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STUDY ON FLOWER YIELD IN DIFFERENT CORM SIZES OF SAFFRON (*CROCUS SATIVUS* L.) UNDER LOCAL FARMING CONDITIONS OF KASHMIR

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The aim of present study was to evaluate different corm sizes of *Crocus sativus* L. for their flower and saffron yield under local farming conditions of Kashmir.The corms were divided into seven size grades of I,II,III,IV,V,VI and VII with an average weight of 3.23 g,7.09 g,12.65 g,18.66 g,21.77 g,27.49 g and 32.01 g respectively.Corms of size grades I,II and III failed to produce flowers during first year of planting while in grades IV,V,VI and VII flower yield gradually increased with increasing corm weight.Maximum flower yield was observed in grade VII.Besides total flower yield,number of flowers produced per corm was also maximum in this grade being often 4 flowers per corm.Saffron yield per flower was also higher in this grade compared to other grades.All other flowering corm sizes produced a maximum of 2 flowers per corm and frequency of corms producing 2 flowers increasing with their weight.Thus, corms weighing more than 30 g(VII) are ideal for increased flower and saffron yield during first year of planting under prevalent farming conditions in Kashmir..

Key words: Flower yield, Corm weight, *Crocus sativus* L., Kashmir, Saffron

Saffron(*Crocus sativus* L.) is an autumn-flowering herbaceous perennial cormous plant belonging to family Iridaceae.It is extensively grown in the Near East and the Mediterranean basin since the Late Bronze Age(Zohary and Hopf 1994,Negbi 1999).Iran,Spain,Greece and Italy are leading saffron producing countries in the world.In Kashmir province of Jammu and Kashmir state of India it is second important cash crop after apple having a long history of cultivation and is cultivated on elevated plateaus locally called as *karewas* of alluvial or lacustrine soil.Currently over sixteen thousand families living in 226 villages of Kashmir with low land holdings are engaged in saffron farming.Nearly 61% of the farmers are having land holdings below 0.6 hectares.In Kashmir a total yield of 83.6 quintals(1 quintal=100 kgs.) of saffron was recorded in the year 2010,out of which about 80 quintals were recorded from world famous saffron fields of Pampore and a meager 3.6 quintals were contributed by other saffron growing areas.In autumn vast stretches of dry uninviting *karewa* lands in Pampore Kashmir are turned into wonderful gardens by purple saffron blooms.The outstanding feature of saffron flower is three pronged style with each prong terminating into a vivid 25-30 mm long scarlet stigma drooping over perianth segements 6 in number.These stigmas are highly valued for flavouring and coloring of foods,dying of textiles and in traditional medicine systems.Saffron(*Kesar* in India) is the world's highest priced spice made from dried stigmas and styles.During last two or three decades saffron production in Kashmir and in almost all other producing countries has unfortunately shown a declining trend.

The life cycle of saffron is similar everywhere but there are differences in the timing of different events(Botella *et al*. 2002).Flowering occurs during autumn generally in the month of October followed by vegetative stage throughout winter and the formation of replacement corms at the base of shoots.Large number of shoots per corm result in the formation of several small-sized replacement corms.In the months of April or May the leaves senesce and wither coinciding with a rise in temperature and the corms go into dormancy.This long vegetative phase and obviously photosynthetic period is essential for the complete development of replacement corms.The transition to reproductive stage

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Table 1. Flower production and saffron yield in various corm sizes of *Crocus sativus* L.

Corm size	Average weight(g)/corm(range)	%age of flowering corms	Flowers/ flowering corm(±SD)	Saffron (mg/ flower)(±SD)
Grade I	3.23(2.60-4.80)	0	0	0
Grade II	7.09(5.38-9.92)	0	0	0
Grade III	12.65(10.06-14.86)	0	0	0
Grade IV	18.66(17.38-19.55)	33	1.0±0	8.3±1.5
Grade V	21.77(20.10-24.02)	46	1.5±0.5	8.3±1.7
Grade VI	27.49(25.39-29.52)	53	1.5±0.6	8.3±1.7
Grade VII	32.01(30.04-35.00)	66	2.1±1.9	10.3±0

occurs shortly afterwards in the apex of the buds of underground corms.In Kashmir this transition occurs during the month of July(Koul and Farooq 1984).Shortly afterwards from around mid July the sheathing non-photosynthetic white leaves known as cataphylls start to grow at a faster rate than the shoot apex piercing through the soil and protecting growth of young shoot and the scape.Long hot summer has been reported to delay flower emergence which occurs in the late autumn as the temperature falls to the range of 15-17^{0}C(Molina *et al*. 2005).Flower formation is directly related to corm size and a quantitative relationship between these two parameters has been found(Negbi *et al*. 1989).Since the ability of a corm to produce flowers depend on its size,quality planting material in terms of corm size is of paramount importance in obtaining immediate good yield of saffron.The present study evaluates the ability of different corm sizes to produce flowers in order to identify suitable corm size for planting to obtain good yields.

To determine the effect of corm size at planting on subsequent flower production under local farming conditions the experiment was conducted in a saffron field at Pampore(latitude 34^o 01' longitude 74^o 58',elevation 1639 m asl) Kashmir during autumn-winter 2012.Corms obtained from a local farmer were divided into following seven size grades on the basis of their weight: Grade I(weight up to 5 gms), Grade II(weight more than 5 gms up to 10 gms),Grade III (weight more than 10 gms up to 15 gms),Grade IV(weight more than 15 gms up to 20 gms),Grade V (weight more than 20 gms up to 25 gms),Grade VI(weight more than 25 gms up to 30 gms and Grade VII(weight more than 30 gms up to 35 gms).The corms had been freshly removed by the farmer from the soil only a day before. For each size grade 40 healthy corms without any cuts were selected.These corms were planted on September 2nd at a depth of 10 cm in seven well prepared clay loam soil beds of 1 m x 1 m size.In each bed there were 4 rows and in each row 10 corms were planted.The distance between rows was 25 cm and 10 cm between corms in a row.Before planting corms were dipped for few seconds in a fungicide solution of 0.7% carbondizium and 2.5% Mancozeb and dried overnight at room temperature to remove excess moisture.Observations on timing of flowering, number of flowers produced and leaf emergence were recorded regularly.The flowers were picked up early in the morning, stigmas along with the styles were separated and dried in a forced draught oven at 80$^?$C for 1 hr and weighed to determine saffron produced per flower.

After planting on September 2nd the corms of *Crocus sativus* L. started flowering from the third week of October and within almost two weeks time flowering was complete.The study has confirmed that ability of corms to produce flowers during first year of planting depend on their weight.Corms which were more than 17

grams flowered whereas those weighing less failed to produce flowers (Table 1).The percentage of flowering corms gradually increased with weight with maximum flowering corms recorded in size grade VII having average weight of 32.01 grams.Besides, corms of this size frequently produced 3 or 4 flowers whereas in other cases frequency of maximum 2 flowers per corm recorded was more in grade VI(27.49 g) and less in grade V(21.77 g).On the other hand corms of grade IV(18.66) generally produced a single flower.Therefore selection of appropriate size of corms for planting during first year result in more saffron yield.The results confirm the findings of Kaushal and Upadhyay(2002) that the yield of flowers depend on initial size of corms on planting.It has been reported earlier also that large corms have positive effect on flowering rate but no effect on stigma weight(De-Maestro and Ratta 1993).However, we have found positive effect of corm weight not only on flowering rate but on stigma weight as well.A higher saffron yield per flower has been recorded by us in size grade I compared to other flowering size grades.Big corm size dimension has been shown to have a great impact on saffron yield(Mashayekhi *et al*. 2006,Cavusoglu *et al*. 2009).During the course of present study we have observed that cataphylls of corms with maximum size grade emerged from the soil earlier than of lesser size grades and produced flowers followed then by leaves.However leaves emerged earlier in corms of size grades with lesser corm weight which failed to produce flowers.More shoots and thus more leaves were produced by larger corms than smaller ones.The average number of leaves in non-flowering corms was 5.5 and 10 in flowering ones.More shoots and leaves in larger corms support the development of more daughter corms during subsequent year.Initial corm weight has prominent effect on daughter corm production(Khan *et al*. 2011).From our study we conclude that flowering rate of corms of size grade VII falling in the weight range of 30-35 g is higher with more flowers produced per corm and more saffron yield per flower,besides having ability to produce more daughter corms.This size dimension should therefore be a very important quality attribute in planting material for getting enhanced saffron yields right from the first year of planting.

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