Evaluation of Saffron (*Crocus sativus* L.) Yield Components

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Abstract

At present, surface area of saffron cultivation in Khorasan is 43,408 ha with 127 t production. Flower production is estimated 10,000 to 13,000 t. Stigma and style are separated from flower and dried in order to be supplied to the market. The remainder of flower is wasteful and is thrown away.

Some evidence from flower components is used is calculating saffron obtained from flower; yield estimation in the farm, value of fresh flower, estimation of available wastes and contracts between landlord and farmer.

INTRODUCTION

Saffron (*Crocus sativus*), crop from *Iridaceae* family, is one of the native plants of Iran that has been moved to other parts of the world. Its origin has been Asia Minor, Greece and Iran, later on it was expanded to the eastern and northern parts of China and India (Abrishami, 1987).

Saffron is perennial, herbaceous, rosette growth and has a tuberous corm, almost spherical with a diameter 3-5 cm. Each corm produces 6-9 leaves and is located on the upper part of soil. Each corm produces 1 to 3 purple flowers that have three violet sepals and three petals similar together. They open with sun shinning. Pistil is centrical with a tubular ovary that a thin style comes out of it. Style is long and pale yellow that is branched to an orange red three-branch stigma with 20 to 35mm long (Kafi, 2002).

Stigmas have been formed from a plate that is cracked from beneath and width and dendate from upper side. Its long edges have been twisted and have been attached each other from the sides and thus they form a tube and always exist in a three stigma group that have been attached from the base. Flowering in this extraordinary plant in contrast to other plants occurs almost in the second half of October. Saffron flowers come out of corm that have been located underground (Behnia, 1991).

Climatic conditions favorable for high yields of saffron are rainfall in the autumn, warm summers and mild winters. Water requirement of saffron is low and is cultivated under irrigated or rainfed conditions. Soil suitable for optimum growth of saffron is garden soil (clay sand). Iranian farmers prefer to plant saffron early in September to ensure a better sprouting and first harvest in the following autumn (Habibi and Bagheri, 1989).

At present, surface area of saffron cultivation in Khorasan is 43,408 ha with 127 t production. Flower production is estimated 10,000 to 13,000 t. Stigma and style is separated from flower and is dried in order to be supplied to the market. The remainder flower parts are wasteful and they are thrown away (Hemmati, 1994).

Some evidence from flower components is used in calculating Saffron obtained from flower, yield estimation in the farm, value of fresh flower, estimation of available wastes and contracts between landlord and farmer.

MATERIALS AND METHODS

This experiment was conducted in the form of Randomized Complete Block (R.C.B.D.) design with nine treatments and four replicates.

Treatments were different ages of farms with respect to corm age and blocks were different farms. Treatments from 1 to 9 were:

Saffron farm 2, 3, 4, 5, 6, 7, 8, 10 and more than 10 years.

Farms were selected in Gonabad randomly and from each farm 150gr flowers were picked by farmers and were put in plastic bags. Samples were preserved in refrigerator in 40ºC after they were sent to the laboratory from farm. Then following operation were done on each sample:

A: 100 gr flowers were weighed precisely and it was counted. It was done for each sample in four replicates.

Results were calculated for each kg of flower.

B: Then components of flower including sepal and petal, stigma, style, stamen were separated each other and were weighed immediately (Figure 1).

C: In order to determine dry weight of flower components, each of components were located in a clean sterile watch glass separately and were put in an oven with 65ºC.

After fixation of weight, samples were come out of oven and after cooling with dessicater were weighed. Weighting fresh samples were done by a Chinese scale with the sensitivity of 1/5gr and dry weights with Sartorius scale 2934 with the sensitivity of 0.01gr.

RESULTS AND DISCUSSION

Results showed that different ages of farms are similar for number of flowers and there are 2,173 flowers in one kg flower averagely and the C.V. was 9.73%. In other characters there was no significant difference among treatments, but there was significant difference for stigma length +style in 10 flowers, dry and fresh weight of style and dry weight of stamen in reduction or increase of farm age. On the average, 47.39 and 9.48 gr fresh and dried stigma, respectively and 28.93 and 3.26 gr fresh and dried style, respectively are obtained from one kg saffron flower (Figure 2). Ratio of dry stigma to style is nearly 3 to 1.

Data were analyzed in different levels of probability in the form of (R.C.B.D.). Results obtained showed (Table1) that number of flowers /1 kg flower have no significant difference between different treatments. In other words, different ages of farms have no significant difference on number of flowers. Similar results have been obtained for fresh weight of sepal + petal, stigma + style and also stigma and stamen. Fresh weight of style and stigma + style length among ten flowers had significant difference between different treatments. But, style and stigma length separately had no significant difference.

Dry weight of sepal + petal and dry weight of stigma + style and also dry weight of stigma /kg saffron flowers had no significant difference. But, dry weight of style ($p>5\%$) and stamen ($p>1\%$) showed significant treatments.

Tables 2 and 3 show that treatments 2&4 and also treatment 9 with treatment 2 have significant difference in dry weight of style. But, treatments 1,3,5,7,8 are similar. Stigma+ style length among treatments 9, 7, 8, 7, 9, 5, 7, and 4, has significant difference ($p>1\%$).

Treatments 9, 8, 6, and 4 in fresh weight of style, had significant difference relative to treatment 2.

Dry weight of stamen among treatments 6 and 5 relative to 4 and 3 and also 2 relative to 4 have significant difference.

Correlation among different components of flower was determined by regression equation and correlation coefficient. Results show that there is no significant correlation between no flowers and corm age ($r=0.19$) and also no correlation between stigma weight and style weight ($r=0.46$). Stigma had 80%moisture and style 88.70% moisture that radio of fresh to dry in stigma 1 to 5 and in style 1 to 9. Ratio of stigma to dry style is 3 to 1. Similar results were obtained for sepal and petal weight with stigma weight ($r=0.3$) and stigma weight with stigma length ($r=-0/53$). Histogram between corm age and stigma and style length and also corm age with dry weight of style showed that in this respect saffron farms are maximum in the fifth year. So, highest yields of dry style (Sargol) are obtained in the fifth year. Ratio of stigma to saffron is subject to climate, soil texture, type and rate of fertilizers and time of flower picking.

Literature Cited

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Tables

Table 1. Mean squares

Characters under study	No. flowers 56994/96 ns	Tepal fresh weight 126/76 ns	Fresh weight of stigma +style 22/04 ns
D.F. 8	Fresh weight Stigma 16/68 ns Style +stigma Length (10flowers) 0/86** Dry weight Style + stigma 0/48 ns Dry weight of stamen 3/65**	Fresh weight of style 23/61ns Stigma length 0/028 ns Dry weight of stigma 0/66ns Dry weight of tepal 72/76ns	Fresh weight of stamen 107/40ns Style weight 1/06 ns

**highly significant
*significant
Ns non significant

Table 2. Evaluation of average dry weight of style by LSD test (P>5%)

Treatment character under study	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dry weight of style	3.16 ^{cd}	2.29 ^{d}	3.11 ^{cd}	3.61 ^{a}	3.17 ^{cd}	3.36^{abc}	3.2^{bcd}	3.25^{abcd}	3.54^{ab}

Table 3. Evaluation of average characters of Saffron flower by LSD test (P>1%)

Treatment character under study	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stigma+style length in 10 flowers	7.5 ^{bc}	7.26 ^{bc}	7.76^{avc}	8.12 ^{ab}	7.47 ^{bc}	7.53^{abc}	6.86^{c}	7.84^{ab}	8.44^{a}
Fresh weight of style in 1 kg flower	28.14^{ab}	24.66^{b}	27.11^{ab}	31.74^{a}	26.84^{ab}	31.08^{a}	29.08^{ab}	30.27^{a}	31.45^{ab}
Dry weight of stamen in 1 kg flower	13.89 ^{bc}	15.84 ^{ab}	13.97^{bc}	13.74 ^{c}	16.04 ^{a}	16.11^{a}	14.56^{abc}	14.62 ^{abc}	14.27 ^{abc}

Figures

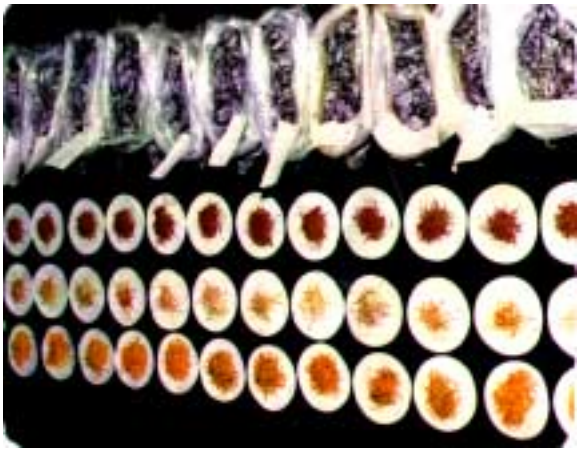

Fig. 1. Separated components of saffron before flower drying

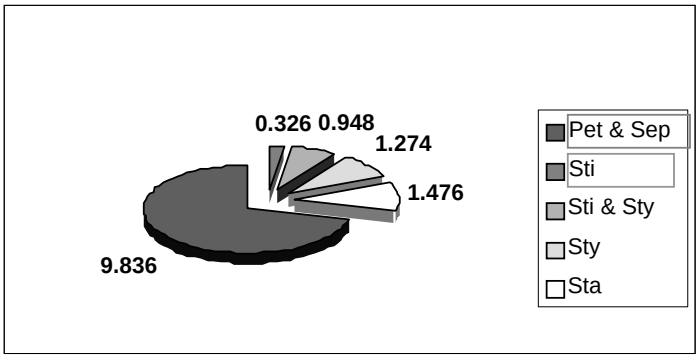

Fig. 2. Different parts of saffron from flowers (% dry weight)