Asian Journal of Plant Sciences

ISSN 1682-3974

Asian Journal of Plant Sciences 7 (4): 413-416, 2008
ISSN 1682-3974

Effect of Different Periodical Weed Interference on Yield and Yield Component in Winter Canola (*Brassica napus* L.)

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Abstract: In order to investigate effect of different periodical weed interference on yield and yield component in winter canola (*Brassica napus* var. Okapy) a field study was conducted in Tarbiat Modarres University on 2004. A randomized complete block design with 3 replication was used to study two sets of treatments. In first set of treatments, the crop was kept weed-free until 2, 4, 6 and 8 leaves, initiation of flowering, 50% pod set and harvest stages. In second set of treatments weeds were allowed to grow with crop until above stages. Results showed that periodical weed interference had no influence on seed thousand weight and seed number on pods on lateral branches but caused to significantly reduction on pod number on main and lateral branches and seed number on pod on main shoot with increasing weed interference duration. Seed yield significantly affected and decreased by weed interference duration exceeding.

Key words: Weed, interference, yield component, canola, competition

INTRODUCTION

Improved crop tolerance to weeds is an important component of sustainable agriculture system. If crop cultivar can tolerate weeds, it may be reduces need for synthetic herbicides (Christensem, 1995). Many factors influence of weed-crop competition include weed interference time and duration, weed and crop density, nutrient level and environmental circumstance (Zimdahl, 2004). Time of weed emergence during a growing season will influence growth and reproductive as well as competitiveness (Blackshaw and Harker, 1998; Knezevic and Horak, 1998). Last research is indicated that weed interference on crop is not same in various growth and development stages therefore weed-crop competition capability is different in their life cycling (Tollenaar *et al*., 1994). Ngouajio *et al*. (2001) reported that weed removal in early season in tomato is not necessary because of there are less competition between weed and crop. Weaver *et al*. (1992) suggested that the length of time that a crop can tolerate early-season weed competition is related more to the availability of soil moisture, or possibly essential nutrients, than to light limitations. Weaver *et al*. (1992) has pointed out the length of maximum weed infested period depends upon how quickly weed begin to shade the crop and compete for water or nutrients and The length of the minimum weed free period, depends upon how quickly the crop develop a closed canopy as well as the germination patterns of the weed species present. Early emerged weeds are more effective in contrast late emerged weeds. Bensch *et al*. (2003) reported the maximum soybean (*Glycine max* L. Merr.) yield loss occurred at pigweed (*Amaranthus retrofilexus*, *A. palmeri* and *A. rudis*) first planting date (companion soybean) and 8 plants m^{-1} of row density. The second pigweed planting date (two weeds later) did not significantly reduce soybean yield. Blachshaw *et al*., (2002) represented Wild radish (*Raphanus raphanistrum* L. RAPRA) that emerged 10 weeks after canola did not reduce canola yield and had no directly effect on canola quality, but the Wild radish seeds that mixed with canola seeds, the amount of erucic acid and glucosinolate was increased above marketable levels in some cases. Evans *et al*. (2003) found that an increase in nitrogen applied early growing season increased corn tolerance to presence of weeds even when no yield response to nitrogen was observed. They believed increasing nitrogen aid in more timely corn leaf area expansion and improving the resiliency of corn leaf nitrogen content to effect of weed interference.

Early-emerging large crabgrass reduced snap bean biomass by 10-28% and snap bean pod numbers by 44-60% depending on the density. Snap bean pod number and biomass were reduced as the density of early-emerging redroot pigweed increased. Regardless of the density, late-emerging redroot pigweed had less effect on snap bean growth and yield than did early-emerging redroot pigweed (Aguyoh and Masiunas, 2003).

Eleftherohorinos *et al*. (2002) reported red rice interference affected panicle number more than 1000-grain

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weight in both rice cultivars. The reduction of all yield components was greater in Thaibonnet than in Ariette. Dry weight and stem or panicle number of red rice plants grown with either of the two rice cultivars increased with increasing red rice density and the values were higher most of the time when grown with Thaibonnet than with Ariette.

The objective of this study were determine the effect of periodical weed interference on yield and yield components and find the most sensitive yield component to weed periodical interference.

MATERIALS AND METHODS

Experimental location: Field study was conducted at the Agriculture Faculty of Tarbiat Modarres University farmland in West of Tehran in 2004. That region had arid climatic condition with 300 mm annual average precipitation. Mean daily temperature during growing season was varied from 25°C in early fall to -5°C in mid winter to 25°C end of spring. The soil type was sandy loam with pH 7.4 and less than 1% organic matter. Canola production in the area is conducted under irrigated conditions. Fields are generally furrow-irrigated immediately after seeding and throughout the season, weekly.

Experimental procedures: After plowing in early summer, 300 kg ha^{-1} triple phosphate fertilizer was added to field and after disking and making furrows the plots established. A canola commercial variety (Var. Okapy) was direct seeded in Sep. 22. After emergence, the canola thinned at 3 leaves stage to get proper density of 650000 plant ha^{-1}. Nitrogen fertilizer added at three times involved 2-4 leaves, rosette quitting and pod filling stages. For control the canola aphid (*Brevicorine brassicae*) systemic pesticide was applied in March 30 and May 10. Irrigation in furrow system had performed weekly. Two weeks before harvest, irrigation was stopped for harmony in ripening.

Experimental design: We used a randomized complete block design with four replications. We had two sets of treatments. In first set, the weeds allowed to interfere with the crop for increasing duration until two-leaf, four-leaf, six-leaf, eight-leaf, early flower and mid pod set stages and removed totally to end of season. In the second of treatment, the canola kept weed-free for increasing duration until above stages. Both full season weed removal and interference treatments considered to control treatments. Plots in this experiment were 1.5 wide by 4 m long involved five furrows. The furrow arranged 30 cm wide.

Data collection: In harvest, 10 canola plants were selected randomly of each plot and the pods number on main and lateral branches were counted separately. Ten pods of main and lateral branches were selected randomly and their seeds number per pod counted. Seed thousand weight were measured by divided 1000 seeds with counter and weighted. A 3 m^2 of each plot was divided and canola hand cut from ground surface and canola seed yield was measured.

Statistical analysis: Data on yield and yield components were subjected to analysis of variance using the PROC MIXED function of Statistical Analysis System (SAS) to assess the effect of weed-interference duration on canola yield and yield components.

RESULTS AND DISCUSSION

In this experiment some species of weeds emerged in fall that involved Hogweed (*Purtulaca oleracea* L.), Common lambsquarters (*Chenopodium album* L.), Redroot pigweed (*Amaranthus retroflexus* L.), Volunteer wheat (*Triticum aestivum* L.) and Jimsonweed (*Datura stramonium*). The London racket (*Sisymbrium irio*) emerged in early spring. Most populated weed species was Hogweed which was emerged in fall. In early winter and canola rosette initiation all of summer weeds disappeared and only Volunteer wheat was remained and passed through the winter.

The results indicated that periodical weed interference had not significant effect on seed thousand weight ($p>0.05$). However with increasing in weed interference duration, seed thousand weight reduced. Seeds number per pod in main stem significantly affected by periodically weed interference ($p<0.01$) and seed number per pod in lateral branches significantly affected by weed interference duration ($p<0.01$) (Table 1). Both pods number in main and lateral branches significantly influenced by weed periodically interference ($p<0.01$) (Table 1) i.e., with delaying in weed removing, number of pods per stems in canola were reduced. Lateral branches numbers were not significantly affected by periodically weed interference. Canola seed yield had reduced significantly as influenced by weed periodically in 5% (Table 1).

Data showed that the highest seed thousand weight of canola was happen in weed interference until two leaf and lowest was occurred in full season weed interference (Table 2).

Evans *et al.* (2003) reported seed hundred weight was negative correlation with weed interference duration and

Table 1: Analysis of variance in canola yield and yield component

SOV	df	Seed thousand weight	Seed No. per pod in lateral branches	Seed No. per pod in main stem	Pod No. in lateral branch	Pod No. in main stem	Lateral branches	Yield
Replication	2	0.091ns	2.1ns	5.2ns	38.7ns	28.0*	1.66ns	140.0ns
Treatment	6	0.072ns	24.3**	31.5**	600.0**	83.0**	1.56ns	3295.0*
Error	20	0.131	9.6	13.5	192.0	28.8	1.04	1414.0
CV		12.000	7.5	9.7	6.9	4.9	11.50	9.9

* and ** significant level in 0.05 and 0.01%, respectively., ns: non significant

Table 2: Effect of periodical weed interference on canola yield and yield component

Parameters	Seed thousand weight (g)	Seed No. per pod in lateral branches	Seed No. per pod in main stem	Pod No. in lateral branch	Pod No. in main stem	Lateral branches	Yield ($g\ m^{-2}$)
WI V2	3.20a	29.8a	28.2a	82.0a	48.6a	7.16abc	296a
WI V4	3.18a	27.2ab	27.0a	67.8b	45.0ab	7.08abc	269a
WI V6	3.50a	25.0bc	26.2ab	66.2b	43.0bc	7.08abc	266a
WI V8	3.53a	25.0bc	25.4ab	65.1b	40.2c	6.25c	196b
WI IF	3.44a	24.8bc	22.9bc	61.1b	40.1c	6.41bc	272a
WI 50%P	3.42a	21.6cd	21.4c	46.1c	34.5d	8.00ab	280a
WI H	3.56a	20.0d	20.8c	39.8c	34.2d	8.10a	260a

WI V2, V4, V6 and V8, weed interference up to 2, 4, 6 and 8 leaf; WI IF, weed interference up to initiation of flowering; WI 50%P, weed interference up to 50% pod set; WI H, weed interference up to harvest. Means within a column followed by the same letter(s) are not significantly different according to Duncan's multiple range test at the 0.05 level

positive with weed free duration. Because of weeds low density and species, weeds had no intensively effect on seed thousand weight but highest reduction in seed thousand weight of canola was happened under weed interference up to 2-8 leaves treatments. Canola canopy in vegetative stages has low height and those weed species grew faster and taller will be dominant in competition for light and will shaded on lower level of canopy and this will induced canola yield loss. Martin *et al.* (2001) and Yaghoobi (2005) reported critical period of weed control happened in this duration (e.g., the critical period of weed control in canola was in 4-6 leaves stage). In present study increasing in weed interference duration up to two leaves stage of canola reduced seeds number per pod in main stem but before that did not. Evans *et al.* (2003) reported the yield component most sensitive to both nitrogen and interference from weeds was seed number per ear.

In early growth stages of canola (i.e., 2, 4 leaf stages) the canopy closure was not established and weed and crop had been competing for nutrient and moisture more than light but after canopy closure weed and crop compete for light intensively (Weaver *et al.*, 1992). Use of irrigation and fertilizer avoid intensive competition for water and nutrient in irrigated farmland but after canopy closure for canola (after 2, 4 leaf stages) competition increase for light intensively.

Reduction in light intensity will decrease in photosynthesis and reduce seeds number per pod. In Table 2 major reduction of seeds number per pod happened in primary growth stages. This indicates that the most influence of weed competition for light begun up to 4 leaf stage of canola and was continued but previous stages (before 4 leaf) had not affected significantly. Evans *et al.* (2003) reported increasing the duration of weed interference reduced seed number per ear as sigmoidal decline which was intensified at the lowest nitrogen rate. Seed numbers per pod in lateral branches were not significantly influenced but reduced with increasing the weed interference duration. Knezevic *et al.* (1997) pointed out Redroot pigweed (*Amaranthus retroflexus* L.) and Sorghum-grain (*Sorghum bicolor* L. Moench) competition caused to reduction in seed number per cluster.

Pod number per main and lateral branches significantly influenced periodical weed interference ($p<0.01$) and this effect was intensive in compare with other yield components (Table 2). Weed interference in first growth stages of canola had less influence on pod number per main and lateral branches.

But after passing these stages (i.e., 6 and 8 leaf stages) increasing on light competition between weeds and crop, caused to decline in pod number in all stems. Weed interference after 6 and 8 leaves and early flowering had same effect on pod number per stems. Weed competition during these stages (i.e., after canopy closure) caused to major loss on pod per stems of canola. Probably competition for light in late season had greatest influence in compare with competition for moisture and nutrient which are available in irrigation-cropping. Martin *et al.* (2001) demonstrated that critical timing of weed removal in canola occurred in about 4 leaves stage. Aguyoh and Masiunas (2003) reported Snap bean pod number and biomass were reduced as the density of early-emerging redroot pigweed increased.

Canola yield differed significantly between various periodical weed interferences after 8 leaf stage (Table 2). Bailey *et al.* (2003) showed cotton yield loss increased with velvetleaf (*Abutilon theophrast*) density e.g., maximum yield loss was 84% at 3.5 velvetleaf plants m^{-1} of row.

CONCLUSION

In addition the seed thousand weight and lateral branches number per plant did not influenced by weed periodical interference significantly but seed per pod in main and lateral branches and pod number in main and lateral branches influenced by weed durational interference significantly. The pod number in stem between other yield components was must sensitive to periodically weed interference. In present study weed species of studied farmland were not sufficiently powerful for influence on winter canola yield because of the canola has planted for a few years in that field and more competitive weed species had not populated sufficiently in practical field.

ACKNOWLEDGMENTS

We gratefully acknowledge Mr. Davood Yaghoobi for his practical aids in performance of experiment and Research Deputy of Tarbiat Modarres University for his financial and technical support.

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