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Short Communication

Determining Critical Period of Weed-crop Competition in Faba Bean (*Vicia faba*)

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ABSTRACT

The field experiment was carried during, 2003-2004 to determinate the critical period of weed-crop competition in faba bean (*Vicia faba* L.). The experimental treatments included weed free throughout the growing period, weed free from 15, 30, 45 and 60 days after emergence (DAE) and no weeding. The main infestation species of weed were *Avena sterilis, Lolium multiflorum, Chenopodium album, Amaranthus retroflexus* and *Convolvulus arvensis*. Grain yield and yield contributing traits were significantly affected by weed competition. Weed-crop competition may end from 45 days. Grain yield losses due to un-controlled weed growth throughout the crop cycle were 46%. At the same time, plant height, numbers of pods per plant, numbers of seeds per pod and 1000-seed weight were significantly decreased due to weeds. © 2010 Friends Science Publishers

Key Words: Weed competition; Critical period; Faba bean; Yield

INTRODUCTION

Weeds are a permanent constraint to crop productivity in agriculture. And they are plant, which compete for nutrients, space, light and exert lot of harmful effects by reducing the quality, as well as quantity of the crop, if the weed populations are left un-controlled (Halford *et al.*, 2001; Kavaliauskaite & Bobinas, 2006).

To reduce the cost and risks of intensive weed control, the frequency or intensity of applications should be reduced or optimized. Critical periods for weed control are defined as the period in the crop growth cycle during, when weeds must be controlled to prevent un-acceptable yield losses (Knezevic *et al.,* 2002). In order to provide more precise information for grower's critical periods for weed control should be determined specifically for a particular region by considering the weed composition and climatic conditions (Rajcan & Swanton, 2001).

The critical period is useful in defining the crop growth stages most vulnerable to weed competition. In practice, the critical period is defined as a number of weeks after crop emergency during, which a crop must be weed-free in order to prevent yield losses grater than 5% (Hall *et al.*, 1992; Knezevic *et al.*, 1994). The critical period of weed control has been determined for several crops (Shuaib, 2002; Knezevic *et al.*, 2003; Seem *et al.,* 2003; Kavaliauskaite & Bobinas, 2006; Williams II, 2006; Hamzei *et al.*, 2007; Oad *et al.*, 2007). Faba bean are generally cultivated near the Mediterian Sea. This region has very rainfall. Because of this, weeds grew up speedily and increased in variety. However, there is a little information critical period of faba bean in weed competition. This study aimed to determine the critical period for weed competition in faba bean under the growing condition of south of Turkey.

MATERIALS AND METHODS

This study was carried out at the Agricultural Research Station in Hatay between, 2003-2004 years. Eresen 87 cultivar was used as material. Crop was sown on 12 October, 2003 and 16 October, 2004. The experiment was laid out in the randomized complete block design with four replications. Soil preparation consisted of primary and secondary tillage, as well as cultural practices was conducted according to local practices for faba bean production. Plot size was 2 m × 3 m, consisting of 8 rows of faba bean with 30 cm between-row and 10 cm within-row spacing. The experimental treatments included weed free throughout the growing period, weed free, weed free from 15 days after emergence (DAE), weed free from 30 DAE, weed free from 45 DAE and weed free from 60 DAE, and no weeding. Water wasn't applied to the plot area throughout the crop growing season. Rainfall provided

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water necessity. Two days before each weed removal, weeds were harvested from three 1 m^2 quadrates staggered on each side of the three middles faba bean rows within each experimental plot. Yield data of individual plots were calculated as the percentage of their corresponding weed-free plot yields. Relative yield data were subjected to analysis of variance with the use of the PROC GLM function of Statistical Analysis System (SAS, 1999), to assess the effect of the length of the weed-free period and increasing duration of weed interference on relative faba bean yields.

Soil was sandy loam with pH 7.8, 0.16% organic matter and 8.4 cation exchange capacity (CEC). The local climate is with the annual average rainfall ranges between 1100–1250 mm. Meanwhile, the minimum and maximum annual temperatures were 25 and 35°C, respectively. Each year, the land was ploughed and cultivated before planting. The net plot size was 5.0 m × 1.80 m. The fertilizers were applied at 30, 40 and 20 kg ha^{-1} NPK, respectively as basal dose. In weed free plots, weeds were removed manually. Weed densities of different weed species were recorded after 60 days of emergence. At the faba bean maturity stage weeds were harvested separately and dried in the oven for 24 h at the 105°C and weighted.

RESULTS

According to results of two years, the main weed species found in the experimental plots were *Avena sterilis, Amaranthus retroflexus, Chenopodium album, Convolvulus arvensis, Lolium multiflorum* and *Sinapsis arvensis* (Table I). The average 5.56 weeds compete with one faba bean plant. In the experimental plots, *Avena sterilis, Chenopodium album, Convolvulus arvensis* and *Lolium multiflorum* dominated the other species in terms of infestation, constituting 91.23% of total weed vegetation. Those species compete vigorously with the faba bean plants, especially, at the early stage of growing periods.

Analysis of variance revealed significant effects duration of faba bean yield and yield component. The tallest plant and the highest yield were obtained in weed free treatment throughout growing period (Table II). The worst effect of weed competition on the yield and yield component were observed, when the weeds were allowed to compete with the crop no weeding until harvest. In this study, the yield losses due to weed competition were 46.14%. The impact of weed weight on faba bean biomass, which accumulated during a common period of growth, is described by regression equations. Yield had the highest of coefficient of variation. But seed number per pod had the lowest of co-efficient of variation. Weed effected significantly yield formations.

DISCUSSION

The different growth stages of investigation are affected by the meteorological conditions and there is very strong negative impact between weed weight and faba bean biomass. Evans (2001) reported that weed heights varied considerably among years and locations due to variable mixture of weed species, differences in the relative time of weed emergence and environmental and soil variables. We suggest that weed height does not provide sufficient information for timing weed control efforts unless it is coupled with crop growth stage. Therefore, from the practical standpoint, the timing of weed control should be based primarily on the crop growth stage.

We suggest that weed control the critical time for

Table I. Weed species infesting faba bean according to treatments on average of two years

Species Names	Weed free		Weed free from 15 DAE		Weed free from 30 DAE		Weed free from 45 DAE		Weed free from 60 DAE		No weeding		Average	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Avena sterilis	109.70	68.62	128.48	63.18	135.20	63.44	149,30	63.60	156.32	63.79	175.10	60.69	142.40	63.50
Lolium multiflorum	12.90	8.07	19.12	9.40	20.60	9.65	21.72	9.25	23.20	9.47	29.42	10.20	21.16	9.43
Chenopodium album	7.68	4.80	15.78	7.76	16.35	7.65	21.57	9.19	22.14	9.03	30.24	10.48	18.96	8.45
Amaranthus retroflexus	9.74	6.09	15.74	7.74	16.48	7.70	16.36	6.97	17.10	6.98	23.10	8.01	16.42	7.32
Convolvulus arvensis	6.05	3.78	11.05	5.45	11.55	5.41	13.25	5.64	13.75	5.61	18.75	6.50	12.40	5.53
Sinapsis arvensis	9.94	6.22	8.12	3.99	8.04	3.70	7.08	3.02	7.00	2.86	5.18	1.80	7.56	3.37
Others	3.86	2.42	5.05	2.48	5.12	2.40	5.48	2.33	5.55	2.26	6.74	2.34	5.30	2.40
Total	159.87	100.00	203.34	100.00	213.34	100.00	234.76	100.00	245.06	100.00	288.53	100.00	224.20	100.00

Table II. Yield and yield components of faba bean as affected by the duration of weed competition

Treatments		Plant height (cm)	Number of pods/plant	Number of seeds/pod	1000 seed weight (g)	Yield (kg ha^{-1})	Yield losses (%)
Weed free	T1	102.3a	9.03a	4.31a	1086.3a	2256.0a	-
Weed free from 15 DAE	T2	100.6a	8.73a	4.17ab	1010.2ab	2179.0ab	3.41
Weed free from 30 DAE	T3	96.5a	8.40a	3.97ab	975.4b	2074.0bc	8.06
Weed free from 45 DAE	T4	93.2ab	8.20a	3.65ab	967.3b	1953.0c	13.44
Weed free from 60 DAE	T5	85.1b	7.85a	3.27b	923.6b	1640.0d	27.30
No weeding	T6	70.1c	5.30b	2.01c	906.0b	1215.0e	46.14
CV (%)		12.15	7.24	6.76	11.60	12.50	

weed removal in faba bean is weed free from after 45 DAE. If the weed control is delayed further than the indicated stages, the yield losses would be much higher than suggested, especially under drought conditions and higher weed densities. If the weed densities were lower than indicated, then the anticipated yield losses would be smaller. In addition, the actual economic losses per every leaf stage of delayed weed control can be easily calculated using anticipated crop price and potential yield (Knezevic *et al.*, 2003). If weeds were destroyed after 30 DAE, they didn't decrease their productivity significantly. The critical periods of weed competition in faba bean should begin from 30 DAE. These results are in agreement with findings of Aziz (1993). Faba bean crop should be preserved without weeds for that period after germination so that yield losses will not exceed 10%.

In order to determine a generalized critical period for weed control and critical time for weed removal in faba bean, as well as the yield penalty due to delayed weed control, the yield loss data from both studies were pooled over years-locations and related to the extrapolated crop growth stage at the time of weed removal for faba bean (Knezevic *et al.*, 2002). Air growing degree days (GDD) were related to the relative yields of faba bean crops. The GDD corresponding to the beginning and the end of critical period for weed control in corn and critical time for weed removal in soybean was then related to crop growth stage.

CONCLUSION

In Turkey, pulling up with hand and herbicide applications are the major methods of weed control in faba bean. According to the results of this study, growers could improve timing of post emergence herbicide applications and hand weeding. Further studies should be conducted to determine the critical periods in other areas, where weed populations are different from those reported here.

REFERENCES

Aziz, M.A., 1993. Critical period of weed competition in lentil. *Lens Newsletter,* 20: 43–45

Evans, S.P., 2001. Effects of varying N supply on the critical period for weed control in corn (*Zea mays* L.). *M.S. Thesis,* University of Nebraska, Lincoln, Nebraska

Halford, C., A.S. Hamill, J. Zhang and C. Douced, 2001. Critical period of weed control in no-till soybean (*Glicine max*) and Corn (*Zea mays*). *Weed Technol.,* 15: 737–744

Hall, M.R., C.J. Swanton and G.W. Anderson, 1992. The critical period of weed control in grain corn (*Zea mays*). *Weed Sci.,* 40: 441–447

Hamzei, J., A.D.M. Nasab, F.R. Khoie, A. Javanshir and M. Moghaddam, 2007. Critical period for weed control in three oilseed rape (*Brassica napus* L.) cultivars. Turky *J. Agric. For.,* 31: 83–90

Kavaliauskaite, D. and C. Bobinas, 2006. Determination of weed competition critical period in red beet. *Agron. Res.,* 4: 217–220

Knezevic, Z.S., S.F. Weise and C.J. Swanton, 1994. Interference of redrood pigweed in corn. *Weed Sci.,* 42: 568

Knezevic, S.Z., S.P. Evans, E.E. Blankenship, R.C. Van Acker and J.L. Lindquist, 2002. Critical period for weed control: The concept and data analysis. *Weed Sci.,* 50: 773–786

Knezevic, S.Z., S.P. Evans and M. Mainz, 2003. Row spacing influence the critical timing for weed removal in soybean (*Glycine max*). *Weed Technol.,* 17: 666–673

Oad, F.C., M.H. Siddiqui and U.A. Buriro, 2007. Growth and yield losses in wheat due to different weed densities. *Asian J. Plant Sci.,* 6: 173–176

Rajcan, I. and C.J. Swanton, 2001. Understanding maize-weed competition: resource competition, light quality and the whole plant. *Field Crops Res.,* 71: 139–150

SAS Inst., 1999. Statistical Analysis Systems Institute Inc. 1999., Version 8. Cary, North Carolina

Seem, J.E., N.G. Cramer and D.V. Monks, 2003. Critical weed-free period for 'Beauregard' sweet potato (*Ipomea batatas*). *Weed Technol.,* 17: 686–695

Shuaib, O.S.B., 2002. Critical period for weed competition in onions (*Allium cepa* L.). *University Aden J. Appl. Sci.,* 5: 355–360

Williams II, M.M., 2006. Planting date influences critical period of weed control in sweet corn. *Weed Sci.,* 54: 928–933

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