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# ORIGINAL ARTICLES

## The Survey of Moisture Regimes on Grain Yield and Oil Content of Safflower Varieties

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**ABSTRACT**

Safflower is one of humanity's oldest crops, but generally it has been grown on small plots for the grower's personal use .In order to investigate of agronomical characteristics of spring safflower varieties in different moisture regimes, an experiment was conducted. Irrigation in two levels in main plots and 6 cultivars (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 seed oil percentage, and oil yield. Mean comparison showed that S541 with 16680 kg/ha in control . Gila with 25.9% in control and with 26.6% in stress condition produced the least oil percentage. Highest oil content was 1198 kg/ha and 123.2 kg/ha in control and stress conditions respectively belonged to S541 and Lesaf. Meanwhile variety of Dinger with 738.9 kg/ha in control and S541 with 82.7 kg/ha in stress condition produced the least oil content.

***Key words:*** Safflower, Variety, Moisture Regimes, Irrigation.

### 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. 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 oil is used by farmers locally. However, safflower can be a potential oilseed crops for low-rainfall areas (Esendal, E., 2001). Safflower, a strongly tap-rooted annual plant from the family Asteraceae, is native to the Middle East. It is resistant to saline conditions (Bassil, E.S., S.R. Kaffka, 2002). and to drought stresses (Bassiri, A., 1977). Safflower is usually planted in California in the spring to prevent excessive vegetative growth leading to poor seed yield (Kaffka, S.R., T.E. 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, B.T., E.K.S. 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, S., 2007; Yau, S.K., 2006). 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. Supplemental irrigation also had a significant effect on grain yield (Kar, G., 2007). 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. 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 (Omidi Tabrizi, A.H., 2006).

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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 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.

## Material and Methods

This study, conducted in spring 2010 was performed at the karaj Local ,Iran. According to the weather, the region with 130 to 155 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 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. 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 (Samarthia, T.T., D.K. Muldoon, 1995).

**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 |
| LESAF | 1708 abc | 28.69 bcde |
| Dinger | 1541 bc | 28.31de |
| Hartman | 1823abc | 29.58 ab |
| S541 | 2060 a | 30.16a |
| Irrigation*variety(A*B) | | |
| $I_1V_1$ | 3093 bcde | 30.10 abcde |
| $I_1V_2$ | 2964 bcde | 25.97 i |
| $I_1V_3$ | 2982 bcde | 28.91 cdef |
| $I_1V_4$ | 2667 de | 27.73 fgh |
| $I_1V_5$ | 3349 abcd | 30.0 abcde |
| $I_1V_6$ | 3845 a | 31.19 a |
| $I_2V_1$ | 378.3 f | 28.85 def |
| $I_2V_2$ | 415.3 f | 26.69 hi |
| $I_2V_3$ | 433.7 f | 28.47 fg |
| $I_2V_4$ | 415.3 f | 28.88 def |
| $I2V_5$ | 296.7 f | 29.15 bcdef |
| $I_2V_6$ | 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

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*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 %). Yau SK (2006) Have reported safflower oil content are not affected by irrigation regimes but Patel-pG & patel-ZG(1996), Concluded that oil content will be affected by irrigation regimes, With the increase in oil content and water also increases (Patel, N.C., Z.G. Patel, 1993; Yau, S.K., 2006).

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