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Agronomic and morphological traits of canola cultivar under the influence of different irrigation systems

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Abstract

This paper investigates the drought stress on agronomic traits of winter canola during 2005-06. Using two treatments and three replicates of which irrigation remained as the main factor in seven levels and the two secondary factors consisting of Zarfam and Opera varieties. The results showed that the effect of variety on the seed yield, seed oil yield, seed oil was significant. Interaction between irrigation and cultivars were determined in comparison with the highest grain yield. In the normal water conditions, Zarfam variety produced the average 4800 kg/ha. Among the studied parameters, the correlation between the seed-oil yield and seed-oil percent was found positive and significant compared to the number of seed in forming pods and the maximum correlation was found between seed yield and oil yield (r = 0.99).

Keywords: Canola; Varieties; Yield and yield component; Drought stress

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Introduction

Amount and velocity transfer of assimilates including plant photosynthesis is depends on plant reverse action and absorption of environmental stimulus, enzyme-hormone and avanti system operation and respective effects of these factors appeared in form of grain filling and have key role in grain resistance operation (DuDaka and Gayianas, 1991). One third of the world lands are classified as arid and semiarid region and the remains are faced with water seasonal or local fluctuations (Beweley and Krochko, 1982). Aridity is the most common environmental stress and approximately includes 25% of the world lands (Christianse, 1982). Among the most important criteria for genotypes assessment to environmental conditions is study of respective effect of genotype and resistant study of grain operation through non-considerable changes in different environmental conditions. The fact that water stress effects on growth and yield are genotype-dependent is well known (Bannayan et al., 2008). Identification of the critical irrigation timing and scheduling of irrigation, based on a time and accuracy to the crop, is the key for conserving water and improving irrigation performance and sustainability of irrigated agriculture (Igbadun et al., 2006; Ngouajio et al., 2007). In arid and semi-arid environments, both efficient use of available water and a higher yield and quality of safflower are in demand (Lovelli et al., 2007; Dordas and Sioulas, 2008; Koutroubas et al., 2008). Major part of canola production in the world is under dry farming conditions and as a result, plant reaction to stress is an important topic. Canola may be treated by dry farming in those regions which have autumn and spring raining. The plant does not need extra water, but in germination stage, rosset period, stem elongation, flowering, seed formation and its growth; there is sense of water requirements (Singh et al., 1977). *B. napus* has considerable resistance against aridity which is due to different features including: root/shoot position; more distribution of plant in comparison with grains and pods after pollination between and inside canola, especially *B. napus* as a considerable variance with

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regard to resistance against aridity such as: proline accumulation; chlorophyll resistance and more germination in water stress conditions (Mendham and Scott., 1975). Whereas most part of consumable oil of the company are import from foreign countries, also due to limitations of water resources, the necessity of planting oil seeds have an important features. The aims of this research were to study the effects of late season drought stress on seed and oil yields and their components, and to evaluate their relationships among autumn rapeseed cultivars.

Materials and Methods

For finding resistance to drought stress, two varieties of autumnal rapeseed in conditions of treatment and regular irrigation (control group), were tested in split plot design in form of complete basis design block in three repetitions that which the irrigation was the main factor in seven levels: consist of regular irrigation (control group), cutting irrigation in stage of jointing, cutting irrigation in stage of flowering, cutting irrigation in stage of forming pods, cutting irrigation in stage of jointing and flowering, cutting irrigation in stage of jointing and forming pods, and cutting irrigation in stage of flowering and forming pods. The experiment was carried out at Karaj, Iran during 2005-06. This region has a semi-arid climate (230 mm annual rainfall). In this survey all the stages of plant's phonology and various attributes such as length of the bush, number of the secondary branches in the bush, the sickness of the stem, the length of pod's main stem, secondary branch, the length of the pod, the number of the pod in the main stem and the secondary stem, number of the pod in the bush, the number of seed in the pod in main stem and secondary stem, the number of the seed in the pod, the weight of the thousand of seeds, function of the seed, biologic function of harvest's coefficient and the percentage of oil of the seed and the function of the seed's oil were measured.

Results and Discussion

Table 1: Irrigation stage and amount of irrigation (m^3)

Irrigation and stress stage	Irrigation phase	Irrigation amount
Regular irrigation	8	5120
Cutting irrigation in stage of jointing	7	4480
Cutting irrigation in stage of flowering	7	4480
Cutting irrigation in stage of Forming pods	7	4480
Cutting irrigation in stage of jointing and flowering	6	3840
Cutting irrigation in stage of jointing and forming pods	6	3840
Cutting irrigation in stage of flowering and forming pods	6	3840

Interaction between irrigation and cultivars were determined in comparison with the highest grain yield. In the normal water conditions, Zarfam variety produces the average yield 4800 kg/ha. And the lowest grain yield in the water phase has been 2100 kg/ha compared with an average of Opera in field conditions (Table 2). Adverse effect of water stress can affect the performance of canola, but these effects depend on genotype, stage of plant development and adaptation to drought (Azizi et al., 2000). Khoshnazar and et al. (2000), Reddy and Rudy (1998) observed significant difference between the different varieties of *Brassica* in grain yield. Puma (1999) stated that one advantage among canola ability is to absorb water from the depths

Table 2: Mean comparison the interaction of irrigation and variety effect on some traits of rapeseed

Irrigation	Grain yield		Oil content		No. of grain in Forming pods		Oil yield	
	Variety Opera	Variety Zarfam	Variety Opera	Variety Zarfam	Variety Opera	Variety Zarfam	Variety Opera	Variety Zarfam
Regular irrigation	3996^{a}	4800^{a}	39.49^{cd}	40.57^{bcd}	19.5^{b}	16.2^{abc}	1574^{abcd}	1945^{a}
Cutting irrigation in stage of jointing	2971^{bcde}	3758^{abcd}	39.63^{bcd}	40.5^{bcd}	20.6^{a}	15.3^{c}	1177^{cde}	1521^{bcde}
Cutting irrigation in stage of flowering	2167^{e}	3108^{abc}	40.5^{bcd}	41.49^{ab}	13.6^{c}	17.6^{abc}	879.5^{e}	1289^{abcd}
Cutting irrigation in stage of Forming pods	2438^{cde}	3204^{abcd}	39.19^{d}	41.26^{abc}	15.3^{abc}	13.3^{abc}	955.4^{cde}	1321^{abc}
Cut. Ir. in stage of jointing and flowering	2321^{abc}	2850^{a}	39.85^{bcd}	42.52^{a}	14^{bc}	18.3^{abc}	924^{abc}	1211^{cd}
Cut. Ir. in stage of jointing and Forming pods	2805^{abcde}	2625^{de}	38.75^{bcd}	41.23^{abc}	15^{abc}	19.6^{a}	1085^{bcde}	1080^{de}
Cut. Ir. in stage of flowering and Forming pods	2100^{abcd}	2452^{ab}	40.32^{bcd}	42.56^{a}	15^{abc}	16.3^{abc}	846^{abcd}	1043^{ab}

^{a,b,c,d}Means in each column having similar letter are not significantly different at the 5% level

of the earth (Poma et al., 1999). Analysis of variance of seed oil determined the variety effect which was significant (P<0.01) as shown in Table 2. In irrigation condition, the highest oil percent was for Zarfam variety (40.5%) and in drought stress condition, most of the oil percent was also for Zarfam variety (42.5%) in condition of water cutting in flowering stage and jointing (Table 2). Jensen (1996) showed that drought stress in canola caused 3.3% reduction in the amount of oil seeds (Jensen et al., 1996). The number of seeds per pod is an important trait in canola yield.

Maximum number of seeds per pod was found in Opera with an average 20.6. This value was obtained with cutting irrigation in stage jointing (Table 2). Niknam and Tarner (1991) stated that drought stress during pollination and grain filling in the canola crop will reduce the number of seeds per pod. In the present study, the number of seeds per pod was low due to drought stress (Opera), which agree with the results of other reports (Halshem et al., 1998; Niknam and Turner, 1999; Poma et al., 1999; Sana et al., 2003).

Comparison of means in the interaction between irrigation and varieties, the maximum oil yield was 1945 kg/ha, achieved in Zarfam variety in regular irrigation. The results of this experiment agree with the results of other reports (Jensen et al., 1996; Das, 1998; Poma et al., 1999; Pritchard, 1999; Sadaqat et al., 2003).

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