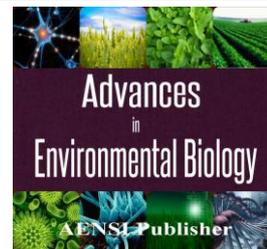




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### Preliminary Study of Agronomy Traits of Fall Safflower Varieties in Karaj Region (*Carthamus tinctorius L.*)

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#### ABSTRACT

Safflower (*Carthamus tinctorius L.*) is an oilseed crop which is grown throughout the semiarid region of the temperate climates in many areas of the world for use as vegetable and industrial oils, spices, and birdfeed. The main of study of Some agronomic traits in foreign varieties of winter safflower, an experiment was carried out in simple lattice design (4\*4) in two replication in the crop growing seasons 2014, in Karaj region of Iran. Treatment effects on the grain yield, harvest index, plant high and biological yield was significant at the 1% ( $p < 0.01$ ). In main comparing cultivars, it was found that the highest grain yield have a varieties (IL-111) with 3832 ( $\text{kg}\cdot\text{ha}^{-1}$ ), and the lowest grain yield have a varieties of Rio-70 with 2439 ( $\text{kg}\cdot\text{ha}^{-1}$ ).

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#### INTRODUCTION

Safflower (*Carthamus tinctorius L.*) is an oilseed crop which is grown throughout the semiarid region of the temperate climates in many areas of the world for use as vegetable and industrial oils, spices, and birdfeed [12]. Safflower (*Carthamus tinctorius L.*) has been grown since ancient times (4500 BC) in Egypt, Morocco, China and India to obtain carthamin from the flowers, a dye that may be either yellow or red. It is a drought tolerant plant and suitable for growing in dry and marginal areas [14]. Safflower has been cultivated in Iran for centuries in small quantities for the extraction of dye from its florets, while its importance, as an oil seed crop, has only been realized since 1970 [4]. Iran is one of the richest germplasm sources of safflower.

Safflower petals have immense medicinal and therapeutic properties as revealed Chinese researchers. Petals of safflower from India were analyzed for carthamin (red pigment) (0.83%), oil(5.0%), protein(1.9%), ash(10.4%), fiber(12.2%) and fatty acid compositions. The petal oil was shown, for the first time, to contain some short chain fatty acids(10:0,12:0 and 14:0), gamma linolenic acid along with fatty acids such as palmitic, stearic, oleic and alpha linolenic acids. Similarly the petals were rich in Ca (530mg), Mg (287mg) and Fe (7.3mg/100g) [16]. Safflower has a long history of cultivation as an oilseed crop and as a source of red dye (carthamin). Carthamin is extracted from its flowers and it is used for treatment in the form of infusion, for circulatory system related diseases. The crop was grown for its flowers, used for coloring and flavoring foods and making dyes, especially before cheaper aniline dyes became available, and in medicines [14,1]. Omidi *et al.* [18] reported that the seed yield per plant is significantly correlated with seed yield per plot, biomass, number of capitula, 100-seed weight, number of secondary branches and oil yield per plant. The results showed a positive correlation between kernel% and oil content, therefore selection for high oil content can be based on thin-hull seeds. Safflower is a highly branched, herbaceous, thistle-like annual or winter annual, usually with many long sharp spines on the leaves. Plants are 30- 150 cm tall with globular flower heads (capitula) and, commonly, brilliant yellow, orange or red flower [22]. Abel *et al.* [2] showed that the number of head per plant or number of seeds per head or both traits could be responsible for high yielding safflower lines. Consentino *et al.* [8] showed that the number of head per plant and seeds per head were significantly and positively correlated. Digming and Yuguang [10] in a study of 30 safflower cultivars, reported that the number of effective branches, main stem diameter, diameter of top seed, 1000 seed weight, oil content and angle of the first branch were the six principal components. Yazdi-Samadi and Abd-Mishani [24] grouped all 1618 Iranian and American safflower genotypes into 5 clusters according to their similarities and reported that the of lines from USA and Iran and

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other eastern countries were classified into same cluster, as they had similar genetic base. Johnson *et al.* [13] indicated that seed yield was positively correlated with seed weight, and plant height. Deharo *et al.*, [9], in a study of 199 safflower genotypes collected from 37 different countries, showed that the oil percent varied by genotype and environmental conditions. The objective of this research was to preliminary study of agronomy traits of fall safflower varieties in karaj region.

## MATERIALS AND METHODS

This experiment was carried out in simple lattice design (4\*4) in two replication in the crop growing seasons 2014, in Karaj region of Iran. Data analysis was based on simple lattice model of statistical design and main comparison was performed using Duncan's multiple range tests. The study was carried out from 16 safflower (*C. tinctorius* L.) genotypes (Table 1). The preparing of the ground was done as: plow, disc, tabulation and stack atmosphere in spring and winter. All operations were performed in a mechanical way to deal with weeds and for a farm pest; the spraying was done three times. Each plot was sown 4 plant lines in 1th May. Each plot had four rows with five meter long and tow meter wide. Characters were examined on twenty plants randomly selected in the mid-rows of plots. For determination of agronomic traits of each experimental plot, 10 plants were randomly selected and their morphological characteristics were measured. After harvesting the following parameters were investigated: Grain yield, Oil Content, Oil yield and Number of head per plant. The safflower seeds with hull were dried at 40 °C for 4 hours under vacuum to less than 5% moisture content and then milled to desired particle size by a mortar. Oil was extracted from 15 grams of each seed powder in Soxhlet extractor for 6 hours using hexane as a solvent, following the AOCS method Ba 3-38 [5]. Oil content of the samples is expressed on a percent basis, based on whole seed. Each treatment was analyzed in triplicate and the figures were then averaged. Data were assessed by analysis of variance (ANOVA) using MSTAT-C software program. Main comparison was performed using Duncan's multiple range ( $p < 0.05$ ) tests.

**Table 1:** Treatments used in the experiment.

Source	Genotype	Cultivar
Mexico	Lesaf	1
Mexico	Dinger	2
Mexico	697	3
Mexico	Cw-4440	4
Mexico	PI 250536	5
Mexico	S-541	6
Mexico	Quirigo-88	7
Mexico	Mante81	8
Mexico	CW-88	9
Canada	Saffire	10
USA	Rio-70	11
USA	CW-74	12
USA	S-555	13
USA	Finch	14
IRAN	IL-111	15
IRAN	LRV-5151	16

## RESULTS AND DISCUSSION

### Grain Yield:

The results of analysis for grain yield showed that there were significant differences among 16 genotypes for seed the oil content ( $P < 0.01$ ) and the grain yield of 16 different genotypes varied from 2439 to 3832 ( $\text{Kg.h}^{-1}$ ), the highest grain yield was obtained from IL.111 genotype ( $3832 \text{ Kg.h}^{-1}$ , respectively). On the other hand, the lowest ( $2439 \text{ Kg.h}^{-1}$ ) was obtained from the Rio-70 genotype (Table 2). This Result is in agreement with studies by Azari [6], Motalebipour [15], Soltani [20], Pasebaneslam [19] and Alhani that reported the superiority and adaptability of L. R. V. 51. 51 for seed oil and grain yields. Banai [7] in a study of the yielding ability and adaptability of twelve chickpea varieties reported that variety 12-60-31 with its high yielding ability was classified in group A (+), on the basis of the Eberhart and Russell method [11].

### Harvest index:

The results of analysis for harvest index showed that there were significant differences among 16 genotypes for seed the oil content ( $P < 0.01$ ) and the harvest index of 16 different genotypes varied from 18.5 to 22.98% are in Table 2, the highest harvest index was obtained from IL-11 genotype (22.8%, respectively). On the other, the lowest (18.5 %) was obtained from the Rio-70 genotype (Table 2). This Result is in agreement with studies by Azari [6], Motalebipour [15], Soltani [20], Pasebaneslam [19] for harvest index.

*Plant high:*

The results of analysis for plant high showed that there were significant differences among 16 genotypes for seed the oil content ( $P < 0.01$ ) and the plant high of 16 different genotypes varied from 89.93 to 124.7 (cm) are in Table 1, the highest plant high was obtained from S-541 genotype (124.7 cm, respectively). On the other, the lowest (89.93 cm) was obtained from the Saffire genotype (Table 2). Yazdi Samadi and Abde Mishani [23] studied 1858 Iranian and foreign lines in irrigation free condition in Karaj announced that the plant height is so changeable and its changing range is from 20 to 90 cm. Also they found out that Iranian lines are the shortest samples.

*Biological yield:*

The results of analysis for biological yield showed that there were significant differences among 16 genotypes for seed the oil content ( $P < 0.01$ ) and the biological yield of 16 different genotypes varied from 13125 to 16842 (Kg.ha<sup>-1</sup>) are in Table 1, the highest biological yield was obtained from IL-111 genotype (16842 Kg.ha<sup>-1</sup>, respectively). On the other, the lowest (13125 Kg.ha<sup>-1</sup>) was obtained from the S-555 and Rio-70 genotype (Table 2). Plaisted and Peterson [21] presented a method for characterizing the stability of yield performance when several varieties were tested at a number of locations within one year, the variety with the smallest mean value being a stable variety.

**Table 2:** Mean values of Cultivars in different agronomic traits of Safflower

Biological Yield (Kg.ha <sup>-1</sup> )	Plant High (Cm)	Harvest Index %	Grain Yield (Kg.ha <sup>-1</sup> )	Cultivar
13429.50d	94.82 c-e	21.5 a-e	2888.55 d-f	Lesaf
13345.50d	97.44 c-e	21.9 a-e	2916.90e-h	Dinger
14353.50 cd	94.03 cd	19.3 cde	2772.00 e-h	697
14038.50def	95.39 cd	19.7 cde	2772.00 e-h	Cw-4440
16138.50 bcd	103.37 cd	21.6 a-d	3486.00 abc	PI 250536
15109.50 a	124.74 a	22.4 cde	3387.30 cde	S-541
16380.00 bc	110.88 bc	20.2 c-f	3307.50 b-e	Quirigo-88
13965.00 d-g	93.14 cd	19.7 cde	2744.70 e-h	Mante81
15865.50bcd	102.85 bcd	21.5 a-e	3405.15 cd	CW-88
15823.50 bcd	89.93 e	22.6 a-e	3568.95 ab	Saffire
13125.00c-f	93.56 cd	18.5 def	2439.15 g	Rio-70
15592.50 f	96.97bcd	21.4 a	3333.75 c-f	CW-74
13125.00 d-g	104.42 bcd	20.4 ef	2683.80 e-h	S-555
15004.50d-g	93.77 de	21.2 b-e	3183.60 b-f	Finch
16842.00a	111.93bc	22.8 a-d	3832.50 a	IL-111
15151.50 c-f	117.29ab	21.9 a-e	3319.05 b-d	LRV-5151

-In each column, means with similar letter are not significantly different ( $P < 0.01$ ).

*Conclusion:*

As a conclusion, between different varieties of safflower, there are significant differences in these experiments, the highest grain yield was obtained from IL.111 genotype (3832 Kg.h<sup>-1</sup>, respectively) Recommended the study be repeated in Karaj and similar areas.

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