughout the season and the minimum was observed in weed-crop competition for 40 days after emergence. 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, branches and seeds per plant. The minimum seed yield was recorded in plots where weeds were allowed to compete with the crop throughout the growth period of the crop. For obtaining higher yield of garden cress it is suggested to control weeds before 40 days after emergence.*

Key words: **Garden Cress, Weeds, Competition Duration, Growth and Yield**

Citation: Shehzad, M., A. Tanveer, M. Ayub, K. Mubeen, M. Ibrahim, I. Qadir and N. Sarwar. 2013. Effect of weed-crop competition on growth and yield of Garden Cress. Sarhad J. Agric. 29(1): 79-82.

INTRODUCTION

Garden cress (*Lepidium sativum* L.) locally known as "Haloon" belongs to family Brassicaceae which is native to Southwest Asia and spread to Western Europe. The young leaves are used for salads. The seeds are used as aphrodisiac and edible oil is also obtained from the seeds. It has some medicinal properties as an antiscorbutic, incites coitus and stimulates the appetite. It is being cultivated as a minor crop in Pakistan. 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 17-25% (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 days after sowing (DAS) in wheat (Ahmad and Sheikh, 2003). The increase in interval between crop and weed emergence will have less impact on yields (Kells, 1999). Critical period of competition varies from crop to crop depending on weed emergence time, weed type, weed density and management practices. Therefore, 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 and to asses yield losses by weeds in garden cress.

MATERIALS AND METHODS

A field experiment to evaluate the effect of different weed-crop competition duration on the growth and yield of *Lepidium Sativum* L. was conducted at Agronomic Research Farm, University of Agriculture, Faisalabad, Pakistan during 2005-06. The experiment was laid out in RCBD with four replications having net plot size measuring 1.8 m×5 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. 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 broadcasted at the time of 2nd irrigation. The treatments comprised weed-crop competition periods of 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 three randomly selected places of one square meter from each plot. Ten crop 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 randomly 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 plot basis and then 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 and least significant difference (LSD) test at 0.05 probability level was employed to compare the treatment means (Steel *et al.*, 1997).

RESULTS 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 with increase in weed-crop competition duration. The maximum *P. minor* density (85.50) was found in plots where the weeds were allowed to compete throughout the season. No weed was recorded in weed free plots because weeds were removed frequently. Minimum numbers of *P. minor* plants (73.75) were 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 numbers of *C. album* plants (9.75) were 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. 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 also were not significant. Significantly higher C*onvolvulus arvensis* density (6.50) was found in plots where *C. arvensis* was allowed to compete with crop throughout the growing season. The minimum number (0.75) of *C. arvensis* plants were found in competition duration of 40 days after emergence. *Medicago denticulata* plants were increased with the increase in competition duration period. Weedy check produced significantly highest number of plants of *M. denticulata* among all other competition periods. The competition periods of 50 days after emergence have statistically similar plants to competition period of 40 and 60 days after sowing (Table-1).

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 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).

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 0.05	2.397	12.20	1.255	1.471	0.887	2.47

Dry Weight of Weeds (g m^{-2})

Dry weight of *C. album*, *A. arvensis*, *C. arvensis* and *M. denticulata* was increased with the increase in competition period, being maximum (178.55g) in weedy check and the minimum (30.69g) in weed crop competition for 40 DAE. The trend was almost similar for all the weeds (Table 2). Maximum dry weight of weeds in weedy check might have been due to higher weed density (Table 1) and longer undisturbed growth period resulting in more accumulation of photosynthates and greater biomass. Akhtar *et al*. (2000) have also obtained maximum dry weight of weeds in weedy check.

Table 2. ***Effect of competition duration on individual and total 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 0.05	5.484	3.132	0.769	4.381	2.557	2.946

Growth and Yield Parameters of Garden Cress

Effect of different weed-crop competition durations on number of plants per plot was not significant (Table 3). 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 (118.8cm) was observed in plots kept weed free throughout the growth period. The difference between zero competition and competition for 40 days after emergence were not significant. 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 confirm the findings of Martinkova and Honek (2001). They also reported decrease in plant height of maize with increase in competition duration. Significant effect of weed-crop competition durations was observed on number of branches per plant (Table-3). A gradual and progressive decrease in number of branches per plant was recorded with increasing competition duration. The zero competition remaining at par with weed crop competition period for 40 DAE produced significantly more number of branches per plant (16.25). 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 have 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) produced maximum number of seeds per plant (1030). The minimum numbers of seeds per plant (540) were obtained in plots where competition was throughout 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 are in accordance with Shafaat (1982). He found that increase in weed competition duration decreased the number of grains per ear.

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	1.57	3750	305.9 a	8.27 a
WCC for 40 DAE	303.50	117.9 ab	15.0 ab	933.3 b	1.56	3750	298.3 b	7.81 a
WCC for 50 DAE	306.80	116.60 bc	14.0 bc	702.3 c	1.57	3750	233.5 c	6.25 b
WCC for 60 DAE	302.50	116.00 c	13.25 c	576.3 d	1.56	3611	227.7 d	6.33 b
WCC for 70 DAE	302.50	112.90 d	12.75 c	563.8 e	1.53	3611	222.2 e	6.24 b
WCC for 80 DAE	304.50	108.20 e	12.75 c	560.5 e	1.51	3472	214.3 f	6.19 b
Competition throughout the season	301.80	107.40 e	10.75 d	540.0 f	1.47	3472	201.6 g	5.83 b
LSD 0.05	-	1.931	1.372	6.537	-	-	4.316	1.144

The data on 1000-seed weight was not influenced significantly by weed-crop competition durations and it ranged from 1.467 to 1.57g (Table 3). Biological yield also was not influenced significantly by competition durations. The maximum (3750 kg ha^{-1}) biological yield was noted in zero competition. The competition throughout the growing season and weed crop competition for 80 DAE gave exactly similar biological yield. The data pertaining to seed yield of *L. sativum* revealed 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 in no weed-crop competition plots and it was significantly higher than all

other treatments. The minimum seed yield (201.6 kg ha^{-1}) was recorded from plots where weeds were allowed to compete throughout the season. 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 Sheikh (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 significantly higher than the remaining treatments. Minimum harvest index value (5.38) was found from plots where weeds were allowed to compete throughout the season. These results are in line with those of Sarwar (1994). He recorded the highest harvest index value in weed free plots throughout the season.

CONCLUSION AND RECOMMENDATIONS

It can be concluded from the results that for obtaining higher yield of *Lepidium 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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