

ORIGINAL ARTICLES

The Amount of Grain yield and oil content in Spring Safflower Varieties in Condition of Different Irrigation

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ABSTRACT

Safflower oil is used by farmers locally in Iran. However, safflower can be a potential oilseed crops for low-rainfall areas. The aim of study of grain yield and oil content of spring safflower varieties in different moisture regimes, an experiment was conducted. Irrigation in two levels (irrigation and non irrigation) in main plots and 6 cultivars as (Syrian, Gila, Lesaf, Dinger, Hartman, and S541) as subplots arranged in a RCBD base split plot in three replicates. Results showed that irrigation and cultivar interaction was significant in oil yield. Mean comparison showed that S541 with 16680 (kg.ha⁻¹) in control . Highest oil content was 1198 (kg.ha⁻¹) and 123.2 (kg.ha⁻¹) in control and stress conditions respectively belonged to S541 and Lesaf. Meanwhile Dinger with 738.9 (kg.ha⁻¹) in control and S541 with 82.7 (kg.ha⁻¹) in stress condition produced the least oil content.

Key words: Safflower , Variety, Different Irrigation, Grain yield

Introduction

Oil has been produced commercially and for export for about 50 years, first as an oil source for the paint industry, now for its edible oil for cooking, margarine and salad oil. Production in the USA, Mexico, Ethiopia, Argentina and Australia comprises most of the remainder[8]. China has a significant area planted to safflower, but the florets are harvested for use in traditional medicines and the crop is not reported internationally. Safflower, a strongly tap-rooted annual plant from the family Asteraceae, is native to the Middle East. It is resistant to saline conditions [5] and to drought stresses. Safflower is usually planted in California in the spring to prevent excessive vegetative growth leading to poor seed yield [11]. 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[9]. 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[7]. 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. 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 [6]. 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[12]. Kar *et al.* (2007) found that the highest water use efficiency was achieved by safflower with the mean values of 3.04 and 1.23 kg ha⁻¹ mm⁻¹ when 3 and 1 supplemental irrigations were applied, respectively[4]. Supplemental irrigation also had a significant effect on grain yield. Therefore, while applying 1 irrigation, only 392 kg ha⁻¹ of grain yield was obtained, and yield was enhanced by 48% when 2 irrigations were applied over the single irrigation. With 3 irrigations, 1258 kg ha⁻¹ of grain yield was obtained, 220% higher than for a single irrigation. 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.

Material And Methods

This study, conducted in spring 2009 was performed at the Zanjan Local ,Iran. 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

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irrigation (stress) the varieties include 6 levels; Syrian, Gila, Lesaf, Dinger, Hartman and 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 MSTAT-C – SPSS and Excel software was used for drawing diagrams.

Results And Discussion

Grain Yield:

Compare the effect of irrigation on the property showed that obtained the highest amount of irrigation in this trait (3041.1 kg/ ha). The mean effect of irrigation and varieties showed the highest yield in the irrigated varieties S541(3845 Kg/ha), variety Dinger(2667 Kg/ha) has in conditions without irrigation . In another study by Bassil *et al*,(2002) took them in different combinations of irrigation at different growth stages were used safflower[1].

Oil Content:

Analysis of variance showed that has significant, variety effect ($P<0.01$) and the interaction of irrigation and varieties effect ($P<0.05$) on seed oil content(Table1). Comparison showed that the interaction of irrigation and varieties the highest of amount seed oil Content under irrigation and without irrigation, the has variety S541 (31.1, 29.12 %). Saini *et al*, (2000, Have reported safflower oil content are not affected by irrigation regimes but Effatdoust (2004), Concluded that oil content will be affected by irrigation regimes, With the increase in oil content and water also increases [10,2].

Table 1: Mean Comparison Study of Morphophysiological Characteristics of Spring Safflower Varieties in Different Moisture Regimes

Treatment	Grain Yield	Oil Content
Irrigation (A)		
I ₁ = Irrigation	3041.1 a	29.1a
I ₂ = Without- Irrigation	380.9b	28.7a
Variety (B)		
Syrian	1736 abc	29.48 abc
Gila	1690 abc	26.33f
LESAAF	1708 abc	28.69 bcde
Dinger	1541 bc	28.31de
Hartman	1823abc	29.58 ab
S541	2060 a	30.16a
Irrigation*variety(A*B)		
I ₁ V ₁	3093 bcde	30.10 abcde
I ₁ V ₂	2964 bcde	25.97 i
I ₁ V ₃	2982 bcde	28.91 cdef
I ₁ V ₄	2667 de	27.73 fgh
I ₁ V ₅	3349 abcd	30.0 abcde
I ₁ V ₆	3845 a	31.19 a
I ₂ V ₁	378.3 f	28.85 def
I ₂ V ₂	415.3 f	26.69 hi
I ₂ V ₃	433.7 f	28.47 fg
I ₂ V ₄	415.3 f	28.88 def
I ₂ V ₅	296.7 f	29.15 bcdef
I ₂ V ₆	274.3 f	29.12 bcdef
Significant (M.S)		
A	**	N.S
B	N.S	**
A*B	N.S	*
CV%	21.16	2.70

Means with similar letter were not significant at the 5% probability level.

Levels of significant: * = $P< %5$, **= $P<% 1$ and NS = not significant

Reference

Bassil, E.S., S.R. Kaffka, 2002. Response of safflower (*Carthamus tinctorius* L.) to saline soils and irrigation. I. Consumptive water use. Agric Water Manage 54: 67-80.

- Effatdoust, N., H. Kazemi, B. Pasban Eslam, M. Zaeifizadeh, 2004. Evaluation of drought stress in different spring safflower genotypes. Agriculture Congress 2004. 4-7 October. Malaysia, AP-72.
- Esendal, E., 2001. Safflower production and research in Turkey. Vth International Safflower Conference , Williston, North Dokota, Sidney, Montana, USA, July 23-27: 203-206.
- Kar, G., A. Kumar, M. Martha, 2007. Water use efficiency and crop coefficients of dry season oilseed crops. Agricultural Water Management, 87: 73-82.
- Kumar-BV., 1991. Response of safflower to irrigation and nitrogen. Orissa Journal of Agriculture Research.4: 1-2: 70-72.
- Lovelli, S., M. Perniola, A. Ferrara, T.D. Tommaso, 2007. Yield response factor to water (ky)and water use efficiency of *Carthamus tinctorius L.* and *Solanum melongena L.* Agricultural Water Management, 92: 73-80.
- Mozaffari, K., A.A. Asadi, 2006. Relationships among traits using correlation, principal components and path analysis in safflower mutants sown in irrigated and drought stress condition. Asian J Plant Sci., 5: 977- 983.
- Omidi Tabrizi, A.H., 2006. Stability and adaptability estimates of some safflower cultivars and lines in different environmental conditions. J Agric Sci Technol., 8: 141-151.
- Parameshwarappa, K.G., R.D. Meghannavar, 2001. Combining hybridization and irradiation for enhancing genetic variability in early segregating generations of safflower crosses. In: 5th International Safflower Conference. Williston, North Dakota and Sidney, Montana, USA.
- Saini, H.S., M.E. Westgate, 2000. Reproductive development in grain crops during drought. Adv Agron., 68: 59-96.
- Steer, B.T., E.K.S. Harrigan, 1986. Rates of nitrogen supply during different developmental stages affect yield components of safflower (*Carthamus tinctorius L.*). Field Crops Res., 14: 221-231.
- Yau, S.K., 2006. Winter versus spring sowing of rain-fed safflower in a semi-arid, high-elevation Mediterranean environment. Eur J Agron., 26: 249-256.