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ORIGINAL ARTICLES

The Study of Biological Yield, Grain Yield and Oil Yield in Spring Safflower Varieties Under of Condition Water Streets

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ABSTRACT

Safflower is one of humanity's oldest crops,for determination of drought tolerance of spring safflower cultivars and studying yield and yield components in control and stress conditions, an experiment was conducted. Irrigation in two levels (control and drought at rosette ending period) in main plots and 12 cultivars as (Syrian, PI-537598, Gila, Lesaf, Dinger, 697, Cw- 4440, PI-250536, Hartman, Kino-76, LRV-51-51, S541) as subplots arranged in a RCBD base split plot in three replicates. In plots that were under water stress (stress from the end stages of forming stem growth) do not have any irrigation. Results of analysis of variance showed that the genotype effect of simple traits, oil yield is significant ($P<0.05$). Highest grain yield in irrigated conditions to variety of S541(3845 kg\ha) and in Conditions without irrigation have variety of PI 250536(463.7 kg\ha). That are recommended for agriculture in the region for the experiment.

Key words: Safflower, cultivars, water stress, irrigation.

Introduction

Safflower, a strongly tap-rooted annual plant from the family Asteraceae, is native to the Middle East. It is resistant to saline conditions (Bassil and Kaffka., 2002) and to drought stresses (Bassiri *et al*.,1977). Safflower is usually planted in California in the spring to prevent excessive vegetative growth leading to poor seed yield (Kaffka and Kearney., 1998).The number of capitula per plant and the number of filled seeds per plant in safflower were shown to be linearly correlated with each other (Steer and Harrigan., 1986). Saini and Westgate (2000) pointed out that all of the reproductive sub phases of safflower are sensitive to water deficit.Water stress during early reproductive growth stages reduces seed and/or flower numbers per capitulum. Parameshwarappa and Meghannavar (2001) showed that the number of capitula, seed weight, and seed oil content varies considerably in the safflower population. Mozaffari and Asadi (2006) studied safflower mutant genotypes under normal and drought conditions and reported a positive correlation among capitulum diameter, number of seeds in the capitulum, and seed oil content. Path analysis revealed that the number of seeds in the capitulum, 100-seeds weight, stem diameter under irrigated conditions, days to 50% flowering, and capitulum diameter under drought stress conditions had the greatest positive direct effects, and capitulum weight had the greatest negative direct effects on seed yield. Effatdoust *et al*., (2004) determined that the number of capitula per plant, number of filled and hollow seeds per capitulum under no stressed conditions, and 1000- seeds weight and number of seeds per capitulum under stressed conditions were suitable traits for the selection of drought tolerant spring safflower genotypes. Lovelli *et al*., (2007) showed that the harvest index in safflower did not significantly change in 5 irrigation regimes with a restoration of 100%, 75%, 50%, 25%, and 0% of the maximum crop evapotranspiration, but seed yield declined sharply when drought was severe (Lovelli *et al*., 2007) Yau (2006) indicated that late sowing of spring safflower in a semiarid and high-elevation Mediterranean environment resulted in lower seed yield as later flowering does not allow an escape from the terminal drought and heat. It was reported that the seed yield of safflower decreased sharply when drought stress was severe (Lovelli *et al*., 2007). Omidi Tabrizi (2006) evaluated safflower genotypes under 3 different environmental conditions, in Karaj, Isfahan, and Darab in Iran, and indicated significant differences among genotypes in seed and oil yield. Iran, with an annual 240 mm of rainfall, is classified as a dry region of the world. Current estimates indicate that 25% of the world's agricultural lands is now affected by water stress. It can be said that it is one of the most devastating environmental stresses. The high yield of a plant in sufficiently irrigated conditions is not necessarily related to high yield under drought stress and vice versa. Depending on which stage of growth a plant experiences drought stress, it reacts quite differently to the stress (Gales,1983). 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 spring safflower genotypes.

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Material and Methods

This study, conducted in spring 2009 was performed at the Farm of the Zanjan local. According to the weather, the region with 120 to 150 days dry, a warm, dry Mediterranean climate regions And having a cold, wet winters, hot summers and dry semi-arid areas is considered public. The average annual rainfall, 243 mm of rainfall occurs mainly in late autumn and early spring. Irrigation as the main factor in two levels, regular irrigation and irrigation (stress) the varieties include 12 levels: Syrian, PI-537598, Gila, Lesaf, Dinger, 697, Cw-4440, PI-250536, Hartman, Kino-76, LRV-51-51, S541 were sub –plots. If a small test plots in a randomized complete block design with three replications. In plots that are under water stress (stress from stem end of bloom growth stages), no irrigation was done. But in the spring when soil moisture conditions, irrigation after rainfall to 60% of field capacity was reached in the seventh stage of the irrigation. Determination of agronomic traits of each experimental plot,10 plants were randomly selected and their morphological characteristics were measured. According to statistical data model factorial design in Split plot analysis of variance was simple and mean comparison using Duncan's multiple range test was performed. Comparison of data for analysis and statistical software SPSS and Excel software was used for drawing diagrams.

Results and Discussion

Biological Yield:

Analysis of variance showed that the simple interaction of irrigation ($P<0.05$) and varieties and varieties and irrigation($P<0.01$) on the property has significant.The mean effect of irrigation and varieties showed the highest biological yield varieties under irrigation and drought stress, S541 (16680,1599 Kg/ha) and in conditions without irrigation has Lesaf variety. Omidi and *et al*., (2000) and Zeynali Brothers (1996) concluded that in their experiments biological yield and seed yield of safflower as a positive and significant correlation exists.

Grain Yield:

Results of analysis of variance showed that Simple effect of irrigation on grain yield is significantly(P(0.01) and as the effect of cultivars and varieties, and irrigation of the interaction has no significant effect on this trait. The mean effect of irrigation and varieties showed the highest yield has in the irrigated varieties S541(2845 kg\ha). And the lowest grain yield under irrigation is the variety of PI-537598(2519 kg\ha)(Table 1). The study by Patel and *et al*. (1993) took the stage to flowering and grain filling as a critical stage as the safflower to irrigation. In another study by Samarthia and Muldoon (1995) took them in different combinations of irrigation at different growth stages were used safflower.

Oil Yield:

Results of analysis of variance showed that Simple interaction effects of irrigation and irrigation on yield and seed oil varieties is significant($P<0.01$) and The simple effect of varieties on the oil yield has significant($P<0.05$). The mean effect of irrigation and varieties showed the highest oil yield seed varieties under irrigation is the S541(1198 Kg\ha). At the lowest oil yield under irrigation has Dinger varieties(738.9 Kg\ha)(Table 1). Among the environmental factors that have an effect on the amount of oil, water can increase the amount of oil (Korgman and Hobbs., 1975). If the stress is reduced(Mailer and Cornish.,1987). Jensen *et al* (1996), Showed that not significantly affected mild water stress on canola, seed yield and seed oil but the severe drought stress, seed yield and oil yield significantly decrease.

Table 1: Mean Comparison the Effect of Cultivars and Irrigation on Some Agronomic Traits of Safflower

Treatment	Biological Yield	Grain Yield	Oil Yield
Irrigation (A)			
Irrigation(I_1)	13953.02a	3041.1a	833.6a
Without- Irrigation(I_2)	1754.9b	380.9b	109.6b
Variety (B)			
Syrian(1)	7865bc	1736abc	518.9ab
PI-537598(2)	7232c	1445c	441.1b
Gila(3)	7725bc	1690abc	437.6b
Lesaf(4)	7755bc	1708abc	493.0b
Dinger(5)	7269c	1541bc	429.3b
697(6)	7608bc	1589abc	483.4b
Cw 4440(7)	7660bc	1482bc	426.9b
PI 250536(8)	8370ab	1964ab	532.1ab
Hartman(9)	7679bc	1823abc	544.4ab
Kino-76(10)	8146bc	1897abc	548.8ab

LRV-51-51(11)	7800bc	1600abc	464.0b
S 541(12)	9140a	2060a	460.4a
Irrigation*variety(A*B)			
A1B1	14090bcd	3093bcde	928.5bc
A1B2	12870d	2519e	767.8c
A1B3	13780bcd	2964bcde	767.0c
A1B4	13480cd	2982bcde	862.8bc
A1B5	12810d	2667de	738.9c
A1B6	13340cd	2760cde	839.1bc
A1B7	13520cd	2630e	760.0c
A1B8	14940b	3463ab	932.3bc
A1B9	13690bcd	3349abcd	1003.0b
A1B10	14420bc	3389abc	981.4b
A1B11	13820bcd	2834bcde	825.3bc
A1B12	16680a	2845a	1198a
A2B1	1636e	378.3f	109.2d
A1B2	1569e	370.7f	114.5d
A2B3	1674e	415.3f	108.2d
A2B4	2032e	433.7f	123.2d
A2B5	1729e	415.3f	119.7d
A2B6	1879e	4193.0f	127.7d
A2B7	1800e	333.7f	93.8d
A2B8	1798e	463.7f	131.2d
A2B9	1668e	296.7f	85.9d
A2B10	1870e	404.3f	116.2d
A2B11	1777e	367.0f	102.8d
A2B12	1600e	274.3f	82.7d
Significant (M.S)			
Irrigation (A)	**	**	**
Variety (B)	**	ns	*
A*B	**	ns	**
CV %	9.54	21.6	20.7

Means with similar letter were not significant at the 5% probability level.
Levels of significant:* =P< %5, **= P<%1 and NS = not significant

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