



Determination of Some Morphological Parameters of Five Different Safflower Varieties in Field Conditions

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ABSTRACT

This research was carried out to determine some morphological parameters of five different safflower cultivars in Van province conditions. The study was prepared in the experimental areas of Van Yüzüncü Yıl University, Faculty of Agriculture, according to the randomized plot design and was carried out for one year. In the experiment, 5 different safflower varieties, namely Asol, Ayaz, Balcı, Dinçer and Göktürk, were used and plant height, stem diameter, number of heads per plant, number of seeds per tray, first flowering period and thousand grain weight of these varieties were determined. According to the results obtained, there were 28-30 cm, 6-8 mm, 12-13 pieces, 13-15 gr and 97 seeds on five cultivars, where plant height, stem diameter, number of heads per plant, thousand grain weight and first flowering period did not make a significant difference. It was found to be in the range of -99 days. Considering the number of seeds per tray, it was observed that there were differences and the highest yield was obtained from Asol variety with 29.54.

Keywords: Morphological Parameters, Plant Height, Safflower

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Introduction

Carthamus tinctorius L., commonly referred to as Safflower or (false saffron), is an arid climate herb belonging to the Compositae or Asteraceae family and typically growing in South Asia, China, India, Iran and Egypt, resembling thistle (Shirwaikar et al., 2010). The seeds of the safflower plant contain a large amount of oil and have a very high nutritional value. Its oil consists of 70% polyunsaturated fatty acids (i.e. linoleic acid), 10% monounsaturated oleic acid and a small amount of stearic acid (Knowles, 1969). It is a plant variety that has the potential to produce completely high yields in the areas where cereals are produced in our country and in all climatic conditions (grown only with rainfall without the need for any irrigation in dry conditions) and important grain products (such as barley, wheat) similar breeding techniques (Arioğlu ve ark., 2010). Safflower is an important oilseed plant whose potential has not yet been realized and has not been adapted to world agriculture for this reason. Although it is cultivated in limited areas and its production is low, it has an important role in agricultural systems (Gilbert 2008). Another sector of oilseed plants that has become important in recent times is the biodiesel sector. Oilseed plants are the main raw material sources of the sector (İlkdoğan, 2012). Factors such as the security and continuity of energy supply, the fact that fossil-based fuel reserves such as (oil-natural gas and coal) will be consumed in the future, the environmental factor of increasing

importance and the realization of rural development have brought biodiesel as an alternative energy source to the world agenda (İlkdoğan, 2012). The cultivation of crops such as rapeseed and safflower, which are frequently on the agenda with biodiesel, has had a positive effect on the solution of problems such as migration and employment in the countryside, as well as the chance to increase the income of the farmers (Berk ve Yaşar, 2008). In this study, it was aimed to determine some morphological parameters of five different safflower cultivars in Van province conditions. As a result, it can be a very important step to provide practical ideas for producers who will produce safflower as a solution to the drought and energy problem to be experienced in the future, especially for producers who will ensure sustainability in agriculture, and also to minimize product losses with more detailed biological research results.

Material and Method

In this study, some morphological parameters of five different safflower plants (Asol, Ayaz, Balcı, Dinçer and Göktürk) in field conditions (plant height (cm), stem diameter (mm), number of heads per plant (pieces), number of seeds per tray (pieces), 1000 grain weight (gr) was investigated. The field experiment was prepared according to the randomized plots trial design in Van

Yüzüncü Yıl University Faculty of Agriculture trial design and carried out for one year. Temperature, humidity and precipitation values of the sowing region are given in Table 1. The study area consists of a total of 25 plots, 5 for each variety. The plots were prepared 5 m x 5 m in length and 2 m gaps were left between the plots (Figure 1). The row spacing was 25 cm on rows and 5 cm intervals. Each parcel was arranged to have 12 rows. The area was prepared by ploughing with the help of a plow and breaking the clods formed on the soil with a disc harrow between 25 March and 15 April. Just before, 240 gr/da phosphorus (TSP) fertilizer and 480 gr/da Nitrogen fertilizer were applied. After the fertilizer application, with the help of a marker, 12 rows were created in each plot and 2 kg/da of seeds were planted. It is covered with 1-2 cm of soil and left to develop.

Soil analysis

Before the collected soil samples were used in the study, PH, EC, Moisture and Lime values were checked and analyzed according to the evaluations. According to the analysis results, the pH value was 8.17 (slightly alkaline), the EC value was 0.161 dS/M (without salt), the lime was 18% (high lime) and the humidity was 8.12.

Features of varieties

Asol variety was developed by Trakya Agricultural Research Institute by crossing. It is the first variety developed by hybridization in our country. Production permit was obtained on 30.01.2015. Its flowers are orange (it first blooms in yellow, then turns orange) with thorny

seeds, the color of the seeds is white and the plant height is between 70-80 cm (Arslan et al., 2019). Ayaz variety was developed by Bahri Bağdaş International Agricultural Research Institute. Safflower populations obtained from local and US gene centers were selected in terms of resistance to cold by planting in October under Konya conditions between 2007-2012. Among the developed Winter safflower lines, the one with the highest seed yield was submitted to the registration, and while the registration trials were continuing, a production permit was obtained under the name Ayaz (Anonymous, 2021). The plant variety has red flowers and has less thorns. The seeds are cream colored. Balcı variety was bred by selection method by Eskişehir Transition Zone Agricultural Research Institute. This variety was registered in 2011. The plant height is between 55-70 cm. It has yellow flowers has a spiny structure, and its seeds are cream-colored (Arslan et al., 2019). Dinçer variety was registered in 1983 by Eskişehir Transition Zone Agricultural Research Institute. When examined in terms of morphological characteristics, the plant height varies between 90-110 cm. This variety, which shows good branching, has medium-sized leaves. The flower color of this variety, which has a thornless structure, is orange/red and the seeds are white (Arslan et al., 2019). Göktürk variety was developed by Bahri Bağdaş International Agricultural Research Institute. This variety was registered in 2016. Plant height varies between 90-100 cm. It has a vertical structure. As a flower color, it first turns yellow and turns into orange over time. Seed color is white (Arslan et al., 2019).

Table 1. Climate values of Van province for 2019-2020 years

Months	1	2	3	4	5	6	7	8	9	10	11	12
2020												
Average temperature (C°)	-2.0	-1.5	4.6	7.9	13.9	18.6	22.2	21.3	20.3	14.2	7.3	2.1
Average relative humidity (%)	69.6	72.0	70.3	65.9	56.2	49.6	50.9	48.0	44.8	47.4	60.0	66.1
Total rain (mm/kg/m2)	50.3	79.9	44.3	51.8	27.8	13.7	17.6	10.0	5.6	1.8	12.8	27.7

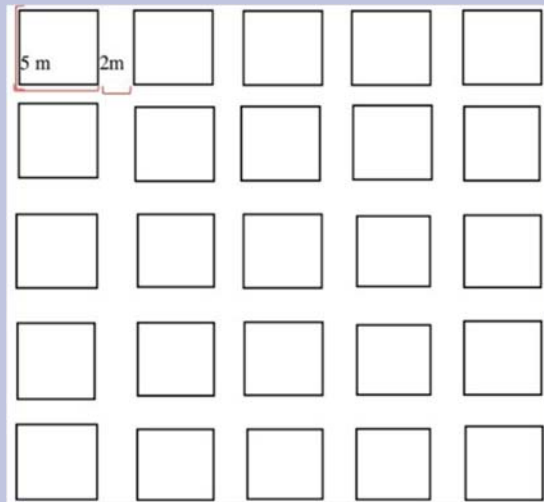


Figure 1. Formal view of parcels

Determination of morphological parameters

Plant height (cm): By making daily observations of the safflower plant, when the harvest time is approached, the distance from the soil level to the top of the plant was found by measuring 10 plants from each plot in cm and 50 plants of each variety in total.

Handle diameter (mm): When the plants matured, 10 randomly selected plants from each sub-plot were measured from the root collar and the parts where the lowest branch was separated from the trunk with a caliper, and the stem diameter was determined by taking the average.

First Flowering Time (days): In each subplot, the time from sowing to the first flower appearance was determined and recorded as days.

Number of Tables per Plant (piece): The number of trays found in all branches of 10 random plants of each variety was written in units.

Number of seeds per tray (pcs): From the safflower plants reaching the maturity stage, 20 pieces of 500 flower heads were cut from each plot and the seeds inside were counted and noted.

Thousand grain weight (gr): The flower trays collected from the plots of the safflower plants reaching the maturity stage were passed through the threshing machine and separated from their seeds. From the seeds obtained, 400 seeds were selected for each variety and weighed on precision scales. Weighed seeds were multiplied by ten and weights were obtained.

Statistic analyses: The data obtained in the study were tested according to a one-way analysis of variance (one-way ANOVA, Tukey), and the differences between varieties were determined (SPSS, 2019).

Results

When the study was examined, no difference was observed in the morphological parameters of five different safflower cultivars. It was observed that the difference was only the stem diameter and the number of seeds per head. Measurements were made from all plots of the safflower plant and calculated in cm and the data obtained are shown in Table 2. When the results were examined, it was seen that the plant heights of Asol, Ayaz, Balcı, Dinçer cultivars were close to each other. Other (28.04, 29.16, 29.00, 29.44 cm) and above (30.00) Göktürk varieties. No statistical difference was found ($P>0.05$). The stem diameters of Asol, Balcı, Dinçer cultivars were close to each other (6.68, 7.50, 7.91 mm), while the stem diameters of Ayaz and Göktürk cultivars were higher (8.32, 8.59 mm) and there was a statistical difference between cultivars ($P<0.05$). It is seen that the number of heads per plant of Asol, Ayaz, Balcı, Dinçer, Göktürk cultivars varies between 12-13 pieces on average (Table 2) ($P>0.05$). The seeds in the flower trays taken from the safflower plants were counted and noted. Looking at the results (Table 2), it was observed that there were statistical differences between the five cultivars ($P<0.05$), the lowest Ayaz (21.76) seeds, and the highest number of seeds (29.54) in Asol cultivar. Looking at Table 2, the thousand-grain weight of Balcı variety was found to be (13.66) g higher among Asol, Ayaz, Balcı, Dinçer and Göktürk varieties ($P>0.05$) (Table 2). In each subplot, the time from sowing to the first flower appearance was determined and recorded as days. It was observed that the first flower heads started to form on 1 June. When we look at Table 3 as a result of the observations, it was observed that the number of first flowering days in Asol, Ayaz, Balcı, Dinçer and Göktürk cultivars were very close to each other (97-99), with only 1-2 days of difference.

Table 2. Determination of morphological parameters of five different safflower cultivars under field conditions (Mean \pm S.E)

Varieties	n	Plant Height	Handle Diameter	Number of Tables Per	Number of Seeds Per	Thousand Grain
		(cm)	(mm)	Plant. (piece)	Tray. (piece)	Weight (gr)
		Mean \pm S.E	Mean \pm S.E	Mean \pm S.E	Mean \pm S.E	Mean \pm S.E
Asol	50	28.04 \pm 0.50a	6.68 \pm 0.19b	13.04 \pm 0.39a	29.54 \pm 1.02c	14.55 a
Ayaz	50	29.16 \pm 0.58a	8.32 \pm 0.26a	12.12 \pm 0.25a	21.76 \pm 0.83a	14.28 a
Balcı	50	29.00 \pm 0.52a	7.50 \pm 0.32ab	12.44 \pm 0.35a	26.34 \pm 0.80bc	15.77 a
Dinçer	50	29.44 \pm 0.53a	7.91 \pm 0.31a	12.82 \pm 0.36a	23.28 \pm 0.76ab	15.43 a
Göktürk	50	30.00 \pm 0.46a	8.59 \pm 2.51a	12.84 \pm 0.35a	25.12 \pm 0.94ab	13.68 a

* The difference between the same letters in each row in the table is statistically insignificant ($P>0.05$).

Table 3. Determination of the first flowering days of five different safflower cultivars (days)

Varieties	Number of First Flowering Days (days)
ASOL	98
AYAZ	99
BALCI	97
DİNÇER	98
GÖKTÜRK	99

Discussion and Conclusion

When the results of the research were evaluated as a whole, it was seen that there were differences in parameters such as plant height, stem diameter, seed, depending on the climatic conditions (temperature, precipitation amount, soil yield) of Van province, and the yield of the safflower plant was not at the desired level. Arslan et al. (2003) Yield characteristics of GW-9003, GW_9025, Yenice, 5-154 and Dinçer cultivars were determined under the climatic conditions of Van province. The plant height of Dinçer cultivar was 69.03 cm, the number of spikes per plant was 12.70 and the weight of 1000 grains was 37.83 g. When compared, it was seen that plant height (29.44 cm) values were close to Dinçer variety and the number of heads was the same (12.82) in our study. Thousand grain weights varied. Çoşkun (2014) conducted a study on the effect of summer and winter planting times on yield in different safflower cultivars. When the data is evaluated that it was (123.67 cm, 16.50 and 39.33 g in the variety of Dinçer), while it was 108.80 cm in plant height, 12.83 in the number of heads per plant, and 35.33 g in 1000-grain weight. When compared with our study, it was observed that the plant heights obtained differed in both cultivars and the number of trays (12.44) was almost similar in the same Dinçer cultivar (12.82) in Balcı cultivar. Gok et al. (2014) A study was conducted on the yield and quality of 3 different safflower varieties (Dinçer, Remzibey, Linas) in dry conditions in Günyazı Village of Şemdinli district of Hakkâri province. The data of Dinçer cultivar were determined as 64.6 cm, 8.9, 37.7, and a thousand grain weight of 40.6 g, respectively. Compared to the Dinçer variety in our study, it was designated that the plant height differences and the number of heads per plant were higher. Different results were obtained from the number of seeds and the weight of one thousand seeds. Gursoy et al. (2018) conducted a study to examine the effect of three different row spacings (20, 30, 40 cm) and three row spacings on yield of two different safflower varieties (Ayaz and Lina) in the experimental area of Ankara University in 2015. The plant height of the Ayaz variety was 111.1 cm, the number of spikes per plant was 20.33 and the number of seeds per tray was 18.57. Ünsal et al., (2020) determined the morphological parameters of different safflower cultivars in their studies. It has been understood that the studies carried out are generally aimed at determining the morphological parameters of plants. When evaluated as a whole, it was observed that the results obtained from the cultivars used differed and there was variability in their morphological parameters. It is thought that factors such as climatic variability in the planting regions, adaptation of varieties to the environmental and precipitation may play an active role. Looking at all the varieties used differences were found according to the Göktürk and Asol cultivars we used in our study. When looked at, it can be concluded that the soil structure of the planted area, climate factor, rainfall frequency affect the yield of the safflower plant. It is foreseen that safflower plant can make important

contributions to the cities with arid climate such as Van, in terms of providing an alternative culture, increasing the welfare level and eliminating the energy that will create serious problems in the future. It is thought that it may be a pioneer for future studies.

Authorship contribution

Esra KINA: Working method, experimental planning, interpretation of results, article writing.

Declaration of ethical code

The research involved no human participants and animals, so the statement on the welfare of animals is not required.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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