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Effect of chemical control of weeds on yield and yield components of rapeseed in Ahvaz region

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Abstract

To investigate the effect of chemical control of weeds on yield and yield components of rapeseed in Ahvaz region, a split-plot experiment was conducted in a randomized complete block design with four replications in 2012. The main factor in this experiment was 6 treatments including: control without the weed, application of Trifluralin herbicide, 2.5 liter per hectare pre planting, Butisan Star herbicide, 2.5 liters per hectare of the crop, Pre-emergence, Sethoxydim herbicide, 3 liters per hectare, Lonetral herbicide; 0.9 liters per hectare and control with the weed and the sub-factor included two cultivars of rapeseed (Hyola 308 and Hyola 401). The results showed that control treatment and Hyola 401 had the highest yield, and among the herbicides Trifluralin herbicide improved yield of rapeseed by better control of the weed. This fact shows high adaptability of Hyola 401 to the climate of Khuzestan (Iran) and also high ability of Trifluralin in controlling weeds in rapeseed.

Keywords: chemical control, cultivar, herbicides, rapeseed, weed control.

Introduction

Rapeseed is an edible oil plant that was developed in 1970 and contains 40% oil. The word rapeseed is the name chosen by Crushers (Western Canadian Oilseeds Association). Rapeseed is planted on 22 million hectares in 53 countries, and the main producers of it are China, Canada and India (Zimmdahl, 2004).

The area under cultivation of rape in Khuzestan province is ten thousand hectares; it is the fourth largest province in Iran in terms of the area under cultivation and harvest of rape oilseed.

Rapeseed is grown in rotation of any crop that allows providing good bed for the seed, planting and preventing soil-borne diseases. Also it is in rotation with other crops, especially cereals and is effective in control of diseases, pests and weeds in farms. The conducted experiments indicated that the yield of planted wheat after rapeseed is about 10% more than wheat planting after fallow. Frequent planting of rapeseed in a land or planting it in rotation with other plants of Brassica causes the diseases to get worse and its factor remains alive for several years in soil. Weeds are considered a problem in planting rapeseed; there will be more than 50 percent of product decrease. These unwanted plants in rapeseed are important limiting factor in its production and reduces quality and quantity of seeds and delays harvest time and causes the yield to decrease. Also they are suitable hosts for pests and diseases in rapeseed and other crops.

One of the aspects of weeds that make it successful in competing with crops is their higher number. Other special features of weeds comparing with crops include: very high seed

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production, rapid consolidation, the existence of dormancy mechanism, efficient insemination system, different systems of proliferation, good ways of dispersion, and patterns of exiting seed from soil. All these cases cause weeds to be dynamic and can significantly reduce the yield of crops (Sinebo, 2004).

According to researches done, 70 percent of the weeds of rapeseed farms in Iran include broad-leaf weed; and 20 percent of them are dark and are difficult to control. The most important narrow leaf weeds, which comprise 30 percent of the weeds of rapeseed include: wild oat, self-planting wheat and barley.

Studies have shown that rapeseed related weeds, particularly wild mustard family, cause quality and quantity of yield to decrease (Lutman, 1991). Kim *et al*, 2006 reported the rate of yield loss due to weeds countries as 25 percent in developing countries and as 10 percent in developed countries. According to Johnson, 1997 if weeds are not controlled, the damage can increase to 100 percent. Burgos *et al*, 2006 stated in their investigation that stated that wild mustard is an extra weed and harmful to rapeseed and its seedlings can grow earlier in autumn and compete with rapeseed and other crops that grow in autumn. They reported that this competition reduces survival and yield of rapeseed and it may also reduce weight of seed.

Safahany *et al.* (2007) reported that after emergence control of the weeds by Lonetral, Butisan Star, and Gallant Super herbicides can manage controlling weeds well and improve production of rapeseed. Mousavi *et al.* (2003) reported that the using cultivation treatment two times and Trifluralin herbicide to control weeds seems optimal. Martin *et al.* (2001) reported that the critical period of weed control was determined by taking into account allowed 5 percent decrease of yield, a period of 59 days in the interval of 31 to 90 days after growth; in four- leaf stage until the beginning of flowering and taking into account allowed 10 percent decrease of yield, a period of 27 days in the interval of 41 to 68 days after growth that coincide with the beginning of the six to eight-leaf stage of rapeseed.

Montazeri (2007) reported that typical herbicides such as Glufosinate, Glyphosate, Paraquat destroy the green cover and they are used before planting with a short time after planting rapeseed. They said that herbicides mentioned are able to control sensitive weeds that are grown after initial tillage operations.

Through development of cultivars of rapeseed that is resistant to Glufosinate and Glyphosate, there has been is the possibility of using these common herbicides after growth in planting this crop. Lenssen *et al.* (2007) reported that in most cases rapeseed farms should be free of weeds until four-leaf stage. Competition power in seedlings stage is little, but it increases after development so that rapeseed canopy closes better. Ahmadi (2000) reported minimum density of weed seed and maximum weight of 1000 seeds of rapeseed and seed yield were obtained by using herbicide Trifluralin. Therefore, the aim of this research assessed the effect of chemical control of weeds on yield and yield component of rapeseed in Ahvaz region.

Materials and Methods

This experiment was carried out in Khuzestan (Iran), an agriculture land located at a distance 45 kilometers from north of Ahvaz in the direction of Ahvaz- Masjed Suleiman road in 2011-2012 crop year. The soil of area under study contained clay with little penetrability. The experiment was Split Plot and was conducted in a randomized complete blocks design with four replications.

The main factor

The main factor included 6 treatments:

1. Control without weeds
2. Using hTrifluralin herbicide; 2.5 liters per hectare as pre-planting
3. Using Butisan Star; 2.5 liters per hectare as pre-emergence
4. Using Sethoxydim herbicide; 3 liters per hectare in three to six-leaves stage of the weed
5. Using Lonteral; 0.9 liters per hectare in the 10-cm stage of weed
6. Control with weeds.

The sub-factor

Sub-factors in this experiment consisted of two cultivars of rapeseed (Hyola 401 and 308).

Preparing the land

The land of study was plowed by plough-

share after irrigating land before plowing and reaching capacity of land; and after setting two perpendicular discs to break up lumps it was ready plot. Leveling the land was done before plotting in land gradient direction and with leveler. Total number of experimental plots was 48 and dimensions of each plot were 3.5*4 meters. To prevent the penetration of the herbicide into adjacent plots, three lines as remove lines were placed between the main plots and excess water got out of the farm by a stream.

Plantation operations

Planting was done manually. Stream of cultivation heaps were created with 60 distance, using furrower. Then water channels were built using ditcher. Seeds were put into the grooves on two sides of the heaps, and some soil was poured on it; this was done by hand. Planting operation was done with density of 90 bushes per square meter and first irrigation was done immediately after planting.

Growing operations

In the time interval of planting date, in late November, until harvest operation there were different operations including irrigation, thinning, adjusting the distance of bushes and top-dressing fertilizers as solvent in water was carried out, so that after irrigation and settlement of water in streams, fertilizer was dispensed in the water. The first irrigation of field was done immediately after planting. Subsequent irrigations were carried out based on plant needs. Dispensing fertilizer was done through being solved in water of irrigation; after irrigation and waters' settling in streams fertilizer was dispensed into water. In order to reduce the intra-specific competition in three - leaves stage, weeding of extra bushes was done. Also after thinning and providing soil to bushes, irrigation was done.

Harvest Operations

Harvest operation was carried out manually by sickle; a square meter of cultivation was cut from fourth and fifth lines by removing half meters from top and bottom of the plot and was transmitted to laboratory.

Varieties Profile

This study was conducted on cultivar Hayo308 and 401 that is well adaptable to conditions of Khuzestan province and has high yield; and it is mid ripe variety which is resistant to common diseases of the region.

Statistical Calculations

Analysis of all the components was done through of MSTATC software. Comparison of means was done using multiple ranges Duncan test at 5 percent statistical level. In order to draw the diagrams, different parameters such as yield and components of yield, Excel software was used.

Results and Discussion

Variance analysis of traits being studied showed that effect of herbicide on seed yield of canola and number of seeds per square meter at 1 percent probability level and on weight of 1000 seeds at five percent level of probability was significant (Table 1).

Table 1. Variance analysis of yield and yield components of canola

S.O.V	d.f	Number of seeds	1000 seed Weight	Seed yield
replication	3	213692271	0.01	810
herbicide	5	32771114542*	0.21*	117174**
error	15	1299563378	0.06	612
cultivar	1	24986782521**	0.42**	69272**
Herbicide × cultivar	5	177492147^{ns}	0.01^{ns}	5175**
error	18	1209111317	0.01	573
CV%		13.5	4.2	11.1

Number of seeds per square meter

Results of variance analysis showed that herbicide treatments and cultivar at 1 percent of probability has significant effect but interaction effect of cultivar and herbicide does not have any significant effect (table 1). Results of comparison of means showed that in cultivar treatment, maximum and minimum seed numbers per square canola belonged to Hyola 401 and 308 respectively. Also in herbicide treatment maximum and minimum seed number per square meter belonged to witness with control (manual weeding) and witness without control of weeds (figure 2). It was shown that the more the density of weeds increases, because of not weeding or using herbicides that cause settling weeds, the less the seed number per square meter reduces.

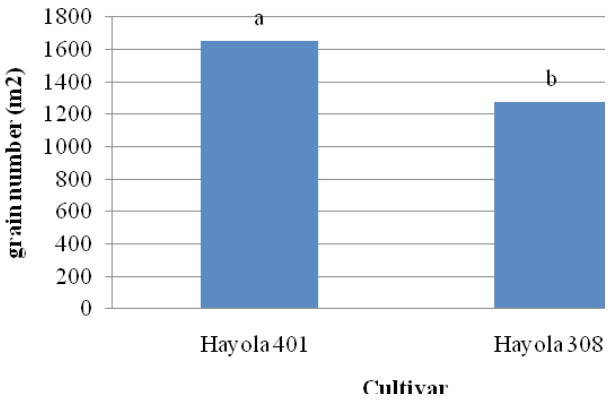

Figure 1. Comparison of means of canola cultivars on seed number per square meter.

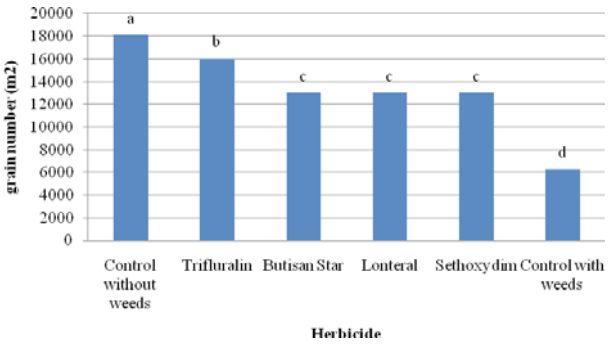

Figure 2. Comparison of poisons mean on seed number per square meter.

1000 seed weight

Results of variance analysis showed that cultivar treatment at 5 percent level of probability and herbicide treatment at 1 percent treatment has significant effect on 1000 seed weight but cultivar interaction effect and herbicide does not have any significant effect (table 1).

Results of comparison of means showed that in cultivar treatment, the most and the least 1000 seed weight belongs to Hyola401 and 308 respectively (figure 3). Also in herbicide treatment the most and the least of 1000 seed weight belonged to witness with control (weeding) and witness without control of weed (figur4). Banaei et al, 2005 reported that minimum density of weed and maximum 1000 seed weight of canola and seed yield was gained by application of Treflan herbicide. Blackshow (2003) stated in their investigations that wild mustard is an extra weed and harmful in planting canola and its seedling is able to grow earlier in autumn and compete with plants that grow in autumn. They reported that this competition decreases canola's survival and yield and it may reduce weight of seed.

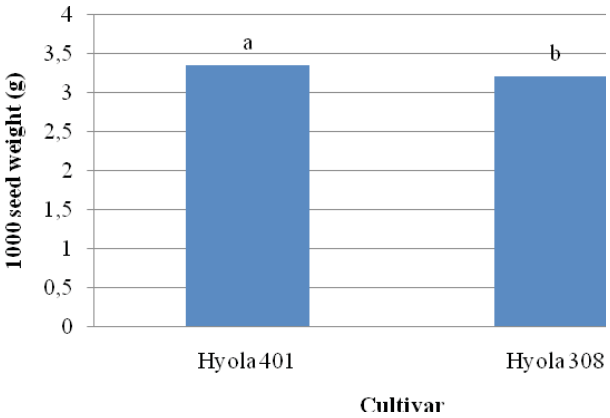

Figure 3. Comparison of canola cultivars mean on 1000 seed weight.

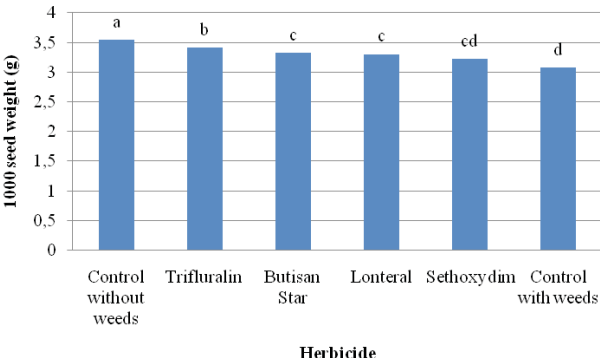

Figure 4. Comparison of poison mean on 1000 seed weight.

Seed yield

Analysis of variance showed that the herbicide treatments, cultivars and cultivar interaction effect and herbicide at 1 percent level of probability were significant (table 1). Results of means comparison showed that in cultivar treatment maximum and minimum seed yield of canola belonged to Hyola 401 and 308 respectively. Also in herbicide treatment, maximum and minimum seed yield of canola belonged to witness with control (manual weeding) and witness without controlling weeds. On the other hand, the highest yield of canola belonged to witness treatments with control and cultivar Hyola 401 and lowest to witness treatments without control and cultivar Hyola 308 (figure 5). Blackshow (1987) reported that by increasing density of wild oat from 100 to 150 bushes per square meter, canola yield increased from 30 to 42 percent. Van Acker and ore (1999) stated that the maximum reduction in canola yield of in the Manitoba province in Canadian was because of competition of 75 percent wild mustard in density of 200 bushes, while low density of wild mustard 10 bushes per square meter caused seed yield to decrease by 5 percent.

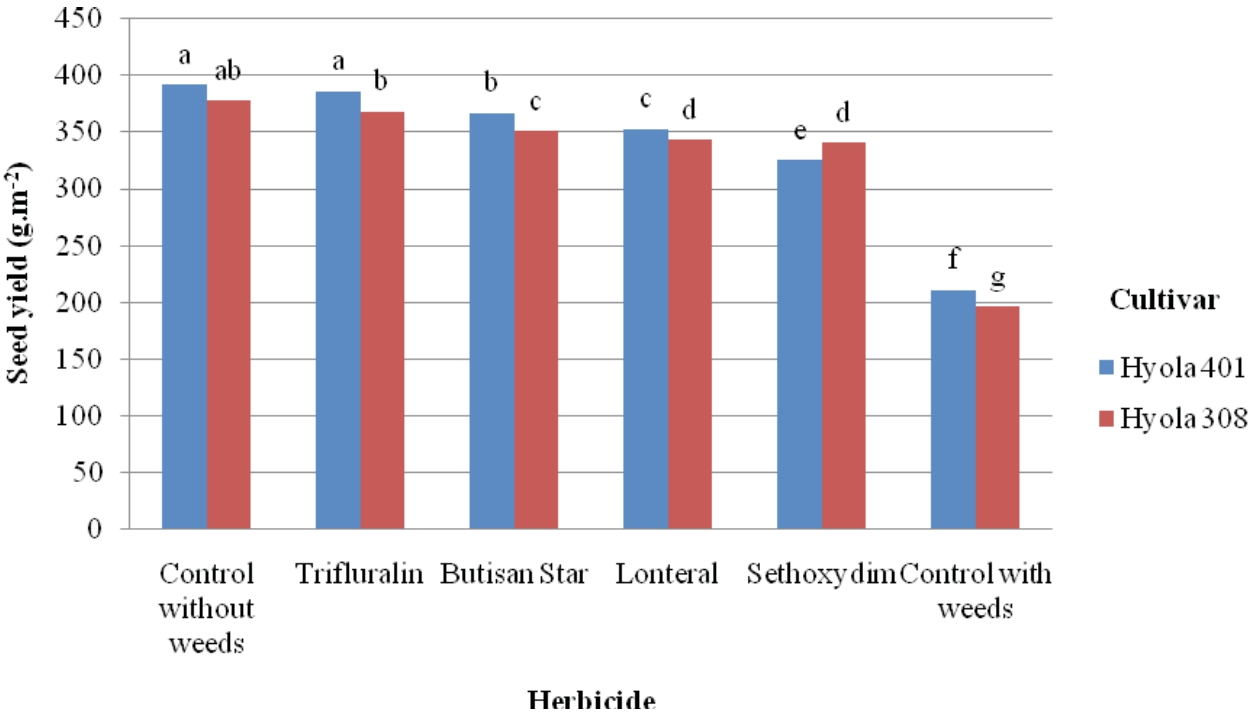

Figure 5. Interaction of herbicide and cultivar on seed yield.

Conclusions

According to the results of this experiment, the best seed yield was observed in witness cultivar Hyola 401. This indicates that cultivar Hyola 401 has more climate adaptability than 308 in the area. This factor caused canola to have the maximum use of moisture, light and nutrients in condition of lacking weed.

Herbicides Treflan comparing other herbicides caused canola plant, by better effect on weed, to succeed in absorbing resources than weeds and finally this resulted in increasing photosynthesis of leaf surfaces and increasing seed yield of canola. As it was expected maximum weed seed production was in witness without control. The reason is that in the witness without control, weed was the most and as a result production of dry material increased and this increased seed production.

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