Research Journal of Fisheries and Hydrobiology, 6(4): 580-583, 2011
ISSN 1816-9112

ORIGINAL ARTICLES

The Survey of Morphophysiological Characteristics of Rapeseed Varieties Under Condition of Water Stress and Irrigation (*Brassica napus L.*)

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ABSTRACT

Rapeseed is an important oilseed crop in the agricultural ,to assess the resistance to drought stress of two varieties of autumnal Rapeseed and study the their individual performance, a split plot experiment is carried out in 2005-06 harvest season to execute in Karaj, Iran. using two treatments and three replicates, in which irrigation remained as the main factor in seven levels and the two secondary factors consisting of Zarfam & Opera varieties. The results reveled that the effect of variety on the seed yield, seed-oil yield, seed-oil percent (P>0.01) and 1000 seed weight (P>0.05) found significant (P>0.05). The complimentary effects of irrigation and variety on attributes number of fructify in the secondary branches and the number of seed in fructify also showed a significant (P>0.05) impact. Among the studied parameters, the correlation between the seed-oil yield and seed-oil percent was found positive and significant (P>0.01) compared to the number of seed in fructify and the maximum correlation was found between seed yield and oil yield (r = 0.99).

Key words: Yield and yield component, Varieties of Rapeseed, Drought stress.

Introduction

Rapeseed is an important oilseed crop in the agricultural systems of many arid and semi-arid regions where its yield is often restricted by water deficiency and high temperature stress during the reproductive growth. Seed yield can be primarily limited even by the relatively short period of soil moisture shortage during the reproductive development. Drought stress significantly limits plant growth and crop productivity. However, in certain tolerant adaptable crop plants, such as rapeseed, morphological and metabolic changes occur in response to drought, which contribute towards adaptation to such unavoidable environmental constraints (Sinha *et al*., 1982; Blum, 1996). The fact that water stress effects on growth and yield are genotype-dependent is well known (Bannayan *et al*., 2008). In Iran, water is a scarce resource, due to the high variability of rainfall. The effects of water stress depend on timing, duration, and magnitude of water deficiency (Pandey *et al*., 2001). 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 & Sioulas, 2008; Koutroubas *et al*., 2008). Efficient management of soil moisture is important for agricultural production in the light of scarce water resources. Soil conditioners, both natural and synthetic, contribute significantly to provide a reservoir of soil water to plants on demand in the upper layers of the soil, where the root systems normally develop. These oftlinepolymeric organic materials and hydrogels, apart from improving the soil physical properties, also serve as buffers against temporary drought stress and reduce the risk of plant failure, during establishment (De Boodt, 1990; Johnson & Leah, 1990). This is achieved by means of reduction of evaporation through restricted movement of water from the sub-surface to the surface layer (Ouchi *et al*., 1990). Brassica oilseed species now hold the third position among the oilseed crops and are an important source of vegetable oil (Ashraf & McNeilly, 2004). The reactions of plants to water stress differ significantly, at various organizational levels, depending upon intensity and duration of stress, as well as plant species and its stage of development (Chaves *et al*., 2003). Environmental stresses, including drought and temperature, affect nearly every aspect of the physiology and biochemistry of plants and significantly diminish yield (Munns, 2002; Pitman & Lauchli, 2002). Therefore, the primary objective of the present investigation was to examine the effect of water stress on the agronomic characters and physiological exchanges in leaves of rapeseed. The work was also aimed at verifying whether a super absorbent polymer supply to plant might be a strategy for increasing the drought tolerance. The effect of water stress on crop is a function of genotype, intensity and duration of stress, weather elongation conditions and developmental stages of rapeseed (Robertson *et al*., 2004).

Material And Methods

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For appoint of resistance to drought stress two kinds of autumnal rapeseed and survey of component of their function in conditions of treatment for examination drought stress and regular irrigation (control group), examination in case of split plot in form of complete basis project 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 tillering, cutting irrigation in stage of flowering, cutting irrigation in stage of fructify, cutting irrigation in stage of tillering and flowering, cutting irrigation in stage of tillering and fructify, and cutting irrigation in stage of flowering and fructify and also the accessory factor in two levels consist of Zarfam & Opera varieties. The experiment was carried out at the Karaj, Iran during 2005-06. This region has a semi-arid climate (230mm annual rainfall) and has a clay loam soil, with montmorillionite clay mineral, low in nitrogen (0.06-0.07%), low in organic matter (0.56-0.60%), and alkaline in reaction, with a pH of 7.9 and Ec=0.66 dS m-1. The soil texture is sandy loam, with 10% of neutralizing substances. 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 silique's main stem, secondary branch, the length of the silique, the number of the silique in the main stem and the secondary stem, number of the silique in the bush, the number of seed in the silique in main stem and secondary stem, the number of the seed in the silique, 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. The experiment was organized in a randomized complete block design, with split plot arrangement, employing three replications. In order to better evaluate and determine the growth characteristics, growth in different treatments and growth analysis were performed. To measure and calculate indexes of growth, from about 4 to 6 leaf stage of plant physiological interval of once every 14 days, all experimental plots, sampling was destructive and leaf dry weight, total plant dry weight and speed plant growth was determined. Data matching statistical models split plot design in randomized complete block design was simple variance analysis and comparison of means using multiple range Duncan test 5% level was performed. The simple correlation between test characteristics was measured.

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

Irrigation amount	Irrigation phase	Irrigation and stress stage
5120	8	regular irrigation
4480	7	cutting irrigation in stage of tillering
4480	7	cutting irrigation in stage of flowering
4480	7	cutting irrigation in stage of fructify
3840	6	Cut. Ir. in stage of tillering and flowering
3840	6	Cut. Ir. in stage of tillering and fructify
3840	6	Cut. Ir. in stage of flowering and fructify

Results And Discussion

The results of analysis of variance showed that cultivar traits such as yield, oil yield, seed oil (P>0.01) and seed weight (P>0.05) were significant. The interaction of irrigation and variety on grain number pod trait significant effect is exhibited (Table 1). The results of the study showed that a simple variety of 1% probability level on grain yield was significant (Table 2). Mean levels Zarfam variety showed that variety with the average of 4192 and 3448 kg/ha were maximum and minimum production yield. Comparing different levels of irrigation also showed that grain yield with irrigation conditions in forming stems and flowering stages with mean 4769 kg/ha respectively (Table 3). Water shortages could affect deleterious effects on canola yield, but the effect of genotype and developmental stage of plant adaptation to drought depends. Rapeseed ability to absorb water from the depths of the earth could be considered as an advantage (Poma *et al*., 1999).

0 Simple interaction effects of irrigation and irrigation and variety on grain weight was not significant. While the simple variety of 5% probability levels were significant. A simple comparison of variety revealed the highest seed weight associated with a mean variety Zarfam 3/85g respectively. In comparing the interaction of irrigation and genotype was found in drought stress conditions the highest seed weight variety Zarfam (4g) cutting off the water in step stems forming and flowering found to have the least amount of this trait (3/4g) and stress at flowering stage and was forming stem (Table 3). In the study of physiological drought tolerance in rapeseed, expressed under drought conditions, significant differences in grain weight has been reported (Sadaqat *et al*., 2003). It seems that in this study, pod number per plant with the loss of drought stress, the remaining pod seeds maintain their weight normally. Analysis of variance of seed oil percent depicted in the variety of 1% level of this trait was significant (Table 2). Also compare the interaction of cultivar and irrigation control irrigation was found that the highest percentage of oil to average variety Zarfam 5.40% and the highest oil content under drought stress conditions Zarfam variety (5.42) with a water cut conditions in flowering stage and pod forming is obtained (Table 3). Drought stress on seed oil content has no significant effect (Munoz and Fernandez, 1998). Analysis of variance in seed number pod showed that the interaction of cultivar and irrigation at 5% this trait were significant (Table 2). Comparison of means of irrigation and cultivar interactions in drought conditions, the highest number of seeds per pod about opera variety mean 6.20 is that the amount of irrigation in the forming stage is derived stem (Table 3). Drought pollination stage and grain filling decrease in canola seeds per pod is

(Niknam and Turner, 1999). In the present study the number of seeds per pod of drought (variety Opera) has a low above results with the results of such research (Halshem *et al*., 1998; Niknam and Turner, 1999, Poma *et al*, 1999; Sana *et al*, 2003). Table of simple correlation between traits indicated that the number of seed oil, seed pod and seed oil yield positive and significant correlation in 5% level, and positively correlated with grain yield and level of significance has had a percentage, the seed performance, a significant positive correlation in 1% level seed oil and seed oil yield (Table 4).

Table 2: Simple analysis of some trsits of rapeseed cultivars in Karaj area (M.S).

	DF	Grain yield	1000 SW	Oil Content	No. of grain in fructify	Oil yield
Rep(R)	2	476937.506 ^{ns}	0.116 ^{ns}	7.622 *	6.64 ^{ns}	39232.64 ^{ns}
Irrigation(I)	6	2853413.399 ^{ns}	0.019 ^{ns}	2.30 ^{ns}	5.42 ^{ns}	516381.44 ^{ns}
Error(a)	12	2020778.131	0.120	1.89	13.427	343002.74
Variety(V)	1	5803203.429 **	0.261 *	32.78 **	22.748 ^{ns}	1424039.34 **
V* I	6	1282716.97 ^{ns}	0.059 ^{ns}	0.88 ^{ns}	26.964 *	197587.37 ^{ns}
Error(b)	14	666355.661	0.330	0.91	8.64	105306.99
%C.V.	-	16.37	4.82	2.36	15.45	14.89

ns, * and ** : Non significant at the 5 and 1% levels probability respectively.

Simple interaction effects of irrigation and irrigation and variety on grain weight was not significant. While the simple variety of 5% probability levels were significant. A simple comparison of variety revealed the highest seed weight associated with a mean variety Zarfam 3/85g respectively. In comparing the interaction of irrigation and genotype was found in drought stress conditions the highest seed weight variety Zarfam (4g) cutting off the water in step stems forming and flowering found to have the least amount of this trait (3/4g) and stress at flowering stage and was forming stem (Table 3). In the study of physiological drought tolerance in rapeseed, expressed under drought conditions, significant differences in grain weight has been reported (Sadaqat *et al*., 2003). It seems that in this study, pod number per plant with the loss of drought stress, the remaining pod seeds maintain their weight normally. Analysis of variance of seed oil percent depicted in the variety of 1% level of this trait was significant (Table 2). Also compare the interaction of cultivar and irrigation control irrigation was found that the highest percentage of oil to average variety Zarfam 5.40% and the highest oil content under drought stress conditions Zarfam variety (5.42) with a water cut conditions in flowering stage and pod forming is obtained (Table 3). Drought stress on seed oil content has no significant effect (Munoz and Fernandez, 1998). Analysis of variance in seed number pod showed that the interaction of cultivar and irrigation at 5% this trait were significant (Table 2). Comparison of means of irrigation and cultivar interactions in drought conditions, the highest number of seeds per pod about opera variety mean 6.20 is that the amount of irrigation in the forming stage is derived stem (Table 3). Drought pollination stage and grain filling decrease in canola seeds per pod is (Niknam and Turner, 1999). In the present study the number of seeds per pod of drought (variety Opera) has a low above results with the results of such research (Halshem *et al*., 1998; Niknam and Turner, 1999, Poma *et al*, 1999; Sana *et al*, 2003). Table of simple correlation between traits indicated that the number of seed oil, seed pod and seed oil yield positive and significant correlation in 5% level, and positively correlated with grain yield and level of significance has had a percentage, the seed performance, a significant positive correlation in 1% level seed oil and seed oil yield (Table 4).

Table 3: Mean comparison the interaction of irrigation and variety effect on some traits of rapeseed.

Irrigation	Grain yield (kg\ha)		1000 SW		Oil Content%		N.of grain in fructify		Oil yield(Kg/ha)	
	Varity Opera	Varity Zarfam	Varity Opera	Varity Zarfam	Varity Opera	Varity Zarfam	Varity Opera	Varity Zarfam	Varity Opera	Varity Zarfam
regular irrigation	3996 abcd	5021 a	3.82 ab	3.77 abc	39.49 cd	40.57 bcd	19.5 c	16.2 abc	1582 abcd	2040 ab
cutting irrigation in stage of tillering	2971 bcde	3758 abcd	3.77 abc	3.8 abc	39.63 bcd	40.5 bcd	20.6 a	13.3 c	1173 cde	1509 bcde
cutting irrigation in stage of flowering	2167 e	4108 abcd	3.61 bc	3.84 ab	40.5 bcd	41.49 ab	13.6 c	17.6 abc	879.5 e	1716 abcd
cutting irrigation in stage of fructify	2838 cde	4204 abcd	3.69 abc	3.78 abc	39.19 d	41.26 abc	15.3 abc	15.3 abc	1116 cde	1729 abc
Cut. Ir. in stage of tillering and flowering	4404 abc	5133 a	3.45 c	4 a	39.85 bcd	42.52 a	14 bc	18.3 abc	1760 abc	2175 a
Cut.Ir. in stage of tillering and fructify	3638 abcde	2625 de	3.66 abc	3.83 ab	38.75 bcd	41.23 abc	15 abc	19.6 ab	1409 bcde	1080 de
Cut.Ir. in stage of flowering and fructify	4129 abcd	4496 ab	3.84 ab	3.92 ab	40.32 bcd	42.56 a	15 abc	16.3 abc	1666 abcd	1913 ab

Means in each column having similar leter (S) , are not significantly different at the 5% leve (DMR-Test)

Table 4: Simple correlation coefficients among different traits of rapeseed cultivars.

	Grain yield	1000 SW	Oil %	No. of grain in fructify	Oil yield
Grain yield	1	0.137^{ns}	0.202**	0.163^{ns}	0.993**
1000 Seed weight		1	0.446**	0.104^{ns}	0.169^{ns}
Oil Percent			1	0.356*	0.308*
No. of grain in fructify				1	0.203^{ns}
Oil yield					1

ns * and ** : Non significant at the 5% and 1% levels probability respectively

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