EVALUATION OF DESSERT TYPE OF MUSKMELON (*Cucumis melo* L.) FOR SOUTHERN REGION OF KERALA

By

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THESIS
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DECLARATION

I hereby declare that this thesis entitled "Evaluation of dessert type of muskmelon (Cucumis melo L.) for southern region of Kerala" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled "Evaluation of dessert type of muskmelon (Cucumis melo L.) for southern region of Kerala" is a record of research work done independently by Mrs. ELIZABETH CHACKO under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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Elizabeth Chacko

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INTRODUCTION

INTRODUCTION

Cucurbits form an important group of vegetables grown in India which include dessert, salad, pickling and cooking types. Among the dessert types, muskmelon (Cucumis melo L.) ranks at the top. The fruits are with attractive flavour, sweet taste and refreshing effect. Muskmelons are good sources of vitamin C, sugars and minerals (Ramayya and Azeemoddin, 1983).

India has a long history of cultivation of muskmelon which was introduced by the Mughal rulers from Central Asia (Nandpuri, 1989). Since then, it has spread to the different parts of the country as far down to the southern parts of Andhra Pradesh and Karnataka. It is commonly grown during the summer in the rice fallows (as crop rotation), in river beds and even in the garden lands (as crop mix). Though cultivation of dessert types has not yet become popular in Kerala and southern parts of Tamil Nadu, semi-dessert, pickling and cooking types (popularly known as 'oriental pickling melon', 'Vellari', 'Vellarikka' etc.) have been reported in various parts (Seshadri, 1986). In Kerala, the demand for dessert vegetables, especially during the summer season, is heavy. No dessert cucurbit is available in the market other than watermelon. It was considered beneficial to explore the possibility of popularising new vegetables to fit into the existing cropping system. The availability of several semi-dessert forms of muskmelon (in cultivation) in Kerala, pointed to the feasibility of identifying a few dessert varieties of muskmelon for commercial vegetable growing.

Evaluation of the available genetic stock is a pre-requisite for formulating a successful improvement programme in a newly introduced crop. The high degree of cross pollination in muskmelon has resulted in tremendous variation (Davis et al., 1967; Khanna et al., 1969). Apart from genetic variability, the genetic coefficient of variations, heritability, genetic advance, genotypic and phenotypic correlations help in determining the extent of improvement that could be made in yield contributing characters.

The present investigations were carried out at the College of Agriculture, Vellayani to assess the variability available in dessert muskmelons with respect to growth, production and quality parameters, to study the interrelationships among the yield components and to assess the suitability of the available dessert types of muskmelon for culture in the southern zone of Kerala during December-February season.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

In the State of Kerala, muskmelon is an under exploited cucurbitaceous vegetable crop. Though cooking types are common in the State (popularly known as oriental pickling melon or Vellari), dessert types (with superior taste) are rarely seen in cultivation. A review of the available literature on muskmelon and related crops was made and the details are presented in the following sections:

2.1 History and origin

The species *Cucumis melo* is a polymorphic taxon encompassing a large number of botanical and horticultural varieties or groups. It includes dessert as well as cooking and salad types used like cucumber (Naudin, 1959). The tropics and subtropics of Africa are considered to be the primary centre of its origin, though there is no evidence to prove this. Grubben (1977) opined that the melons originated in tropical and subtropical Africa, where many wild types occur. Dane *et al*. (1980) reported that both cross-compatible and cross-incompatible species of *Cucumis* are distributed in South Africa which, therefore, was the likely primary centre of origin of the genus.

The hot valley of Iran or Persia and North-West India are reported as the probable centres of origin, in the

Asiatic regions (Choudhury, 1976). According to Grubben (1977), the secondary centres of diversity are the older cultivation areas in Asia viz., China, India, Iran and the USSR.

An extensive study conducted by Whitaker (1978) revealed that muskmelon proliferated extensively under cultivation after being introduced into India. According to him, well developed secondary centres of distribution existed in several areas of the Indian sub continent. Later, the crop exploded with variability in a congenial environment under the guidance of man. This would account for the large number of species that have come into existence in a relatively short time.

2.2 Taxonomy and ploidy

Muskmelon belongs to the family Cucurbitaceae, sub family Cucurbitae and genus Cucumis. The genus includes more than 40 non-cultivated species of African origin and three cultivated species viz., Cucumis melo (muskmelon), Cucumis sativus (Cucumber) and Cucumis anguria (West Indian gherkin).

Robinson et al. (1976) opined that the word melon referred to the fruits of different botanical varieties of Cucumis melo. According to them, the cultivated forms of Cucumis melo are very many and are difficult of clear classification. There are two principal classes of melons viz., the scent-less melons (winter melons) and the musk scented melons, which comprises netted or soft rinded melons (cvs. mostly grown in America) and cantaloupes or rockmelons or hard rinded melons (cvs. grown principally in Europe).

In America, even the netted melons are called as cantaloupes ie, the name cantaloupe has become generic for all the musk scented melons.

Cucumis melo L. is a diploid, the somatic chromosome number being 2n = 24. Eventhough this is a highly diverse and polymorphic species, cytologically it is very stable and there are no natural polyploids in this species (Ashumetor and Dze Valtovskii, 1975).

2.3 Genetic variability

2.3.1 Length of vine

Sivakami and Choudhury (1974) reported that the vine length in thirteen cultivars and four F_1 hybrids of muskmelon ranged from 0.93 to 3.58 m under Delhi conditions whereas Nandpuri et al. (1975) observed a range of 0.98 to 2.95 m with a general mean of 1.92 m under Punjab conditions. Nandpuri et al. (1976) studied three varieties under screen house conditions and reported that there was significant difference among them for vine length. The range was 2.02 to

4.73 m, with a mean of 3.65 m. Robinson *et al.* (1976) reported that plant size in *Cucumis melo* varied from 1 to 10 m. Chhonkar *et al.* (1979) observed the range of variability from 162 to 282 cm with a general mean of 200 cm at Varanasi and a GCV of 14.51%.

According to Deol *et al.* (1981), the vine length ranged from 76.90 to 209.30 cm, with a mean of 130.20 cm and a GCV of 20.89%, under Punjab conditions. Swamy *et al.* (1985) reported that main vine length ranged between 50.00 and 279.00 cm with a mean of 168.00 cm and a high GCV of 24.39%, under Bangalore conditions.

2.3.2 Number of primary branches per plant

Chhonkar *et al.* (1979) reported that in muskmelon, the number of subcreepers ranged from 10.75 to 15.00, with a mean of 12.11, at Varanasi. They reported a low GCV of 7.59%. Deol *et al.* (1981) observed a range of 5.70 to 11.70 with a mean of 9.70 and a low GCV of 13.33%, at Ludhiana. Swamy *et al.* (1985) reported that the number of primary branches per plant ranged between 2.30 and 8.30 with a mean of 5.70. They observed a low GCV value of 14.24%, at Bangalore.

2.3.3 Flowering parameters

Nandpuri *et al.* (1976) studied the performance of three muskmelon varieties under screen house and field conditions in Ludhiana and observed significant varietal differences for number of days taken from sowing to both first male and female flower production and anthesis. Deol et al. (1981) also observed highly significant differences between varieties for days taken to first female flower production. The range of variation for this trait was 32.70 to 53.10 days with a low GCV of 11.76%.

2.3.4 Yield parameters

2.3.4.1 Days to first harvest

Nandpuri et al. (1975) observed that in muskmelon, the range for number of days taken to maturity was 61.70 to 92.70 with a general mean of 77.60. They obtained a moderate value (8.66%) for GCV. Nandpuri and Tarsem (1978), in an attempt to study the varietal response to date of planting, observed considerable variation among the varieties for the number of days taken from transplanting to fruit maturity, irrespective of the planting date. Deol et al. (1981) reported that this trait showed a range of 71.20 to 87.10 days with a mean of 73.70 days. However, they reported a low value of GCV (5.50%). Swamy et al. (1985) observed considerable variation among 45 genotypes of muskmelon for number of days to first harvest. They observed a range of 75.00 to 96.60 days with a mean of 84.60 days and a low GCV of 5.53%.

2.3.4.2 Yield per plant

Nandpuri *et al*. (1975) reported that the yield per plant ranged from 672 to 4811 g with a general mean of 2821 g. The highest GCV of 52.10% was observed for this trait, indicating that there is much scope for selection among the varieties for yield per plant. Kalyanasundaram (1976) observed that variation among the varieties for yield per plant was non-significant at Annamalai. Chhonkar *et al*. (1979) reported a range from 1060 to 1902 g with a mean of 1435 g. GCV was low of only 10.50%. Deol *et al*. (1981), after evaluating twenty five muskmelon varieties, reported a range of 630.00 to 1820.00 g with a mean of 1223.00 g and a low GCV of 25.20%. Swamy *et al*. (1985) reported that the total yield per plant ranged between 349 and 3061 g with a mean of 1999 g. They reported a GCV of 35.03%.

Regarding the number of fruits per plant, Nandpuri *et al*. (1975) reported a range of 1.6 to 7.3 with a mean of 3.6 whereas Deol *et al*. (1981) reported a low value ranging from 1.30 to 4.50 with a mean of 2.00 and a GCV of 37.69%. Swamy *et al*. (1985) reported a range of 1.20 to 3.90 with a mean of 2.20. They reported a GCV value of 26.19%.

2.3.4.3 Average fruit weight

Review of the available literature showed that in muskmelon, the fruit weight varied widely. Ranges of 338 g to 2064 g (Nandpuri et al., 1975), 262 g to 1973 g (Chaudhury, 1975), 10 g to 10,000 g (Robinson et al., 1976), 200 g to 1010 g (Gurdeep et al., 1977), 395 g to 795 g with a mean of 609 g and GCV of 17.4% (Chhonkar, 1979), 247 g to 995 g with a mean of 656 g and GCV of 35.38% (Deol et al., 1981) and of 314 g to 1517 g with a mean of 907 g and a high GCV of 34.96% (Swamy et al., 1985) have been recorded.

2.3.5 Quality parameters

2.3.5.1 Flesh thickness and flesh/cavity ratio

From Varanasi, Chhonkar et al. (1979) reported that thickness of the pulp ranged from 1.25 to 3.15 cm with a mean of 2.85 cm. They obtained a low GCV of 29.75% whereas a lower range (1.12 to 2.49 cm with a mean of 1.87 cm) and a lower GCV (19.79%) were recorded by Deol et al. (1981) at Ludhiana. Swamy et al. (1985) reported that the trait showed a range of 9.0 to 29.1 mm, with a mean of 11.9 mm and a low GCV of 23.59%. However in Delhi, More et al. (1987) reported a range of 0.34 to 1.57 for flesh/cavity ratio.

2.3.5.2 Total soluble solids (T.S.S.)

Khanna et al. (1969) reported that in muskmelon the T.S.S. ranged from 6.8 to 12.0%. Nandpuri et al. (1975) reported that it was from 4.3 to 12.1% with a general mean of 9.20% and a low GCV of 20.76%. Sivakami and Choudhury

(1975) observed a range of 0.8 to 12.3% in the cultivars of muskmelon and a range of 12.7 to 14.2% in the F_1 hybrids. Robinson *et al*. (1976) reported a range of 3 to 18%. However, Kalyanasundaram (1976) while evaluating three muskmelon cultivars at Annamalai observed that there was no significant difference among the varieties for TSS. Gurdeep *et al*. (1977) reported a range of 5.43 to 8.21% while Chhonkar *et al*. (1979) observed a range of 4.25 to 10.25% with a mean of 6.23% and a low GCV of 24.10%. Deol *et al*. (1981) obtained a range of 4.1 to 10.6% and a mean of 8.7% and low GCV of 19.5% while Swamy *et al*. (1985) recorded a range of 4.7 to 15.3% with a mean of 10.0% and GCV of 23.75%. Reddy (1986) from Delhi reported that in medium TSS varieties, the variation of TSS content was very high. He also observed that TSS variation was high between the fruits of the same plant and between the plants of the same variety than between the high and low TSS varieties. Gurdeep *et al*. (1987) from Ludhiana reported that TSS varies between 7.13 and 11.30%.

2.3.5.3 Content of reducing and non-reducing sugars

Gurdeep *et al*. (1977) reported that the reducing sugars ranged from 2.52 to 4.76%. Reddy (1986) observed that reducing sugars comprised about 60% of the total sugars and non-reducing sugars, about 40%.

2.3.5.4 Acidity

Ito and Sugasegaws (1952) reported that muskmelon flesh contained substantial amounts of citric acid; but no malic or tartaric acid. Robinson et al. (1976) concluded that in muskmelon, acidity varied from pH 3 to 7. Gurdeep et al. (1977) from Ludhiana reported that the acidity in terms of anhydrous citric acid (g/100 ml of the juice) ranged from 0.04 to 0.16. Swamy et al. (1985) reported that the titrable acidity ranged from 0.06 to 0.24 with a mean of 0.12% and a low GCV of 34.18%.

2.4 Heritability and genetic advance

2.4.1 Main stem length

Nandpuri et al. (1975) reported that vine length showed a high value of 77.77% for heritability and a moderate genetic gain (43.23%). Chhonkar et al. (1979) reported that heritability was very high (97.58%) with a low genetic gain (29.53%). According to Deol et al. (1981) also, heritability was high (70.64%) and genetic gain was low (36.24%). High heritability for main stem length was reported by Kalloo and Sidhu (1981) whereas Swamy et al. (1985) reported moderate heritability (55.6%) and low genetic advance (37.6%).

2.4.2 Number of primary branches per plant

Chhonkar et al. (1979) reported that in muskmelon, number of subcreepers showed a high heritability (88.65%) and a low genetic gain (14.66%) whereas Deol et al. (1981) reported moderate heritability (50.59%) and low genetic gain (19.79%). Swamy et al. (1985) obtained a very low heritability value (18.00%) and low genetic advance (12.40%) for this character.

2.4.3 Flowering parameters

Deol et al. (1979) reported that "the number of days to produce the first female flower" showed moderate heritability (69.14%) and low genetic advance (20.28%), indicating that selection could be less effective in bringing about improvement in this character.

2.4.4 Yield parameters

2.4.4.1 Days to first harvest

Nandpuri et al. (1975) obtained a high value of 75.0% for heritability along with low genetic gain of 15.1% whereas Singh et al. (1976) obtained a high value of 72.0% for heritability in narrow sense along with low genetic gain. On the contrary, Chhonkar et al. (1979) reported that the number of days taken from fruitset to maturity showed the lowest heritability of 53.33% and a low genetic advance. Dyutin and Prosvirnin (1979) recorded the highest heritability value for days to first harvest while Deol et al. (1981)

obtained a value of 42.7% for heritability and a low genetic gain of 7.4%. A very low heritability value (less than 13%) for maturity of first fruit has been reported by Lippert and Hall (1982). Swamy et al. (1985) found that the number of days to first harvest had moderate heritability of 47.4% with low genetic advance.

2.4.4.2 Yield per plant

As far as the yield in terms of total weight of fruits, Nandpuri et al. (1975) reported a high heritability (87.8%) with a highest percentage of genetic gain (100.7%). Singh et al. (1976) obtained a low estimate of narrow sense heritability (39.0%) along with low genetic gain (34.0%). Chhonkar et al. (1979) reported that the yield per plant showed a moderate heritability (69.7%) and a low genetic gain (18.0%). Kalloo and Dixit (1981) reported high heritability and high genetic advance for this trait. However, Lippert and Hall (1982) reported a low heritability value of less than 13.0% for this character.

2.4.4.3 Number of fruits per plant

Nandpuri et al. (1975) reported a very high heritability value (97.28%) along with a high genetic gain (88.39%) for total number of fruits per plant. Singh et al. (1976) reported a moderate estimate of heritability (54.0%) and a moderate genetic advance (36.9%). Later, Deol *et al.* (1981) reported a high heritability (85.23%) and a high genetic gain (77.39%). Similar results were reported by Kalloo and Dixit (1981).

2.4.4.4 Average fruit weight

Nandpuri *et al.* (1975) reported a low heritability (36.17%) and a moderate genetic gain (42.67%) as far as the mean fruit weight was concerned. Singh *et al.* (1976) reported a moderate estimate of both heritability and genetic gain (47.0% and 36.8%, respectively). Chhonkar *et al.* (1979) obtained a high heritability (96.4%) and a low genetic gain (35.05%). However, Deol *et al.* (1981) observed a high heritability (78.87%) and moderate genetic gain (66.92%). Kalloo and Dixit (1981) obtained high values for both heritability and genetic advance. Later, Swamy *et al.* (1985) obtained a high value (62.1%) of heritability and a moderate genetic gain (56.7%).

2.4.5 Quality parameters

2.4.5.1 Flesh thickness or flesh/cavity ratio

Singh *et al.* (1976) observed a low estimate of narrow sense heritability (28.0%) along with a moderate genetic gain (36.3%) for flesh thickness. Chhonkar *et al.* (1979) reported that heritability for these characters was high (99.86%), with low genetic gain (30.43%). Deol et al. (1981) observed a high heritability (87.14%) and low genetic gain (38.50%) for flesh thickness. Swamy et al. (1985) reported a high heritability (59.0%) and a high genetic advance (59.4%).

2.4.5.2 TSS

Nandpuri et al. (1975) reported that in muskmelon a high heritability (86.9%) and a moderate genetic gain (39.67%) were observed for TSS. Singh et al. (1976) observed a moderate estimate of narrow sense heritability (57.0%) along with low genetic gain (33.9%). Chhonkar et al. (1979) reported that TSS showed high heritability (92.01%) and moderate genetic advance (45.63%) while Deol et al. (1981) obtained high heritability (75.54%) and low genetic gain (35.4%). However, Lippert and Hall (1982) reported a low heritability (16.0%) for TSS. Swamy et al. (1985) reported high heritability (64.3%) and a low genetic advance (39.71%).

2.4.5.3 Acidity

High heritability (60.3%) and a moderate genetic advance (51.3%) were observed in muskmelon for acidity (Swamy et al., 1985).

2.5 Correlation studies

2.5.1 Growth and flowering parameters

Chhonkar et al. (1979) reported that in muskmelon the length of the main creeper had a positive association, both phenotypically and genotypically, with fruit weight. Deol et al. (1981) found a positive and highly significant correlation for vine length with the number of branches per plant.

Chhonkar et al. (1979) reported that the number of sub creepers was very strongly and positively associated with the number of nodes on the main creeper. The number of branches was correlated with vine length (Deol et al., 1981). They observed a positive and significant correlation of the number of days to produce the first female or bisexual flower with the number of days to fruit picking which showed that the cultivar early in producing female flowers was early in picking too.

2.5.2 Yield parameters

Daljith Singh and Nandpuri (1978) reported that days to first fruit maturity was positively correlated phenotypically as well as genotypically with days to opening of first female flower. TSS, fruit weight and total yield per vine.

Chhonkar et al. (1979) reported that yield was strongly and positively correlated phenotypically and genotypically with the weight of the fruit and the length of the main creeper. The number of sub creepers showed a negative association with yield. Deol et al. (1981) reported that yield per plant showed a highly significant positive correlation with weight per fruit; but negative correlation with number of days to first female flower. Non-significant association was observed for this trait with flesh thickness and shape index. However, these two quality traits were correlated significantly with weight per fruit which in turn was strongly associated with fruit yield. Kalloo and Sidhu (1981) reported that yield per plant was significantly and positively associated with number of fruits, weight of fruits, node at which first hermaphrodite flower appeared, number of branches and length of vines at genotypic and phenotypic level. Salk (1982) observed that total fruit yield per plant was positively correlated with number of fruits per plant and the latter was negatively correlated with fruit weight. Swamy (1985) observed that yield per plant was positively correlated with number of fruits, average fruit weight, number of nodes on the main stem, stem length, internode length, number of primary branches and fruit shape index and negatively correlated with TSS, ascorbic acid and dry matter.

Deol et al. (1981) reported that in muskmelon number of fruits per plant showed non-significant association with yield per plant, fruit weight, shape index, flesh thickness, TSS, vine length and number of branches per plant. It had positive correlation with quality traits. Salk (1982) reported that number of fruits per plant was negatively correlated with fruit weight.

2.5.3 Quality parameters

Guardeep et al. (1977) reported significant positive correlation of flesh thickness with fruit weight. Daljit Singh and Nandpuri (1978) reported that flesh thickness was positively correlated, both phenotypically and genotypically, with total yield. Parthasarathy and Kalyana Sundaram (1978) reported correlation of flesh thickness with weight of fruit and TSS. Deol et al. (1981) reported that in muskmelon flesh thickness did not exhibit significant correlation with any of the traits viz., TSS, vine length, number of branches per plant, yield per plant, shape index and number of fruits per plant. However, More et al. (1987) reported that variation in fruit shape influenced flesh/cavity ratio.

From the factor analysis in muskmelon, Davis et al. (1964) concluded that sweetness was not associated with oblateness of fruit. The first cantaloupe to set and to ripen (on the same plant) were of high quality in appearance and in soluble solids content (Davis et al., 1967). Kalyanasundaram (1976) reported close positive association of TSS with fruit weight. Yamaguchi et al. (1977) reported that the correlation between soluble solids content and eating quality was low. Gurdeep et al. (1977) reported positive non-significant association of TSS with acidity. Daljit Singh and Nandpuri (1978) reported that phenotypically, TSS showed positive and significant correlation with fruit weight and total yield per vine and genotypically it had a significant association only with total yield per vine though it had a positive non-significant association with flesh thickness. However, Deol et al. (1981) reported that TSS had no significant association with the other traits studied.

Gurdeep et al. (1977) reported significant negative association of acidity with flesh thickness in muskmelon. Yamaguchi et al. (1977) reported low correlation between eating quality and soluble solids content. This indicated that high soluble solids content does not necessarily confirm good quality. They further reported that aroma, as judged by the panel, correlated poorly with eating quality.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The present investigations were carried out at the College of Agriculture, Vellayani during the summer season (December-May) 1989-'90. The soil and the agroclimatic factors of the location are furnished in Appendix I.

3.1 Materials

Fifteen muskmelon varieties popular in various melon growing locations of India were used in the study. The varieties were collected from the Divisions of Vegetable crops, Indian Agricultural Research Institute, New Delhi; Punjab Agricultural University, Ludhiana and Indian Institute of Horticultural Research, Bangalore. The varieties included in the present programme are listed in Table 1.

3.2 Methods

The present study was carried out with the objectives of assessing the variability of muskmelon in relation to growth, production and quality parameters and the suitability of the available dessert types of muskmelon to the southern zone of Kerala.

The fifteen varieties of dessert types of muskmelon were evaluated in a randomised block design with three replications. Sowing was carried out during three consecutive months (ie, on 22-12-1989, 19-1-1990 and 16-2-1990). In each cropping season, the same varieties were grown so as to assess the effect of date of sowing on various yield and yield attributing factors.

The area was first levelled and pits of 60 cm diameter and 30-45 cm depth were taken at a spacing of 2 x 2 m. Sowing was done in such a way that in each replication, there were two pits per variety. Seeds were sown at the rate of 3-4/pit and after germination, the seedlings were thinned out to two per pit, resulting in a total population of four plants per plot.

The cultural operations adopted for Vellarikka (oriental pickling melon), as per the "Package of Practices recommendations" of the Kerala Agricultural University (Anon., 1989), were followed for muskmelon, in the absence of specific recommendation for muskmelon.

3.3 Observations

Observations were recorded on twentyfive characters. One plant out of the two in each pit, was tagged for this purpose and the average was calculated. The details of the experimental observations are given below:

3.3.1 Germination parameters

Number of days for germination and the percentage of germination were recorded.

Table 1. Names of varieties included in the experiment and their source

Sl. No.	Variety	Source
1	Pusa Madhuras	IARI, New Delhi
2	Pusa Sharbathi	IARI
3	Durgapura Madhu	Rajasthan
4	Lucknow Safeda	Lucknow
5	Harela	Jamuna
6	Chittidar	Kanpur
7	M-4 (Monoecious-4)	IARI
8	Sanganeer Local	Jaipur
9	Mathuria	Kanpur
10	Bhagpat	Meerut
11	Jaunpuri	Ayodhya
12	FM-1 (Cornell 83-273-6R, Mon-MR-328)	U.S.A.
13	Iroquois	U.S.A.
14	PMR-6	U.S.A.
15	Doublon	France

3.3.2 Growth parameters

Length of the vine, number of branches per vine and fresh weight of the shoot were recorded. These three parameters were taken after the final harvest and uprooting of the plants.

3.3.3 Flowering parameters

The number of days for the appearance of the first male flower and the node at which it formed were observed. Similarly, the appearance of the first female or bisexual flower and the node at which it appeared, were also recorded. The node number was counted starting from the first node at the base of the plant.

3.3.4 Yield parameters

Number of days taken to harvest the first fruit at "full slip stage", branch and node at which the first fruit was produced, total number and weight of fruits, shape of the fruits, and the volume of the fruits were recorded.

3.3.5 Quality parameters

3.3.5.1 Flesh/cavity (F : C) ratio

The flesh thickness was obtained by the following formula (as suggested by Davis *et al*., 1964).

$$\text{Flesh thickness} = \frac{\text{Melon cross diameter without rind cavity diameter}}{2}$$

The F:C ratio was calculated using the formula

$$\frac{\text{Flesh thickness}}{\text{1/2 cavity diameter}}$$

3.3.5.2 T.S.S.

The content of total soluble solids of flesh at the equatorial region, was recorded with the help of a hand refractometer and expressed in percentage.

3.3.5.3 Total sugars

The content of total sugars was determined according to the procedure given by S.L. Chopra and J.S. Kanwar and was expressed in percentage.

3.3.5.4 Reducing sugars

The content of reducing sugars was also determined in accordance with the procedure of S.L. Chopra and J.S. Kanwar.

3.3.5.5 Non-reducing sugars

The percentage of non-reducing sugars too was determined according to the procedure given by S.L. Chopra and J.S. Kanwar.

3.3.5.6 Acidity

Acidity was determined according to the method suggested by AOAC (1960) and expressed in terms of anhydrous citric acid (g/100 ml of the juice).

3.3.5.7 Organoleptic test score

An arbitrary scale 0-4 was given for the different taste categories. The fifteen varieties were tested by a panel of three judges who gave scores based on their personal judgement. A score 'Zero' was given if the variety had a totally unacceptable taste and the higher scores were given relative to the taste of the fruits as judged by the persons. The average of the three scores for each variety was finally recorded.

3.3.6 Reaction to major pests and diseases

3.3.6.1 Reaction towards major pests

Observations were made on the incidence of fruit flies (*Dacus cucurbita* and *Dacus dorsalis*) and pumpkin beetles (*Aulacophora sp.*). A scoring procedure (with a scale 0-4) was attempted depending on the extent of damage to the plants or fruits.

3.3.6.2 Reaction towards major diseases

No major disease problem was noticed, except for an unidentified virus disease in certain varieties. The varieties showing the symptom were classified as susceptible to the virus disease.

3.4 Statistical analysis

The details of the statistical analysis followed are given below:

3.4.1 Analysis of variance

Analysis of variance was done to test the significance of the differences observed between the varieties, with respect to the various traits, to estimate the variance components and to work out the correlation coefficients (Panse and Sukhatme, 1978).

Since the extent of phenotypic variation for any character is the sum of the genetic and environmental effects, it was determined by the methods given by Kempthorne (1957).

$V(P) = V(G) + V(E)$

$\sigma^2 p(x) = \sigma^2 g(x) + \sigma^2 e(x)$

where $V(P) = \sigma^2 p(x)$ = variance due to phenotype

$V(G) = \sigma^2 g(x)$ = variance due to genotype

$V(E) = \sigma^2 e(x)$ = variance due to environment

Source of variation	Degrees of freedom	Sum of squares	Mean squares	'F' ratio
Blocks	(b-1)	$\frac{\sum_j B_j^2}{v} - C = SS_B$	$SS_B/(b-1) = MS_B$	MS_B/MS_E
Varieties	(v-1)	$\frac{\sum_i V_i^2}{b} - C = SS_V$	$SS_V/(v-1) = MS_V$	MS_V/MS_E
Error	(b-1)(v-1)	$SS_T-(SS_B+SS_V) = SS_E$	$SS_E/(b-1)(v-1) = MS_E$	
Total	(bv-1)	$\sum_{ij} Y_{ij}^2 - C = SS_T$		

where $B_j s^1$ are the block totals,

$j = 1, 2, \ldots\ldots b$

$V_i s^1$ are the treatment totals

$i = 1, 2, \ldots\ldots v$

$Y_{ij} s^1$ are the individual observations

The ratio $\frac{MS_B}{MS_E}$ follows an 'F' distribution

with (b-1) and (b-1)(v-1) degrees of freedom and provides a test of significance for the blocks. Similarly, the ratio $\frac{MS_V}{MS_E}$ follows an 'F' distribution with (v-1) and (b-1)(v-1) degrees of freedom and provides a test of significance for the varieties. MS_E is the estimate of error variance and $\sqrt{\frac{MS_E}{b}}$ is the estimate of standard error of the mean. The varieties were compared using the value of the critical difference given by

$$CD = t\ (b-1)(v-1) \sqrt{\frac{2\ MS_E}{b}}$$

The analysis of variance was done separately for the three planting seasons.

Pooled analysis of variance was done to investigate the variety x season interaction for the various characters. Prior to pooling, the estimates of error variance for the three trials were tested for homogeneity by applying the 'F' test. Whenever the error variances were homogenous, the following analysis was done.

Source of variation	Degree of freedom	Sum of squares	Mean squares	'r' ratio
seasons	(l-1)	$\frac{\sum L_{ij}^2}{v6} - C = SS_L$	$SS_L/(l-1) = MS_L$	
Varieties	(v-1)	$\frac{\sum_i V_i^2}{16} - C = SS_V$	$SS_V/(v-1) = MS_V$	$\frac{MS_V}{MS_{VL}}$
Variety X Season	(v-1) (l-1)	$SS_T - (SS_L + SS_V)$	$SS_{VL}/(v-1)(l-1)$	$\frac{MS_{VL}}{MS_E}$
Pooled error	$n_1+n_2 = n$	$SS_{E1} + SS_{E2} = SS_E$	$SS_E/n = MS_E$	

where L_{js}' are the season totals, j = 1, 2, ... l

V_is' are the treatment totals, i = 1, 2 v

n_1 = error degrees of freedom for the first trial

n_2 = error degrees of freedom for the second trial

SS_T = sum of squares of variety totals

SS_{E1} = Error sum of squares for the first trial

SS_{E2} = Error sum of squares for the second trial

The ratio MS_{VL}/MS_E follows an 'F' distribution with (v-1)(l-1) and n degrees of freedom and provides a test of significance for variety x season interaction. Similarly, the ratio MS_V/MS_{VL} follows an 'F' distribution with (v-1) and (v-1) (l-1) degrees of freedom and provides a test of significance for the varieties.

Wherever the error variances were found to be heterogenous, the procedure of weighted analysis of variance was done as follows:-

Weight for each season = $W_i = \frac{r}{s_i^2}$

where r = number of replications

s_i^2 = error mean square of the corresponding character

$W_i P_i$ for each season, where P_i's are the season totals for the corresponding characters.

$W_i t_i$ for each variety, where t_i's are the means for each variety for each season.

S_i = The column-wise sum of squares.

The various items in the analysis of variance were calculated as follows:-

Total sum of squares $= \sum W_i S_i - C$

$= SS_T$

where, $C = \frac{G^2}{t \sum W_i}$, $G = \sum (\sum W_i t_i)$

$= \sum W_i P_i$

t = number of varieties

Season sum of squares $= \frac{1}{t} \sum (W_i P_i^2) - C$

$= SS_L$

Variety sum of squares $= \frac{\sum (W_i t_i)^2}{\sum W_i} - C$

$= SS_V$

Variety X Season sum of squares $= SS_T - (SS_L + SS_V)$

$= SS_{VL}$

Source of variation	Sum of squares
Seasons	SS_L
Varieties	SS_V
Variety X Season	SS_{VL}
Total	SS_T

For testing the significance of Variety X Season interaction $\chi^2 = \frac{(n-4)\ (n-2)}{(n + t-3)} \times I$ was compared with the table value of χ^2 having

$\frac{(p-1)\ (t-1)\ (n-4)}{(n + t-3)}$ degrees of freedom where,

$I = SS_{VL}$

n = degrees of freedom for error

p = number of seasons

t = number of varieties

The significant χ^2 values indicated that the varieties differed from season to season with respect to the particular character. Hence, the relevant varietal differences were tested by comparing the variety and interaction mean squares obtained from an unweighted analysis.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	'F' ratio
Season	(1-1)	$\frac{\sum_i L_j^2}{V} - C = SS_L$	$SS_L/(1-1) = MS_L$	
Varieties	(v-1)	$\frac{\sum_I V_i^2}{1} - C = SS_V$	$SS_V/(v-1) = MS_V$	MS_V/MS_{VL}
Season X variety inter-action	(v-1)(1-1)	$SS_T-(SS_L+SS_V) = SS_{VL}$	$SS_{VL}/(v-1)(1-1) = MS_{VL}$	
Total	(vl-1)	$\sum_{ij} Y_{ij}^2 - C = SS_T$		

where L_j's are the season totals, j = 1, 2, ... 1

V_i's are the varietal totals, i = 1, 2, ... v

Y_iJ's are the individual observations

The ratio MS_V/MS_{VL} follows an 'F' distribution with (v-1) and (v-1) (1-1) degrees of freedom and provides a test of significance of varieties.

Non-significant χ^2 values indicated the absence of interaction. Under such a condition, no general test for overall treatment difference available.

3.4.2 Coefficient of variation

The coefficient of variation was used for comparing the extent of variation between different characters measured in different scales and its possible components were estimated as suggested by Burton (1952). The formulae used in the estimation of variability at genotypic and phenotypic levels are as follows:

Phenotypic coefficient of variation (PCV)

$$\text{PCV for character } x = \frac{\sigma p(x)}{\bar{x}} \times 100$$

Genotypic coefficient of variation (GCV)

$$\text{GCV for character } x = \frac{\sigma g(x)}{\bar{x}} \times 100$$

where $\sigma p(x)$ and $\sigma g(x)$ are the phenotypic and genotypic standard deviation respectively and $\bar{x}$ is the mean of the character x.

3.4.3 Heritability

Heritability in the broad sense was estimated as suggested by Jain (1982) as

$$H^2 = \frac{\sigma g^2(x)}{\sigma p^2(x)} \times 100$$

where H^2 = Heritability in the broad sense

$\sigma g^2(x)$ = Genotypic variance

$\sigma p^2(x)$ = Phenotypic variance

3.4.4 Genetic advance under selection (G.A.)

Genetic advance is the measure of the change in the mean phenotypic level of the population produced by the selection and depends upon heritability of the character and selection differential. Genetic advance for character x is estimated as suggested by Lush (1940) and Johnson _et al._ (1955) using the constant (i) as 2.06 as given by Allard (1960).

$$GA = KH^2 \sigma p(x)$$

where GA = genetic advance

σp = phenotypic standard deviation

K = Selection differential which is 2.06 at 5% intensity of selection in large samples

3.4.5 Correlation coefficients

The phenotypic correlation coefficient rp(x,y) between x and y was estimated as:

$$rp\ (x,y) = \frac{\sigma p\ (x,y)}{\sigma p\ (x)\ \ p\ (y)}$$

where p (x,y) = Phenotypic covariance between x and y.

p (x) = Standard deviation of the character x

p (y) = Standard deviation of the character y

The genotypic correlation coefficient r_g (x,y) between x and y was estimated as

$$r_g\ (x,y) = \frac{\sigma g\ (x,y)}{\sigma g\ (x) \times \sigma g\ (y)}$$

where σg (x,y) = genotypic covariance between x only

σg (x) = standard deviation of the character x

σg (y) = standard deviation of the character y

The environmental correlation coefficient r_e (x,y) between x and y was estimated as

$$r\ e\ (x,y) = \frac{\sigma e\ (x,y)}{\sigma e\ (x)\ \sigma e\ (y)}$$

where σe (x,y) = environmental covariance between x and y

σe (x) = standard deviation of the character x

σe (y) = standard deviation of the character y

Critical values of 'r' corresponding to 43 degrees of freedom at 5% level of significance were used for the test of significance for phenotypic as well as environmental correlation coefficients (Fisher & Yates, 1957).

RESULTS

RESULTS

The results of the experiments are presented under the following subheadings:

4.1 Variability

The data collected on the various characters were subjected to analysis of variance for testing the significance of the difference between varieties during the three seasons and the ANOVA is furnished in Tables 2 to 8. Pooled analysis was done to test the influence of environment on these characters, and the ANOVA is presented in Appendix III 26.

4.1.1 Germination parameters

Significant difference was recorded among the treatments, during the three seasons for the number of days taken for the seeds to germinate. Since the error variances were heterogenous, weighted analysis was performed to test genotype-environmental interaction, which was found to be non-significant.

The number of days for the seeds to germinate ranged from 4.00 (Doublon & Lucknow Safeda) to 7.50 (FM-1) in December sowing, from 5.67 (Jaunpuri & Pusa Madhuras) to 8.33 (FM-1) in January sowing and 5.17 (Doublon) to 8.00 (FM-1) in February sowing (Table 9).

Table 2. Analysis of variance (ANOVA) for different germination parameters in 15 muskmelon varieties during the three seasons

Season I — MEAN SQUARES

Source of variation	df	Days to I germination			Percentage of germination		
		S-I	S-II	S-III	S-I	S-II	S-III
Replication	2	0.69	0.34	0.51	251.81	26.67	50.55
Genotype	14	4.89**	2.41*	3.23**	2540.14	2753.33**	2629.60**
Error	28	0.98	0.90	0.35	69.51	52.86	25.56

Season II

* Significant at 5% probability level

** Significant at 1% probability level

Table 3. Analysis of variance for different flowering parameters in 15 muskmelon varieties during the II season

rce of iation	df	Days to I S flower			Node no. of I S flower			Days to I positively significant flower			Node no. of I positively significant flower		
		S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III
.ica-	2	2.22	5.49	2.42	6.67	0.42	0.27	0.80	2.75	0.96	1.09	0.02	6.07*
type	14	92.17**	77.50**	64.23**	11.72**	3.27**	4.06**	48.06**	110.52**	57.04**	10.27**	12.37**	7.91**
r	28	3.06	1.77	1.76*	0.95	0.71	0.84	4.44	1.66	4.41	2.09	1.57	1.50

* Significant at 5% probability level

** Significant at 1% probability level

Table 4. Analysis of variance for different quality parameters in 15 muskmelon varieties during the three seasons

Source of variation	df	Flesh/cavity			TSS			Reducing sugars		
		S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III
Replication	2	0.02	0.001	0.001	0.05	0.10	0.02	0.14	0.02	0.01
Genotype	14	0.11**	0.09**	0.06**	1.91**	4.38**	2.70**	1.69**	3.87**	2.75**
Error	28	0.02	0.002	0.001	0.13	0.08	0.03	0.17	0.11	0.03

* Significant at 5% probability level

** Significant at 1% probability level

Table 5. Analysis of variance for different quality parameters in 15 muskmelon varieties during the three seasons

Source of variation	df	Non-reducing sugars			Acidity		
		S-I	S-II	S-III	S-I	S-II	S-III
Replication	2	0.03	0.001	0.001	0.02	0.001	0.01
Genotype	14	0.03	0.03	0.02**	0.02**	0.03**	0.03*
Error	28	0.02	0.02	0.004	0.001	0.004	0.01

* Significant at 5% probability level

** Significant at 1% probability level

Table 6. Analysis of variance for different growth parameters in 15 muskmelon varieties during the III seasons

Source of variation	df	Length of vine			No. of secondary branches			No. of tertiary branches			Fresh weight of shoot		
		S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III
Replication	2	1440.13*	88.81	165.69	0.29	0.80	0.62	12.02	1.76	1.09	728.5	965.5	421.00
Genotype	14	6251.05**	4964.96**	2625.02**	2.40**	1.33**	1.99**	418.31**	302.18**	177.92**	50044.18**	23050.61**	42250.43**
Error	28	382.87	321.92	381.50	0.77	0.28	0.69	7.02	6.81	5.83	646.05	312.39	366.36

* Significant at 5% probability level

** Significant at 1% probability level

Table 7. Analysis of variance for the reaction of 15 muskmelon varieties to the incidence of major pests and their performance in the organoleptic test during the three seasons

Source of variation	df	Fruit fly attach scores			Pumpkin beetle attack scores			Organoleptic test score
		S-I	S-II	S-III	S-I	S-II	S-III	S-I
Replication	2	0.47	0.16	0.29	0.16	0.09	1.36**	0
Genotype	14	2.30**	2.52**	2.61**	1.57**	1.79**	1.32**	1.49**
Error	28	0.42	0.30	0.29	0.32	0.40	0.19	0.29

* Significant at 5% probability level

** Significant at 1% probability level

Table 8. Analysis of variance for different yield parameters in 15 muskmelon varieties during the three seasons

Source of variation	df	Days to I harvest			Node no. of I harvest			Total no. of fruits/vine			Total weight of fruits/vine			Volume of a fruit		
		S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-II
Replication	2	0.30	1.75	0.86	0.96	1.16	5.96*	0.21	2.29	0.17	31216.00*	4824.00	4240.00	348.56	105.43	153.8
Genotype	14	460.19**	461.71**	364.27**	12.07**	13.88**	10.60**	1.81**	1.96	1.32**	238469.90**	91826.25**	166636.60**	33548.12**	21571.39**	27351.6*
Error	28	10.86	3.80	6.70	1.86	1.75	1.48	9.24	1.74	0.07	6211.07	3736.75	4534.68	160.33	91.60	136.1

*Significant at 5% probability level

**Significant at 1% probability level

The variance among the varieties in the percentage germination was also tested. The ANOVA revealed significant difference among the genotypes for the character only in the January and February sown crops. Since the error variances were heterogenous, weighted analysis was done which indicated non-significant interaction.

The percentage germination ranged from 12.50 to 100.00, from 13.30 to 96.66 and from 16.67 to 96.67 in the three trials. The highest germination percentage was shown by the variety Jaunpuri and the lowest, by M-4 in the three trials. The varieties Lucknow Safeda, Sanganeer Local and PMR-6 were on par with Jaunpuri for the December sown crop.

4.1.2 Flowering parameters

The mean data and the pooled mean are presented in Table 10. Significant difference was observed among the genotypes for the number of days to male flower production in the December, January and February sown crops. Since the error variances were homogenous, unweighted pooled analysis was done to test the genotype x environmental interaction, which was found to be significant. Significant treatment differences were also observed when tested against this interaction.

The number of days to male flower production ranged from 26.00 to 44.67, 21.67 to 38.00 and 22.33 to 38.33 in the

December, January and February sown crops, respectively. Durgapura Madhu was found to be earliest with respect to male flower production, in the three cropping seasons. PMR-6 and Doublon were on par with Durgapura Madhu during the December sown crop. In the January sown crop, Lucknow Safeda and Harela were on par and in the February sown crop, Lucknow Safeda was on par with Pusa Madhuras.

The first male flowering node also showed significant genotypic variance for the three crops. The error variances were homogenous and therefore, unweighted pooled analysis was done which showed non-significant interaction with genotype. The character ranged from 2.67 (PMR-6, Sanganeer Local & Lucknow Safeda) to 8.33 (Iroquois & Chittidar), 2.67 (Pusa Sharbathi & FM-1) to 6.33 (Chittidar) and 3.33 (Pusa Sharbathi) to 7.67 (Chittidar) during the December, January and February sowings, respectively.

Significant difference was recorded among the treatments for the days to female/bisexual flower production and the first female/bisexual flowering node for the December, January and February sown crops. The variances were heterogenous for the days to flower and homogenous for the first flowering node and therefore, weighted and unweighted pooled analyses were respectively done to test genotype x environment interaction which was found to be significant for both characters. Treatment differences, when tested against this interaction, was significant only for the days to flower. The days to female/bisexual flower production ranged from 40.33 (Durgapura Madhu) to 55.67 (M-4), 34.00 (Harela) to 52.00 (PMR-6) and 35.33 (Lucknow Safeda) to 51.33 (Iroquois) for the December, January and February sown crops, respectively. The pooled data showed that Lucknow Safeda was the earliest in female/bisexual flower production (38.33 days). The first female/bisexual flower was produced at the lowest node by Durgapura Madhu (6.00) during the December crop, Mathuria (7.00) by the January crop and February crop (7.67). The pooled value showed that Mathuria produced first female/bisexual flower at the lowest node (8.00). Pusa Madhuras and Doublon were on par with Durgapura Madhu during December, Pusa Madhuras & M-4 were on par with Mathuria during January and Pusa Madhuras & M-4, Jaunpuri & PMR-6 were on par with Mathuria during February crop.

Harela was on par with Durgapura Madhu for the December crop, Pusa Madhuras & Lucknow Safeda with Harela for the January crop and Pusa Madhuras & Pusa Sharbathi with Lucknow Safeda for the February crop for the earliness in female/bisexual flowering.

It was observed that the days to male/female/bisexual flower production decreased from December to February sown crops while the female/bisexual flowers were borne on higher nodes from December to February sown crops even though first male flowering node did not show much difference.

4.1.3 Yield parameters

Significant **difference** was seen among the treatments in the three trials with respect to the days to first fruit harvest and the first fruiting node. Since the error variances were heterogenous for the days to first harvest, weighted pooled analysis was done to test genotype x environmental interaction and found to be significant. Significant treatment differences were also seen when tested against this interaction.

The character ranged from 67.67 (Pusa Sharbathi) to 115.33 (Iroquois) for the December sown crop, 62.33 (Pusa Madhuras & Lucknow Safeda) to 105.67 (Iroquois) for the January sown crop and 62.67 (Lucknow Safeda) to 107.33 (Iroquois) for the February sown crop (Table 11). The pooled data showed that Lucknow Safeda was the earliest in fruit harvest (67 days). It was observed that the number of days to first fruit harvest decreased from December to the February sown crops. The variety Jaunpuri was on par with the earliest fruit harvest variety of December crop and Harela with that of January crop.

ANOVA revealed significant genotypic difference for the first fruiting node in the three trials. Since the error variances were homogenous, unweighted pooled analysis was done to test the genotype x environment interaction. A significant interaction was observed. But the treatment differences were non-significant when tested against this interaction. The first fruit was harvested from lowest node (7.3) from Durgapura Madhu for the December sown crop, from Mathuria for the January and February crops (7.6 and 10.0 respectively). It was observed that fruits were borne at higher nodes when planting was delayed from December to January & February. The pooled data showed Pusa Madhuras as the variety bearing fruits at the lowest node (9.3).

Pusa Madhuras was on par with Durgapura Madhu for December crop, Pusa Madhuras & M-4 for January crop and Pusa Madhuras, Pusa Sharbathi for the February sown crop.

The total number of fruits per vine showed significant treatment differences only for the December and February sown crops. The error variances were heterogenous and hence unweighted pooled analysis was done and interaction was found absent. Hence the data was left unpooled. The total number of fruits per vine ranged from (Harela) to 3.83 (Jaunpuri), 1.33 (M-4, Bhagpat, Doublon) to 4.17 (FM-1) and from 1.00 (Harela) to 3.17 (Jaunpuri) for the December, January & February sown crops respectively (Table 11).

The total weight of fruits per vine showed significant treatment differences in the three trials. Since the error variances were homogenous, unweighted pooled analysis was done to test the genotype x environment interaction. The interaction was significant. Significant treatment differences were also observed when tested against this interaction.

The character ranged from 153.33 (FM-1) to 1191.00 (Pusa Sharbathi), 175.67 (FM-1) to 760.67 (Iroquois) and from 104.33 (Iroquois) to 1091.00 (Pusa Sharbathi) for the December, January and February sown crops respectively. The pooled mean when examined showed that Pusa Sharbathi was the highest yielder with regard to total weight of fruits per vine and the least was Harela.

The abstract of ANOVA revealed significant differences among the genotypes in the three trials with respect to volume of a fruit. Since the error variances were homogenous, unweighted pooled analysis was done to test the genotype x environmental interaction and was found significant. The mean values ranged from 82.67 (FM-1) to 390.00 (Pusa Sharbathi), 96.01 (FM-1) to 351.27 (Iroquois) and 80.40 (Iroquois) to 426.17 (Doublon) for the December, January and February sown crops respectively. The pooled mean showed highest volume of a fruit (352.57) for Doublon and lowest (93.70) for FM-1 (Table 11).

4.1.4 Quality parameters

The treatment means differed significantly in the three trials for flesh/cavity ratio. Since the error variances were homogenous, unweighted pooled analysis was done to test the interaction and found to be non-significant.

The variety M-4 recorded the lowest F/C ratio (29.00) irrespective of sowing month. The highest mean was recorded by Iroquois during the December and January crop and by Chittidar during the February crop. Chittidar and FM-1 were on par with Iroquois during the January sown crop and Durgapura Madhu and FM-1 during the February sown crop (Table 12).

The abstract of ANOVA revealed significant differences among the treatments in all the trials for TSS. The error variances were heterogenous and hence a weighted pooled analysis was done and found that interaction was absent. Hence the data was left unpooled.

The mean values ranged from 4.03 (M-4) to 1.50 (Jaunpuri) for the December crop, 5.37 (PMR-6) to 1.37 (Jaunpuri) for the January crop and 5 (PMR-6) to 1.23 (Harela) for the February sown crop. Pusa Madhuras, Pusa Sharbathi, Durgapura Madhu and PMR-6 were on par with M-4 during the December sown crop. It was observed that PMR-6 maintained a high TSS irrespective of the month of sowing. It was lowest for December crop compared to January and February crops.

Significant treatment differences existed for reducing sugars in the three trials. Since the error variances were heterogenous, weighted pooled analysis was done to test the interaction which was found non-significant. The highest mean values were shown by Durgapura Madhu (3.57) during the December crop and PMR-6 during the January and February crops (4.92 and 4.78 respectively). Pusa Madhuras, Pusa Sharbathi, M-4 and Madhuria were on par with Durgapura Madhu during December crop. The pooled mean showed PMR-6 as having largest quantity of reducing sugar (Table 13).

Significant treatment differences were seen in February sown crop only with regard to percentage of non-reducing sugars. Unweighted analysis was carried out to test the genotype x environmental interaction which was found non-significant.

The mean values for this quality parameter ranged from 0.02 (PMR-6) to 0.42 (M-4), from 0.05 (Doublon and Bhagpat) to 0.34 (M-4, Lucknow Safeda) and from 0.07 (Harela) to 0.34 (M-4) in the December, January and February sowings respectively.

Lucknow Safeda, FM-1 and Iroquois were on par with M-4 during the December crop. However all varieties performed equally with respect to percentage of non-reducing sugars during the January crop.

The abstract of ANOVA revealed significant differences among the treatments for acidity during the three cropping months. The error variances were heterogenous and hence a weighted pooled analysis was done to test genotype x environmental interaction. Interaction was absent and hence the data was left unpooled.

The lowest mean value of acidity was registered by the variety Mathuria (0.11) during the December crop and Chittidar (0.11 and 0.12) during the January and February crops (Table 13).

Pusa Sharbathi, Lucknow Safeda, Harela, Sanganeer Local, Iroquois, FM-1 and Doublon were on par with Mathuria during December crop.

Pusa Sharbathi, Lucknow Safeda, Mathuria, FM-1 and Doublon were on par with Chittidar during January crop. All varieties except M-4, Jaunpuri, PMR-6 and FM-1 were on par with Chittidar during February crop.

4.1.5 Growth parameters

The details of growth parameters are furnished in Table 14 and displayed in Appendix IV

The abstract of ANOVA revealed significant treatment differences for all the growth parameters recorded during the three sowing months.

Since the error variances were homogenous for the length of vine, an unweighted pooled analysis was done which revealed significant genotype x environment interaction. Hence the genotypes were tested against this interaction but found to be non-significant.

The error variances for number of secondary branches was heterogenous, and hence a weighted analysis was done to test genotype x environmental interaction which was found to be non-significant. Hence the genotypes did not differ from season to season with respect to this character.

The largest number of secondary branches was shown by Harela (4.0), during December crop, M-4 during January crop (3.00) and Doublon (4.30) during February crop. The pooled mean showed Sanganeer Local (2.89) as having largest number of secondary branches.

The error variances for number of tertiary branches was homogenous and therefore an unweighted analysis was done to test genotype x environment interaction. It was found significant. The genotypes also were significant.

PMR-6 (45.67) had greatest number of tertiary branches during December crop, Jaunpuri (42.67) during January crop and PMR-6 (36.33) during February crop. Pooled mean showed PMR-6 as having highest number of tertiary branches (35.44).

Fresh weight of shoot was tested by unweighted analysis which revealed significant interaction and genotypes were also significant.

PMR-6 (616.00) had highest fresh weight for December crop, and Bhagpat (183.67) the lowest. Jaunpuri was on par with PMR-6.

During January crop Jaunpuri (517.00) had highest fresh weight and FM-1 (192.33) the lowest. During February crop Doublon (622.33) was heaviest and FM-1 (145.00) the lowest. Doublon was followed by Jaunpuri in fresh weight. Pooled mean showed Jaunpuri to be having highest fresh weight of shoot.

4.1.6 Reaction towards the scoring of fruit fly infestation

The abstract of ANOVA revealed significant treatment difference during the three trials. Since the error variances were homogenous unweighted analysis was done to test genotype x environmental interaction which was found to be non-significant.

Comparison of means showed that, Jaunpuri was the most damaged during December and January crop and Lucknow Safeda the least. Pusa Sharbathi was also attacked least being during January crop. During February, Pusa Sharbathi was least attacked. The varieties namely Pusa Madhuras, Mathuria, Bhagpat and Iroquois were on par with the least attacked variety of December, January and February crops. In addition, M-4 and Sanganeer Local were on par with Lucknow Safeda during December, M-4 with Lucknow Safeda during January crop and Lucknow Safeda with Pusa Sharbathi during February crop. Comparison of pooled mean indicated Pusa Sharbathi and Lucknow Safeda as the least attacked varieties and Doublon as the most susceptible (Table 15).

4.1.7 Reaction towards the pumpkin beetle infestation

The ANOVA revealed significant treatment differences during the three trials. An unweighted analysis was done which showed non-significant interaction indicating that varieties did not differ from season to season with respect to pumpkin beetle infestation.

Comparison of treatment means (Table 15) showed that Pusa Sharbathi and Iroquois were least attached during December crop. Lucknow Safeda, Harela, Chittidar, M-4 and Bhagpat were on par with them. Pusa Madhuras, Durgapura Madhu and PMR-6 were most susceptible.

During January crop, Pusa Sharbathi was least affected. Lucknow Safeda, Harela, Chittidar, M-4, Mathuria, Sanganeer Local, Bhagpat and Iroquois were on par with it. PMR-6 and Durgapura Madhu were most susceptible.

During February crop, Pusa Sharbathi, Bhagpat and Iroquois were least attacked, Lucknow Safeda, Harela,

Table 9. Mean values for different germination parameters in 15 muskmelon varieties during the three seasons and pooled mean

Varieties	Days to first germination				Percentage of germination			
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled mean
1	5.83	5.67	5.50	5.67	66.67	46.67	63.33	58.89
2	5.83	7.50	5.17	6.17	85.83	63.33	73.33	74.17
3	4.83	7.33	5.33	5.83	50.00	83.33	81.67	71.67
4	4.00	7.17	6.17	5.78	87.50	83.33	81.67	84.17
5	7.33	8.00	7.67	7.67	20.83	16.67	16.67	18.06
6	4.67	7.50	5.83	6.00	25.00	13.33	20.00	19.44
7	7.17	8.00	7.33	7.50	12.50	13.33	16.67	14.17
8	6.50	6.00	7.00	6.50	91.67	83.33	86.67	87.22
9	7.33	7.67	7.17	7.39	33.33	16.67	26.67	25.56
10	4.17	6.67	5.67	5.50	58.33	46.67	53.33	52.78
11	5.67	5.67	5.67	5.67	100.00	96.67	93.67	97.78
12	7.50	8.33	8.00	7.94	29.17	16.67	20.00	21.94
13	6.33	8.17	8.00	7.50	58.33	46.67	33.33	46.11
14	4.67	8.17	6.67	6.50	91.67	83.33	86.67	87.22
15	4.00	7.50	5.17	5.56	50.00	50.00	46.67	48.89
CD	1.66	1.59	0.99	1.44	-	12.16	8.45	11.74

Table 10. Mean values for different flowering parameters in 15 muskmelon varieties during the three seasons and pooled mean

Varieties	Days to I male flower				Node no. of I male flower				Days to I female/bisexual flower				Node no. of I female/bisexual flower			
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled
1	36.67	26.33	28.67	30.56	4.00	3.67	4.33	4.00	48.67	36.00	38.67	41.11	8.33	7.67	9.67	8.56
2	33.33	29.33	30.67	31.11	3.33	2.67	3.33	3.11	46.67	43.67	37.67	42.67	9.00	11.67	10.33	10.33
3	26.00	21.67	22.33	23.33	3.67	3.00	4.00	3.56	40.33	49.33	41.33	43.67	6.00	13.33	11.67	10.33
4	32.00	22.00	23.33	25.78	2.67	3.33	4.33	3.44	45.00	34.67	36.33	38.33	10.33	11.00	11.33	10.89
5	35.33	22.67	29.33	29.11	4.33	4.00	5.67	4.67	43.00	34.00	41.67	39.56	10.33	11.00	10.00	10.44
6	36.33	38.00	35.67	36.67	8.33	6.33	7.67	7.44	45.67	46.00	43.33	45.00	13.33	9.67	11.33	11.44
7	37.67	27.00	28.33	31.00	3.33	3.33	5.33	4.00	55.67	42.00	40.33	46.00	9.33	9.00	8.67	9.00
8	30.00	27.33	28.00	28.44	2.67	3.00	4.33	3.33	44.67	49.67	40.67	45.00	11.00	14.33	11.67	12.33
9	43.33	33.67	36.67	37.89	5.33	4.67	6.67	5.56	48.33	42.67	47.00	46.00	9.33	7.00	7.67	8.00
10	40.00	25.00	28.67	31.22	5.67	3.67	5.00	4.78	48.67	46.67	42.67	46.00	11.33	10.00	10.00	10.44
11	35.67	28.33	31.00	31.67	7.33	3.67	5.33	5.44	45.00	40.67	43.00	42.89	11.00	13.00	9.33	11.11
12	35.33	25.33	25.67	28.78	4.00	2.67	3.67	3.44	48.67	51.67	45.00	48.44	10.33	10.67	10.00	10.33
13	44.67	38.00	38.33	40.33	8.33	5.33	5.67	6.44	54.67	49.67	51.33	51.89	11.67	9.67	10.33	10.56
14	27.00	26.33	26.00	26.44	2.67	4.00	4.00	3.56	45.67	52.00	48.00	48.56	12.33	10.33	9.33	10.67
15	28.00	27.67	26.67	27.44	3.33	5.00	4.67	4.33	45.33	49.00	48.33	47.56	8.00	12.33	14.67	11.67
CD	2.92	2.23	2.22	4.25	1.63	1.41	1.53	1.52	3.52	2.15	3.51	6.59	2.42	2.10	2.04	2.87

Table 11. Mean values for different yield parameters in 15 muskmelon varieties during the three seasons and pooled mean

Var.	Days to first harvest				Node no. of first harvest				Total no. of fruits/vine				Total weight of fruits/vine				Volume of a fruit			
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	pooled	S-I	S-II	S-III	Pooled
1	80.67	62.33	69.67	70.89	8.33	9.33	10.33	9.33	2.00	1.67	2.17	1.94	345.47	326.33	399.67	357.16	98.73	137.23	114.27	116.74
2	67.67	78.33	68.33	71.44	9.67	11.67	11.33	10.89	2.33	1.67	2.33	1.94	1191.00	437.33	1091.00	906.44	390.00	328.77	321.87	346.88
3	74.00	71.33	72.00	72.44	7.33	15.00	13.33	11.89	2.17	2.50	2.67	2.44	520.00	586.67	501.33	536.00	126.57	132.13	117.87	125.52
4	76.00	62.33	62.67	67.00	10.67	11.67	12.33	11.56	2.83	1.67	2.17	2.22	413.33	223.67	347.67	328.22	139.00	128.50	136.23	134.58
5	74.00	63.67	70.67	69.44	12.33	13.67	12.67	12.89	1.00	1.17	1.00	1.06	197.33	211.67	215.00	208.00	180.77	173.03	186.20	180.00
6	73.33	69.67	70.67	71.22	14.00	10.67	13.33	12.67	1.17	1.17	1.33	1.22	241.33	278.00	335.67	285.00	128.57	165.90	143.40	145.96
7	80.33	70.00	70.67	73.67	10.33	9.67	10.33	10.11	1.17	1.33	1.17	1.22	504.00	565.00	505.67	524.89	278.40	274.93	269.00	274.11
8	77.33	79.67	78.33	78.44	12.67	15.00	13.67	13.78	2.00	1.83	2.17	2.00	495.33	355.33	410.00	420.22	238.67	182.93	177.87	199.82
9	90.00	74.00	83.67	82.56	12.00	7.67	10.00	9.89	1.33	1.50	1.17	1.33	300.00	339.67	279.00	306.22	212.00	208.90	221.13	214.01
10	77.67	80.67	78.33	78.89	13.33	13.33	12.00	12.89	1.17	1.33	1.33	1.28	262.47	224.67	210.33	232.49	119.10	103.70	89.63	104.14
11	71.33	77.00	76.67	75.00	11.33	13.33	10.33	11.67	3.83	2.83	3.17	3.28	542.00	537.23	446.67	508.67	141.60	188.30	139.73	156.54
12	100.00	100.33	92.67	97.67	11.67	11.33	13.00	12.00	1.17	4.17	1.33	2.22	153.33	175.67	179.67	169.56	82.67	96.01	102.43	93.70
13	115.33	105.67	107.33	109.44	13.00	10.33	13.33	12.22	1.17	1.83	1.17	1.39	817.53	760.67	104.33	560.84	416.37	351.27	80.40	282.68
14	74.33	79.67	74.67	76.22	14.33	12.00	10.33	12.22	2.33	1.83	2.17	2.11	856.30	598.33	534.67	663.10	291.87	251.83	190.93	244.88
15	78.67	79.67	75.67	78.00	10.33	14.00	17.00	13.78	1.67	1.33	1.33	1.44	516.51	460.33	578.67	518.52	301.33	330.20	426.17	352.57
CD	5.51	3.26	4.33	7.68	2.28	2.21	2.03	3.01	0.51	-	0.44	0.02	131.79	102.22	112.61	256.41	21.17	16.00	19.51	86.57

Table 12. Mean values for different quality parameters in 15 muskmelon varieties during the three seasons and pooled mean

Varieties	Flesh/cavity ratio				TSS			
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled
1	0.39	0.32	0.43	0.38	3.43	3.93	2.67	Unpooled
2	0.38	0.33	0.32	0.34	3.43	3.07	3.20	
3	0.74	0.69	0.70	0.71	3.67	2.87	3.10	
4	0.53	0.48	0.49	0.50	3.10	2.23	2.23	
5	0.37	0.40	0.42	0.40	2.10	1.17	1.23	
6	0.69	0.73	0.71	0.71	2.97	1.43	1.97	
7	0.29	0.29	0.29	0.29	4.03	3.13	3.67	
8	0.38	0.30	0.29	0.32	2.93	4.67	3.33	
9	0.49	0.50	0.48	0.49	3.10	2.83	3.13	
10	0.61	0.55	0.50	0.56	1.87	2.57	2.70	
11	0.40	0.37	0.36	0.38	1.50	1.37	1.40	
12	0.69	0.72	0.66	0.69	1.93	1.77	2.13	
13	0.98	0.75	0.57	0.77	2.00	1.83	2.03	
14	0.58	0.67	0.55	0.61	3.83	5.37	5.00	
15	0.30	0.35	0.38	0.34	3.23	2.87	2.77	
CD	0.22	0.07	0.05	2.02	0.61	0.47	0.27	
Mean	0.52	0.49	0.48					

Table 13. Mean values for different quality parameters in 15 muskmelon varieties during the three seasons and pooled mean

Varieties	Reducing sugar				Non-reducing sugars				Acidity ABSENT. (Interaction Hence data unpooled)		
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III
1	3.10	2.41	3.59	3.03	0.14	0.17	0.08	0.13	0.20	0.22	0.29
2	3.17	2.89	2.67	2.91	0.10	0.15	0.14	0.13	0.15	0.17	0.21
3	3.57	2.77	2.65	2.99	0.09	0.14	0.10	0.11	0.19	0.21	0.18
4	2.52	1.80	1.61	1.97	0.28	0.34	0.18	0.27	0.13	0.13	0.13
5	1.68	1.00	0.91	1.20	0.18	0.13	0.07	0.13	0.14	0.18	0.21
6	2.77	1.73	1.21	1.91	0.14	0.13	0.12	0.13	0.32	0.11	0.12
7	3.50	3.50	2.60	3.20	0.42	0.34	0.34	0.36	0.35	0.40	0.42
8	2.50	2.92	4.03	3.15	0.16	0.19	0.23	0.19	0.15	0.18	0.20
9	2.89	2.82	2.43	2.71	0.13	0.29	0.16	0.19	0.11	0.13	0.13
10	1.70	2.50	2.43	2.21	0.12	0.06	0.10	0.09	0.18	0.31	0.23
11	1.39	1.12	1.24	1.25	0.08	0.08	0.19	0.12	0.25	0.32	0.39
12	1.63	1.87	1.58	1.70	0.24	0.09	0.13	0.15	0.12	0.12	0.38
13	1.30	1.74	1.33	1.46	0.30	0.10	0.13	0.17	0.15	0.17	0.18
14	2.46	4.78	4.92	4.05	0.02	0.06	0.10	0.06	0.25	0.43	0.40
15	2.28	2.60	2.59	2.49	0.06	0.06	0.02	0.05	0.13	0.15	0.14
CD	0.69	0.29	0.55	1.75	0.24	0.22	0.10	2.65	0.05	0.03	0.20
Mean	2.43	2.39	2.43	0.16	0.15	0.14					

Table 14. Mean values for different growth parameters in 15 muskmelon varieties during the three seasons and pooled mean

Varieties	Length of vine				No. of secondary branches				No. of tertiary branches				Fresh weight of shoot			
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled
1	205.00	132.33	215.67	184.33	2.00	2.33	1.33	1.89	20.00	7.67	13.00	13.56	427.33	309.67	419.00	385.33
2	206.67	170.00	197.33	191.33	2.33	1.33	2.00	1.89	20.33	8.33	18.33	15.67	316.67	294.00	305.00	305.22
3	198.00	230.67	165.33	198.00	1.33	1.33	2.00	1.56	14.00	14.67	18.00	15.56	269.33	356.33	267.33	297.67
4	197.00	134.67	191.00	174.22	2.00	1.00	2.00	1.67	39.33	21.33	28.67	29.78	288.00	216.67	279.00	261.22
5	120.00	155.33	215.67	163.67	4.33	1.00	1.67	2.33	22.67	19.67	21.33	21.22	202.33	245.67	307.00	251.67
6	164.67	180.67	204.33	183.22	1.00	1.00	1.67	1.22	11.00	17.00	17.33	15.11	374.33	376.33	355.00	368.56
7	173.00	237.67	198.33	203.00	1.67	3.00	2.67	2.44	20.33	29.67	23.33	24.41	330.00	454.33	374.33	386.22
8	259.67	160.67	216.00	212.11	3.00	2.67	3.00	2.89	43.00	20.67	31.67	31.78	440.00	251.33	366.67	352.67
9	113.00	179.33	189.00	160.41	1.33	1.33	1.67	1.44	24.33	29.67	27.33	27.11	221.00	255.33	360.00	278.78
10	170.33	246.33	204.00	206.89	1.33	2.33	1.67	1.78	15.67	24.33	19.00	19.67	183.67	348.33	217.00	249.67
11	205.67	156.33	175.67	179.22	1.33	2.00	1.67	1.67	35.67	42.67	17.00	31.78	583.67	517.00	528.67	543.11
12	176.67	131.33	113.33	140.44	2.00	1.33	1.33	1.56	12.67	11.00	8.67	10.78	258.33	192.33	145.00	198.56
13	228.00	193.67	164.33	195.33	2.33	2.00	1.67	2.00	40.67	37.00	22.67	33.44	430.33	357.33	317.33	368.33
14	282.67	118.33	189.33	196.78	3.33	1.00	3.00	2.44	45.67	24.33	36.33	35.44	616.00	296.67	445.00	452.56
15	229.00	208.67	239.33	225.67	2.00	1.33	4.33	2.56	31.00	27.67	32.67	30.44	323.67	282.00	622.33	409.33
CD	32.72	30.00	32.66	64.69	1.46	0.88	1.39	1.27	4.43	4.38	4.04	11.19	42.50	29.55	32.01	136.43
Mean	195.29	175.73	191.91		2.09	1.67	2.11		26.42	22.38	22.36		322.49	316.89	353.91	

Table 15. Mean values for different pest attack scores in 15 muskmelon varieties during three seasons and pooled mean

Varieties	Fruit fly attack scores				Pumpkin beetle attack scores			
	S-I	S-II	S-III	Pooled	S-I	S-II	S-III	Pooled
1	1.33	1.33	1.00	1.22	2.67	2.33	1.67	2.22
2	0.67	0.67	0.33	0.56	0.67	0.67	0.33	0.56
3	2.00	3.00	3.33	2.78	2.67	3.33	1.67	2.56
4	0.33	0.67	0.67	0.56	1.33	1.33	1.00	1.22
5	2.67	2.00	2.33	2.33	1.33	1.33	0.67	1.11
6	2.33	2.67	2.33	2.44	1.00	1.67	0.67	1.11
7	0.67	1.00	0.67	0.78	1.33	1.33	0.67	1.11
8	1.33	2.00	1.33	1.56	2.00	1.67	1.67	1.78
9	0.67	1.00	0.67	0.78	1.67	1.67	0.67	1.33
10	1.33	1.33	1.00	1.22	1.00	1.33	0.33	0.89
11	3.33	3.33	2.67	3.11	2.33	1.67	2.00	2.33
12	1.67	2.00	1.33	1.67	2.00	2.33	1.67	2.00
13	1.00	1.00	0.67	0.89	0.67	1.33	0.33	0.78
14	2.33	2.67	1.67	2.22	2.67	3.33	2.33	2.78
15	2.33	3.00	2.67	2.67	2.33	2.00	1.00	1.78
CD	1.08	0.91	0.89	0.97	0.95	1.06	0.73	0.92

Chittidar, M-4, Mathuria and Doublon were on par. PMR-6 was the most attacked variety.

4.1.8 Reaction towards virus attack

Only a few varieties viz., Pusa Sharbathi, Durgapura Madhu, Lucknow Safeda, FM-1 and Doublon were mildly attacked by virus in the December sown crop.

4.1.9 Organoleptic scoring

The abstract of ANOVA revealed significant treatment differences for the organoleptic test. The mean score showed a highest value of 2.33 for PMR-6 and lowest value of 0 for Jaunpuri. The varieties Pusa Madhuras, Durgapura Madhu, M-4, Sanganeer Local and Mathuria were on par with PMR-6.

4.2 Phenotypic and genotypic variability and genetic advance

4.2.1 Yield and its attributes

The phenotypic and genotypic variances and the phenotypic and genotypic coefficients of variation are presented in Table 16.

The maximum amount of phenotypic coefficient of variation (96.41) was registered by the percentage of non-reducing sugars in the December sown crop followed by average weight of fruits per vine (58.97) and number of secondary branches per vine (54.81). The number of days to first female or bisexual flower recorded the minimum phenotypic coefficient of variation (9.26). In the January sown crop also, percentage of non-reducing sugars recorded the maximum PCV of 93.67. The minimum PCV was registered by days to

Table 16. Phenotypic and Genotypic variances and co-efficients of variation (percentage) for twentyfour characters during the three seasons

Sl. No.	Character	Phenotypic variance (VP)			Phenotypic coefficient of variation (PCV)			Genotypic variance (Vg)			Genotypic coefficient of variation (GCV)		
		S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III
1.	Days for I germination	2.28	1.41	1.31	26.41	16.27	17.82	1.30	0.50	0.96	19.95	9.72	15.24
2.	% germination	893.06	953.02	893.57	52.07	60.93	55.82	823.54	900.16	868.02	50.01*	59.22	55.01
3.	Days for I male flower	32.76	27.02	22.58	16.47	18.62	16.22	29.70	25.24	20.83	15.68*	18.00	15.58
4.	Node number of I male flower	4.54	1.56	1.91	46.32	32.14	28.02	3.59	0.85	1.07	41.20	23.76	20.99
5.	Days for I female/ bisexual flower	18.98	37.95	21.95	9.26	13.84	10.91	14.54	36.29	17.54	8.10*	13.53	9.75
6.	Node number of I female/bisexual flower	4.82	5.17	3.64	21.70	21.23	18.33	2.73	3.60	2.14	16.33	17.72	14.07
7.	Days for I harvest	160.64	156.44	125.89	15.70	16.25	14.61	149.78	152.64	119.19	15.16*	16.05	14.22
8.	Number of fruits/vine	0.66	1.81	0.49	43.91	73.83	39.25	0.57	0.07	0.42	40.76	14.93	36.23
9.	Weight of fruits/vine	83630.70	33099.92	58568.66	58.97	44.88	59.13	77419.99	29363.17	54033.98	56.74	42.27	56.79
10.	Average weight/fruit	16403.90	10276.88	14135.92	47.17	38.26	50.35	16004.62	10192.21	13987.61	46.59	38.10	50.09
11.	Volume of fruit	11289.60	7251.53	9207.98	50.67	41.83	52.97	11129.26	7159.93	9071.83	50.31*	41.57	52.58*
12.	F/C ratio	0.05	0.03	0.02	42.37	35.37	29.65	0.03	0.03	0.02	33.70	34.79	28.90
13.	TSS	0.72	1.52	0.92	29.59	44.92	35.41	0.59	1.44	0.89	26.76	43.72	34.90
14.	Total sugars	0.68	1.36	0.97	31.88	45.83	38.35	0.53	1.27	0.93	27.96	44.26*	37.57
15.	Reducing sugars	0.68	1.36	0.94	33.91	48.92	39.83	0.51	1.25	0.91	29.30	46.93*	39.19
16.	Non-reducing sugars	0.03	0.02	0.01	96.41	93.67	63.98	0.004	0.00	0.004	38.56	40.88	45.24
17.	Acidity	0.01	0.01	0.02	41.07	46.45	60.16	0.01	0.01	0.01	37.49	46.45*	34.73
18.	Length of vine	2338.93	1869.60	1129.34	24.77	24.61	17.51	1956.06	1547.68	747.84	22.65	22.39	14.35
19.	Fresh weight of shoot	17112.09	7891.80	14237.71	37.27	28.03	33.72	16466.04	7579.45	13961.36	36.56	27.47	33.39
20.	Fruit fly attack scores	1.04	1.04	1.06	63.86	55.24	68.23	0.63	0.74	0.78	49.41*	46.64	58.26
21.	Pumpkin beetle attack score	0.74	0.86	0.57	50.17	49.18	67.65	0.41	0.47	0.38	37.60	36.10	55.19
22.	Number of secondary branches	1.31	0.63	1.12	54.81	47.59	50.22	0.55	0.35	0.43	35.31	35.60	31.06
23.	Number of tertiary branches	144.12	105.31	63.19	45.44	45.86	35.56	137.10	98.44	57.37	44.31	44.34	33.88
24.	Node number of I harvest	5.26	5.79	4.52	20.09	20.21	17.40	3.40	4.04	3.04	16.15	16.88	14.27

* Significant at 5% probability level

Table 17. Environmental coefficient of variation (ECV) (percentage) for twentyfour characters during the three seasons

Sl. No.		S-I	S-II	S-III
1.	Days for I germination	17.30	13.09	9.22
2.	% germination	14.53	14.35	9.44
3.	Days for I male flower	5.03	4.78	4.52
4.	Node no. of I male flower	21.19	21.60	18.60
5.	Days for I female/bisexual flower	4.48	2.89	4.89
6.	Node no. of I female/bisexual flower	14.30	11.70	11.78
7.	Days for I harvest	4.08	2.53	3.37
8.	No. of fruits/vine	16.48	72.48	15.07
9.	Weight of fruits/vine	16.07	15.08	89.42
10.	Average weight/fruit	7.36	3.47	5.16
11.	Volume of fruit	6.04	4.70	6.44
12.	F/C ratio	25.80	6.32	6.59
13.	TSS	12.62	10.32	6.42
14.	Total sugars	15.35	11.81	7.78
15.	Reducing sugars	17.07	13.88	7.13
16.	Non-reducing sugars	90.57	86.92	45.18
17.	Acidity	16.64	0	49.30
18.	Length of vine	10.01	10.21	10.18
19.	Fresh weight of shoot	7.24	5.58	4.70
20.	Fruit fly attack scores	40.26	29.77	35.04
21.	Pumpkin beetle attack scores	33.24	33.38	39.17
22.	No. of secondary branches	41.85	31.52	39.67
23.	No. of tertiary branches	10.03	11.71	10.79
24.	Node no. of first harvest	11.94	11.11	9.96

female/bisexual flower (13.80) followed by days to first harvest (16.25). In the February sown crop too a maximum PCV of 63.98 for per cent non-reducing sugars and minimum PCV of 10.91 for days to first female/bisexual flower (10.91) were recorded.

As regards genotypic coefficient of variation, the maximum (56.74) and minimum (8.10) were recorded by weight of fruits/vine and days to first female/bisexual flower respectively in the December sowing. In the January sowing, the maximum amount of GCV (59.22) was registered by percentage of germination and days to first germination recorded the minimum gcv (9.72). In the February sowing, weight of fruits per vine recorded the maximum gcv (56.79) and the days to first female/bisexual flower the least (9.75).

In the December and January crops, maximum environmental coefficient of variation was recorded for percentage of non-reducing sugars. This was followed by number of secondary branches in December crop and the number of fruits/vine in January crop. The minimum ECV was shown by days to first harvest in December and it was zero for acidity in January. In February, the maximum was shown by weight of fruits/vine and minimum by days to first harvest.

In the December crop, maximum heritability (98.58) was displayed by volume of a fruit followed by the fresh

Table 10. Heritability, Genetic advance and Genetic gain for 24 characters during the three seasons

Sl. No.	Character	Heritability (H^2)			Genetic advance (GA)			Genetic Gain		
		S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III
1.	Days for I germination	57.06	35.69	73.19	1.78	0.87	1.73	31.04	11.96	26.86
2.	% germination	92.22	94.45	97.14	56.77	60.07	59.82	98.92	118.55	111.69
3.	Days for I male flower	90.67	93.43	92.23	10.69	10.004	9.03	30.76	35.84	30.82
4.	Node number of I male flower	79.13	54.68	56.15	3.47	1.41	1.60	75.50	36.20	32.41
5.	Days for I female/ bisexual flower	76.59	95.62	79.92	6.87	12.13	7.71	14.60	27.26	17.96
6.	Node number of I female/bisexual flower	56.63	69.64	58.87	2.56	3.26	2.31	25.32	30.46	22.23
7.	Days for I harvest	93.24	97.57	94.68	24.34	25.14	21.88	30.16	32.68	28.50
8.	Number of fruits/vine	86.08	4.10	85.40	1.45	0.11	1.23	77.89	6.23	69.02
9.	Weight of fruits/vine	92.57	88.71	92.26	551.49	332.47	459.94	112.46	82.02	112.38
10.	Average weight/fruit	97.57	99.18	98.95	257.42	207.11	242.35	94.80	78.16	102.64
11.	Volume of fruit	98.58	98.74	98.52	215.77	173.21	194.75	102.89	85.08	107.51
12.	F/C ratio	64.09	94.94	94.94	0.29	0.35	0.28	55.72	69.55	58.36
13.	TSS	81.71	94.74	97.15	1.43	2.40	1.92	49.83	87.66	70.86
14.	Total sugars	76.89	93.34	95.93	1.31	2.24	1.95	50.51	88.10	75.79
15.	Reducing sugars	74.71	91.98	96.79	1.27	2.21	1.93	52.18	92.71	79.43
16.	Non-reducing sugars	15.31	17.62	54.16	0.05	0.05	0.10	30.49	33.61	71.89
17.	Acidity	86.29	96.06	30.84	0.13	0.20	0.09	71.21	94.15	38.44
18.	Length of vine	83.63	82.78	66.22	83.32	73.74	45.84	42.66	41.96	23.89
19.	Fresh weight of shoot	96.23	96.04	97.44	259.30	175.76	240.27	73.88	55.46	67.89
20.	Fruitfly attack scores	59.88	71.25	72.84	1.26	1.50	1.55	78.79	81.08	102.40
21.	Pumpkin beetle scores	56.25	53.86	66.57	0.99	1.03	1.03	58.12	54.58	92.78
22.	Number of secondary branches	41.65	56.06	38.28	0.98	0.92	0.84	47.03	54.94	39.60
23.	Number of tertiary branches	95.13	93.47	90.78	23.53	19.76	14.87	89.04	88.30	66.50
24.	Node number of I harvest	64.66	69.78	67.28	3.06	3.46	2.95	26.75	29.05	24.11

weight of shoot (96.23) and number of tertiary branches (95.13). Among the yield parameters, lowest heritability (64.66) was observed for node number of first harvest in the December crop followed by number of fruits/vine (86.08).

In the January crop also volume of fruit recorded maximum heritability (98.74) closely followed by days for first harvest (97.57), acidity (96.06) and fresh weight of shoot (96.04) and days for first female/bisexual flower (95.62). The minimum heritability was expressed by number of fruits per vine (4.10).

In the February crop also, volume of fruit registered maximum heritability (98.52) followed by fresh weight of shoot (97.44), TSS (97.15), percentage of germination (97.14).

The minimum heritability was shown by acidity (30.84).

The study of genetic advance and genetic advance as per cent of mean (ie, genetic gain) revealed that the characters viz., weight of fruits per vine (112.46), volume of fruit (102.89), percentage of germination (98.92) and number of tertiary branches (89.04) had high values for genetic gain accompanied by high heritability values during the three sowing months and also low values of genetic gain during the three sowing months were shown by the characters viz., days for seed germination, days for male flower production, days for first female/bisexual flower production and its node number, length of vine and node number of first harvest and days for first harvest. The number of fruits per vine showed moderate to high values of genetic gain during December and February crops but a low value during the January crop (Table 17).

4.2.2 Reaction towards the fruitfly attack

This showed high estimates of gcv + pcv during the three cropping months. High values of heritability and high values of genetic gain were displayed in all the sowing months. However, low estimates of genetic advance were exhibited in all the three sowing periods (1.26, 1.50 and 1.55 respectively for December, January and February sown crops).

4.2.3 Reaction towards the pumpkin beetle attack

Moderate to high values of pcv were shown (50.17, 49.18 and 67.65 respectively) for the December, January and February sown crops even though gcv values were lower (37.60, 36.10 and 55.19 respectively for the three sowing periods). Moderate to high values of heritability were also shown (56.25, 53.86 and 66.50 respectively) for the three crops. Low estimates of genetic advance were recorded (0.99, 1.03 and 1.03 respectively for the three cropping periods).

4.3 Correlation studies

The phenotypic and genotypic correlation coefficients between fruit yield per plant and other twentyone characters and their interse associations during December, January and February sown crops are presented in Tables 19 to 24.

4.3.1 Genotypic correlation

The total weight of the fruits per plant displayed significant positive genotypic correlation with percentage of germination, average weight per fruit, volume of a fruit and fresh weight of shoot in the three cropping months. The association of the total weight of fruits per vine with the days to first harvest were found to be significantly positive in the December and January sown crops and significantly negative in the February sown crop. Significant positive association of total weight of fruits/vine with the number of days to first male flower production and acidity were noticed only during the January sown crops while the December and February sown crops exhibited non-significant association. The days to first female/bisexual flower displayed positive significant correlation with weight of fruits/vine during the January and February crops only and it was non-significant for the December sown crop. The association of the node numbers of first female/bisexual flower and first harvest with yield/vine were non-significant in the three trials.

The days to first germination, node number of first male flower and F/C ratio showed significant negative association with yield/plant in February crop and non-significant correlation in December and January crops. The number of fruits/vine exhibited significant positive correlation with yield/plant only in the February crop. TSS, total sugars and reducing sugars exhibited significant positive correlation in the February crop alone while it was positive significant in December crop also for TSS. The length of vine and number of tertiary branch showed positive significant correlation in December and February crops while the number of secondary branches showed positive significant correlation with total weight of fruits/vine only in the February crop.

The days to first female/bisexual flower showed significant positive genotypic correlation with days to first harvest in the three cropping months.

The association of days to first female/bisexual flower was significant positive with volume of fruit in December crop, while it was positive but non-significant in January and February crops. Its association was positive significant with F/C ratio in January and February crops but was positive non-significant in December crop. In addition, this trait had positive significant association with number of fruits/vine weight of fruits/vine and TSS during January sowing. Number of fruits/vine showed significant negative association in December and February crops and also with weight/vine in February, while this was positive non-significant in December.

The node number of first female/bisexual flower showed significant positive association with node number of first harvest in the three trials. It also displayed significant positive association with acidity, fresh weight of shoot and number of tertiary branches in December crop, number of fruits/vine in January crop and volume of fruit, length of vine and number of secondary branches in February crop.

The association of days to first harvest was positive significant with F/c ratio in December and January and non-significant in February. The correlation with acidity was positive in December and February but significant only in December and negative non-significant in January. The days to first harvest had positive significant association in January while it was negative significant in December and February with the number of fruits per vine. The association with weight of fruits per vine was positive significant only in January and was negative non-significant in December and negative significant in February.

The association with volume of fruit was positive in December and January but was significant only in January and was negative significant in February.

The number of fruits/vine had significant positive association with weight of fruits/vine in December and February while it was negative non-significant in January. It has also positive significant association with length of vine, fresh weight of shoot and number of fruit branches in December. In January positive significant association was noted only with F/c ratio. The association with length of vine and number of fruit branches were negative non-significant in January and February. The fresh weight of shoot exhibited negative non-significant association in January and positive non-significant association in February.

Weight of fruits/vine displayed positive significant associations with volume of fruit, fresh weight of shoot in the three cropping months. Positive association existed with TSS and length of vine in the three trials but was significant only in December and February. The association with number of tertiary branches was also positive in the three trials but was significant only in December and January. The association with number of secondary branches was also positive in the three trials but was significant only in February.

The association of volume of fruit with number of tertiary branches was positive significant in the three trials. It had positive association with number of secondary branches and length of vine in the three trials but was significant only in December and February. It also had positive correlation with TSS and fresh weight shoot in the three trials but was significant only in February. Similarly it also exhibited significant positive association with node number of first harvest in February only.

F/c ratio had no significant association with any of the traits studied.

TSS displayed positive significant association with acidity uniformly in the three trials and also with number of tertiary branches in February. The association of length of vine was significant positive with fresh weight of shoot and number of tertiary branches in the three trials. The association with number of secondary branches was positive in the three trials but was significant only in December and February.

Fresh weight of shoot had positive significant correlation with number of tertiary branches in the three trials. Its association with number of secondary branches was positive in the three trials but was significant only in January and February.

Number of secondary branches had positive significant association with number of tertiary branches and node number of first harvest in December and February crops while it was

Table 19. Phenotypic correlation for December sowing

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1		-0.36*	0.40*	0.03	0.29	-0.04	0.36*	-0.28	-0.13	0.07	0.09	-0.18	-0.16	-0.04	-0.10	0.29	-0.13	-0.32*	-0.14	0.28	-0.11	-0.04
2			-0.33*	-0.19	-0.24	0.15	-0.26	0.79**	0.52**	0.04	0.16	-0.02	-0.02	-0.15	-0.10	-0.28	0.15	0.66**	0.60**	0.09	0.64**	0.05
3				0.57**	0.64**	0.26	0.56**	-0.32	-0.20	0.08	0.07	0.18	-0.44	-0.27	-0.32	0.24	0.03	-0.50	-0.22	-0.14	-0.18	0.21
4					0.22	0.35*	0.33*	-0.09	-0.14	-0.03	-0.03	0.45**	-0.48*	-0.33*	-0.34*	0.08	0.21	-0.27	0.11	-0.29	-0.15	0.30*
5						0.19	0.63**	-0.29	0.01	0.43**	0.34*	0.10	-0.04	-0.01	-0.09	0.41**	0.20	-0.08	0.04	-0.07	-0.002	0.16
6							0.12	0	-0.02	-0.02	0.04	0.30*	-0.37*	-0.44*	-0.42*	-0.13	0.22	0.12	0.33*	0.05	0.25*	0.87**
7								-0.32*	-0.08	0.16	0.22	0.52**	-0.33*	-0.31*	-0.37**	0.32*	0.31*	-0.05	-0.07	0.01	0.10	0.18
8									0.46**	-0.11	-0.002	-0.11	-0.07	-0.13	-0.09	-0.22	0.03	0.43**	0.59**	-0.06	0.50**	-0.18
9										0.79**	0.78**	0.01	0.28	0.11	0.13	-0.12	0.05	0.55**	0.44**	0.13	0.42**	-0.08
10											0.92**	0.06	0.36*	0.22	0.20	0.11	0.16	0.33*	0.16	0.14	0.21	0.03
11												-0.01	0.23	0.04	0.03	0.05	-0.04	0.38**	0.23	0.24	0.47*	0.12
12													-0.20	-0.13	-0.14	0.07	0.08	0.06	-0.01	-0.15	-0.02	0.30*
13														0.88**	0.88**	-0.002	0.30*	0.21	0.07	-0.01	-0.003	-0.31
14															0.98**	0.12	0.30*	-0.04	-0.15	-0.16	-0.28	-0.43*
15																-0.08	0.29*	-0.002	-0.12	-0.17	-0.27	-0.40*
16																	0.05	-0.21	-0.15	0.07	-0.02	-0.15
17																		0.03	0.39**	-0.28	-0.14	0.10
18																			0.69**	0.10	0.62**	0.07
19																				0.10	0.61**	0.19
20																					0.31	0.07
21																						0.28
22																						

* Significant at 5% probability level ** Significant at 1% probability level

1. Days for first germination
2. Percentage of germination
3. Days for I male flower
4. Node at which I male flower is produced
5. Days for I female/bisexual flower
6. Node at which I female/bisexual flower is produced
7. Days for I harvest
8. Number of fruits per vine
9. Weight of fruits/vine
10. Average weight/fruit
11. Volume of fruit
12. F/C ratio
13. TSS
14. Total sugars
15. Reducing sugars
16. Non-reducing sugars
17. Acidity
18. Length of vine
19. Fresh weight of shoot
20. No. of secondary branches
21. No. of tertiary branches
22. Node of first harvest

Table 20. Genotypic correlation of December sowings

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1		0.47	0.50**	0.03	0.44**	-0.03	0.46**	-0.40*	-0.18	0.06	0.09	-0.06	-0.18	0.02	-0.04	0.75**	-0.10	-0.47*	-0.16	0.29	-0.16	0.07
2			-0.36	-0.19	-0.32	0.09	-0.29	0.87**	0.57**	0.04	0.17	-0.12	-0.05	-0.21	-0.15	-0.73	-0.17	0.73**	0.61**	0.15	0.67**	-0.05
3				0.70**	0.73**	0.36*	0.60**	-0.37*	-0.22	0.08	0.07	0.32*	-0.46*	-0.25	-0.33*	0.84**	0.02	-0.57*	-0.25	-0.35*	-0.18	0.35*
4					0.29	0.57**	0.38**	-0.04	-0.15	-0.04	-0.03	0.57**	-0.65*	-0.52*	-0.53*	-0.03	0.25	-0.29	0.12	-0.52*	-0.17	0.45**
5						0.24	0.63**	-0.37*	0.12	0.51**	0.42**	0.17	-0.01	0.02	-0.09	1.21	0.26	-0.04	0.03	-0.27	0.02	0.18
6							0.14	-0.11	-0.09	-0.001	0.06	0.19	-0.44*	-0.57*	-0.62*	0.39**	0.32*	0.11	0.39**	0.25	0.33*	0.96**
7								-0.36*	-0.09	0.18	0.23	0.67**	-0.35*	-0.37*	-0.44*	0.81**	0.33*	-0.03	-0.08	-0.09	0.11	0.21
8									0.43**	-0.10	0.01	-0.16	-0.02	-0.07	-0.03	-0.53*	0.04	0.52**	0.64**	-0.13	0.54**	-0.31*
9										0.82**	0.81**	0.02	0.36*	0.18	0.21	-0.28	0.06	0.63**	0.47**	0.22	0.43**	-0.13
10											0.93**	0.09	0.38**	0.23	0.21	0.30*	0.18	0.35*	0.17	0.21	0.22	0.05
11												0.001	0.25	0.03	0.02	0.17	-0.04	0.40**	0.25	0.38**	0.47**	0.15
12													-0.36*	-0.38*	-0.40	0.17	-0.09	0.08	-0.02	-0.25	-0.07	0.25
13														0.89**	0.91**	-0.01	0.32*	0.27	0.10	-0.02	-0.001	-0.44*
14															0.10**	0.26	0.35*	-0.07	-0.15	-0.34*	-0.33*	-0.65*
15																0.17	0.33*	-0.03	-0.11	-0.33*	-0.32*	-0.67*
16																	0.30*	-0.37*	-0.47*	-0.25	-0.12	0.12
17																		0.11	0.45**	-0.27	-0.16	0.12
18																			0.76**	0.31*	0.67**	0.04
19																				0.14	0.63**	0.22
20																					0.55**	0.41**
21																						0.34*
22																						

* Significant at 5% probability level ** Significant at 1% probability level

1. Days for first germination
2. Percentage of germination
3. Days for I male flower
4. Node at which I male flower is produced
5. Days for I female/bisexual flower
6. Node at which I female/bisexual flower is produced
7. Days for I harvest
8. Number of fruits per vine
9. Weight of fruits/vine
10. Average weight/fruit
11. Volume of fruit
12. F/C ratio
13. TSS
14. Total sugars
15. Reducing sugars
16. Non-reducing sugars
17. Acidity
18. Length of vine
19. Fresh weight of shoot
20. No. of secondary branches
21. No. of tertiary branches
22. Node of first harvest

Table 2[illegible]. Phenotypic correlation of January sown crop

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1		-0.37*	-0.14	0.05	0.23	-0.19	0.27	0.06	0.05	0.30*	0.26	0.35*	-0.17	-0.19	-0.19	0.04	-0.07	0.02	-0.23	-0.30*	0.03	-0.14
2			-0.32*	-0.32*	0.11	0.59**	-0.04	0.11	0.33*	-0.13	0.01	-0.12	0.36*	0.34*	0.36*	-0.11	0.26	-0.19	0.14	0.05	0.13	0.51**
3				0.59**	0.25	-0.36*	0.38**	-0.14	0.27	0.43**	0.46**	0.26	-0.18	-0.21	-0.21	-0.003	-0.24	0.09	0.25	0.05	0.31*	-0.46
4					0.07	-0.25	0.05	-0.16	0.14	0.18	0.26	0.30*	-0.21	-0.21	-0.20	-0.10	-0.21	0.10	0.16	-0.23	0.28	-0.15
5						0.23	0.72**	0.18	0.36*	0.21	0.22	0.49**	0.30	0.29	0.34*	-0.36*	0.07	0.21	-0.02	0.02	0.06	0.21
6							0.09	0.24	0.13	-0.15	0.01	-0.09	0.04	0.01	0.04	-0.26	0.004	0.05	0.02	-0.03	-0.01	0.85**
7								0.29	0.32*	0.21	0.31*	0.46**	-0.09	-0.12	-0.08	-0.34*	-0.08	0.04	-0.06	0.07	0.23	-0.01
8									0.01	-0.24	-0.23	0.24	-0.08	-0.06	-0.04	-0.11	0.002	-0.15	-0.03	-0.10	-0.02	0.16
9										0.66**	0.66**	0.12	0.24	0.21	0.22	-0.11	0.42**	0.24	0.54**	0.12	0.47*	-0.03
10											0.88**	-0.11	0.22	0.19	0.19	0.004	0.25	0.28	0.32*	0.15	0.12	-0.25
11												0.18	0.16	0.11	0.12	-0.05	0.11	0.18	0.20	0.04	0.35*	-0.13
12													-0.23	-0.24	-0.21	-0.19	0.16	0.002	-0.10	-0.40*	0.01	-0.06
13														0.99**	0.99**	0.04	0.42**	-0.15	-0.16	0.18	-0.22	0.02
14															0.99**	0.04	0.43**	-0.13	-0.14	0.17	-0.24	0.01
15																-0.08	0.44**	-0.14	-0.13	0.15	-0.24	0.05
16																	0.06	0.07	-0.06	0.18	0.01	-0.35*
17																		0.14	0.55**	0.34*	0.31	0.06
18																			0.44**	0.38*	0.25	0.14
19																				0.36*	0.53**	-0.03
20																					0.21	0.05
21																						-0.03
22																						

* Significant at 5% probability level ** Significant at 1% probability level

1. Days for first germination 2. Percentage of germination 3. Days for I male flower
4. Node at which I male flower is produced 5. Days for I female/bisexual flower 6. Node at which I female/bisexual flower is produced
7. Days for I harvest 8. Number of fruits per vine 9. Weight of fruits/vine 10. Average weight/fruit
11. Volume of fruit 12. F/C ratio 13. TSS 14. Total sugars 15. Reducing sugars
16. Non-reducing sugars 17. Acidity 18. Length of vine 19. Fresh weight of shoot
20. No. of secondary branches 21. No. of tertiary branches 22. Node of first harvest

Table 22. Genotypic correlation for January sown crop

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	-0.64*	0.18	0.37*	0.38**	-0.31	0.45**	-0.19	0.23	0.48**	0.43**	0.67**	-0.17	-0.20	-0.20	-0.07	-0.12	0.14	-0.36	-0.64	-0.06	-0.35
		-0.34*	-0.41*	0.11	0.69**	-0.05	0.46**	0.37*	-0.14	0.01	-0.12	0.39**	0.37*	0.39**	-0.29	0.26	-0.21	0.15	-0.01	0.16	0.58**
			0.85**	0.26	-0.37*	0.40**	-0.63*	0.32*	0.45**	0.48**	0.31*	-0.19	-0.21	-0.21	-0.16	-0.26	0.08	0.27	0.01	0.33	-0.55
				0.09	-0.45*	0.06	-1.53*	0.16	0.25	0.33*	0.40**	-0.35	-0.37	-0.36	-0.32	-0.26	0.17	0.21	-0.27	0.44**	-0.41
					0.31*	0.73**	1.13**	0.39**	0.22	0.22	0.53**	0.32*	0.31*	0.35*	-0.80	0.08	0.22	-0.03	0.01	0.06	0.26
						0.10	0.52**	0.13	-0.18	-0.01	-0.16	0.02	0.004	0.03	-0.48	-0.04	0.02	0.05	-0.04	0.05	0.95**
							1.50**	0.34*	0.21	0.31*	0.49*	-0.10	-0.14	-0.10	-0.74	-0.09	0.06	-0.06	0.11	0.26	-0.003
								-0.13	-1.27*	-1.19*	1.02**	-0.52	-0.50	-0.44	-1.15	-0.22	-1.01	-0.24	0.13	-0.09	0.15
									0.70**	0.70**	0.11	0.25	0.22	0.23	-0.22	0.44**	0.28	0.56**	0.30	0.52**	0.03
										0.89**	-0.11	0.23	0.20	0.20	0.02	0.26	0.30*	0.32*	0.19	0.13	-0.30
											-0.19	0.16	0.11	0.12	-0.09	0.11	0.18	0.20	0.07	0.38*	-0.16
												-0.25	-0.25	-0.22	-0.61	-0.17	-0.01	-0.09	-0.52	-0.02	-0.10
													0.99**	0.99**	0.13	0.44**	-0.17	-0.18	0.33	-0.21	0.04
														0.49**	0.11	0.46**	-0.14	-0.16	0.33*	-0.23	0.04
															0.05	0.47**	-0.15	-0.15	0.32*	-0.23	0.08
																-0.20	-0.04	-0.16	0.21	-0.08	-0.73
																	0.14	0.58**	0.48**	0.34*	0.08
																		0.45**	0.40**	0.25	0.16
																			0.52**	0.55**	0.01
																				0.27	-0.13
																					-0.02

* Significant at 5% probability level ** Significant at 1% probability level

1. Days for first germination
2. Percentage of germination
3. Days for I male flower
4. Node at which I male flower is produced
5. Days for I female/bisexual flower
6. Node at which I female/bisexual flower is produced
7. Days for I harvest
8. Number of fruits per vine
9. Weight of fruits/vine
10. Average weight/fruit
11. Volume of fruit
12. F/C ratio
13. TSS
14. Total sugars
15. Reducing sugars
16. Non-reducing sugars
17. Acidity
18. Length of vine
19. Fresh weight of shoot
20. No. of secondary branches
21. No. of tertiary branches
22. Node of first harvest

Table 27. Phenotypic correlation for February sowings

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1		-0.48*	0.20	0.15	0.28	0.35*	0.50**	-0.46*	-0.51*	-0.29*	-0.25	0.50	-0.09	-0.08	-0.09	0.20	0.18	-0.32*	-0.34*	-0.17	0.02	-0.13
2			-0.42*	-0.45*	-0.28	0.15	-0.32*	0.85*	0.41**	-0.15	-0.07	-0.20	0.28	0.23	0.23	0.01	0.08	0.06	0.25	0.17	0.26	-0.12
3				0.60**	0.44**	-0.29	0.48**	-0.37*	-0.23	-0.05	-0.06	0.02	-0.27	-0.24	-0.25	0.05	-0.20	0.03	0.10	-0.23	-0.08	-0.14
4					0.28	0.17	0.11	-0.41*	-0.39*	-0.07	-0.09	0.18	-0.32*	-0.28	-0.29	0.06	-0.17	0.18	0.15	-0.07	-0.02	-0.09
5						0.07	0.72**	-0.37*	-0.34*	-0.10	0.05	0.30*	0.08	0.10	0.12	-0.23	-002	-0.13	0.25	0.24	0.20	0.23
6							-0.11	0.04	0.15	0.17	0.30*	0.03	-0.07	-0.12	-0.10	-0.28	-0.25	0.26	0.25	0.41**	0.16	0.87**
7								-0.32*	-0.49*	-0.41*	-0.30*	0.28	-0.15	-0.14	-0.14	-0.06	0.04	-0.44*	-0.19	-0.12	-0.10	0.18
8									0.50**	-0.14	-0.12	-0.12	0.12	0.08	0.07	0.13	0.20	-0.08	0.21	-0.09	-0.05	0.20
9										0.74**	0.64**	-0.42*	0.43**	0.42**	0.41**	0.08	0.07	0.24	0.30*	0.23	0.13	-0.08
10											0.91**	-0.40*	0.40**	0.44**	0.43**	0.09	-0.01	0.43**	0.38**	0.44**	0.24	0.08
11												-0.54*	0.31*	0.32*	0.33*	-0.03	-0.10	0.48**	0.57**	0.56**	0.44**	0.25
12													-0.13	-0.13	-0.11	-0.32*	-0.16	-0.48*	-0.43*	-0.27	-0.30	0.12
13														0.99**	0.99**	0.19	0.19	0.13	0.14	0.40**	0.51**	-0.19
14															0.10**	0.24	0.22	0.14	0.15	0.40**	0.48	-0.24
15																0.17	0.20	0.15	0.16	0.41**	0.50**	-0.21
16																	0.23	-0.09	-0.08	0.02	0.03	-0.35
17																		-0.19	0.04	-0.07	-0.15	-0.29
18																			0.54**	0.36*	0.38**	0.16
19																				0.48**	0.45**	0.10
20																					0.62**	0.38*
21																						0.16
22																						

* Significant at 5% probability level ** Significant at 1% probability level

1. Days for first germination
2. Percentage of germination
3. Days for I male flower
4. Node at which I male flower is produced
5. Days for I female/bisexual flower
6. Node at which I female/bisexual flower is produced
7. Days for I harvest
8. Number of fruits per vine
9. Weight of fruits/vine
10. Average weight/fruit
11. Volume of fruit
12. F/C ratio
13. TSS
14. Total sugars
15. Reducing sugars
16. Non-reducing sugars
17. Acidity
18. Length of vine
19. Fresh weight of shoot
20. No. of secondary branches
21. No. of tertiary branches
22. Node of first harvest

Table 24. Genotypic correlation for February sown crop

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1		-0.58**	0.32*	0.23	0.42**	-0.49*	0.66**	-0.62*	-0.65*	-0.34*	-0.30*	0.10	-0.09	-0.06	-0.09	0.40**	0.29	-0.51	-0.40*	-0.24	0.05	-0.09
2			-0.45*	-0.62*	-0.33*	0.20	-0.32*	0.94**	0.44**	-0.15	-0.07	-0.21	0.29	0.24	0.25	0.01	0.13	0.09	0.26	0.23	0.27	-0.15
3				0.82**	0.46**	-0.39*	0.51**	-0.40*	-0.23	-0.05	-0.07	0.01	-0.27	-0.25	-0.26	0.04	-0.34*	0.06	0.10	-0.40*	-0.09	-0.18
4					0.34*	-0.23	0.14	-0.54	-0.52*	-0.12	-0.12	0.21	-0.41*	-0.37	-0.39*	0.08	-0.54	0.24	0.15	-0.36*	0.02	0.01
5						-0.01	0.78**	-0.42*	-0.38*	-0.13	0.05	0.33*	0.09	0.09	0.12	-0.42*	0.02	-0.23	0.27	0.22	0.28	0.28
6							-0.16	0.08	0.20	0.22	0.40**	0.08	-0.15	-0.19	-0.14	-0.56*	-0.77*	0.40**	0.31	0.80**	0.29	0.96**
7								-0.38*	-0.53*	-0.43*	-0.32*	0.28	-0.15	-0.15	-0.15	-0.08	0.05	-0.60*	-0.19	-0.23	-0.13	0.16
8									0.46**	-0.14	-0.13	-0.13	0.12	0.08	0.08	0.07	0.27	-0.11	0.24	0.04	-0.05	-0.29
9										0.77**	0.67**	-0.45*	0.44**	0.44**	0.44**	0.06	0.06	0.32*	0.32**	0.53**	0.15	-0.09
10											0.91**	-0.49*	0.41**	0.45**	0.44**	0.13	-0.01	0.50**	0.38**	0.71	0.26	0.10
11												-0.56*	0.31*	0.33*	0.34*	-0.03	-0.16	0.57**	0.58**	0.93**	0.47**	0.30*
12													-0.12	-0.15	-0.13	-0.49	-0.21	-0.59*	-0.45*	-0.50*	-0.32*	0.21
13														1.00**	1.00**	0.19	0.33*	0.12	0.13	0.60**	0.56**	-0.28
14															0.99**	0.24	0.42**	0.12	0.15	0.60**	0.53**	-0.30*
15																0.17	0.38**	0.13	0.16	0.62**	0.54**	-0.26
16																	0.56**	-0.20	-0.12	-0.08	0.07	-0.51*
17																		-0.56*	0.07	-0.04	-0.28	-0.80*
18																			0.61**	0.67**	0.56**	0.20
19																				0.79**	0.49**	0.13
20																					0.91**	0.64**
21																						0.18
22																						

* Significant at 5% probability level ** Significant at 1% probability level

1. Days for first germination
2. Percentage of germination
3. Days for I male flower
4. Node at which I male flower is produced
5. Days for I female/bisexual flower
6. Node at which I female/bisexual flower is produced
7. Days for I harvest
8. Number of fruits per vine
9. Weight of fruits/vine
10. Average weight/fruit
11. Volume of fruit
12. F/C ratio
13. TSS
14. Total sugars
15. Reducing sugars
16. Non-reducing sugars
17. Acidity
18. Length of vine
19. Fresh weight of shoot
20. No. of secondary branches
21. No. of tertiary branches
22. Node of first harvest

positive and negative non-significant respectively for the two traits respectively in January crop.

DISCUSSION

DISCUSSION

The improvement of any crop depends on altering the genetic make up of the existing varieties. The choice of the most suitable breeding method for the improvement of yield and its components largely depends on the available genetic variability, heritability of the characters, genetic advance under selection and the association among the characters.

Selection is the fundamental process in the development of superior varieties, and it depends on the variability available in the crop. Selection based on yield alone is not very efficient, but that based on its components as well could be more efficient (Evans, 1978).

The present study was undertaken to evaluate the dessert types of muskmelon for their suitability under the agro-climatic conditions of the southern zone of Kerala. The extant of variability, heritability of the commercially important traits, genetic advance under selection and correlations among the characters were assessed with a view to suggest measures to bring about genetic improvement for yield and its components.

5.1 Germination parameters

The germination parameters conventionally studied are the number of days to first germination and the percentage of germination. The present investigation also involved the study of these characters.

Significant differences were observed among the test varieties for the days to first germination in the three sowing months. This indicated that thistrait can be used for selection among the genotypes included in the present studies. However, the percentage of germination showed significant differences only for the January and February sowings. No definite conclusion could therefore be drawn about the behaviour of percentage of germination.

The pooled ANOVA for the germination parameters revealed non-significant G x E interaction. Therefore, it can be presumed that the environment (seasonal differences during the months of December, January and February) had no influence on either of the characters.

On examining the coefficients of variation, it can be observed that the percentage of germination had moderate GCV and genetic advance along with high heritability. Heritability in conjunction with genetic advance would provide better information on the criteria for selection (Johnson et al., 1955). Percentage germination, therefore, seems to be a reliable index for selection. The varieties namely, Jaunpuri, Lucknow Safeda, PMR-6 and Sanganeer Local showing high percentage of germination in the three sowing months could be successfully used in future breeding programmes to improve this character. The percentage germination displayed significant positive genotypic association with total weight of fruits per plant and number of fruits per vine in the three trials.

5.2 Flowering parameters

In any cucurbitaceous crop, the flowering parameters are very important. The flowering parameters usually studied are the number of days to flowering, the node at which it is formed, the duration of flowering and the sex ratio. In this study, the investigator studied the performance of the varieties with respect to the number of days taken to produce the first male/female/bisexual flower and the node at which it is produced.

Significant differences were observed among the genotypes for the four flowering parameters studied during the three sowing months. Many of the earlier workers (Nandpuri et al., 1976); Deol et al., 1981) have reported significant varietal differences for flowering parameters. Significant effects of dates of sowing for days taken to first male flower anthesis were reported by Nandpuri et al. (1976). Nandpuri and Tarsem (1978) also have recorded similar results with respect to days taken from transplanting to flowering. The pooled ANOVA in the present investigations revealed significant G x E interaction for the flowering parameters studied, except for the node of first male flower anthesis. The influence of environment on the expression of these characters has been thus indicated. They may be attributed to the complex polygenic system operating on the inheritance of these characters. Environmental influence on the first male flowering node was found to be non-significant, implying its non-polygenic nature.

The results indicated that these flowering characters could be successfully used for selection among the genotypes in the population studied. However, these characters registered low values of GCV, except for moderate value obtained for the node of first male flower production during December crop. This indicated a limited scope for the improvement of these characters. Deol et al. (1981) reported low GCV for days for first female flower production. In the present investigations, these characters exhibited moderate to high values of heritability; but low genetic advance. This may be attributed to the action of non-additive genes. Hence, straight selection may have limited scope for improving these traits. Deol et al. (1981) reported moderate heritability and low genetic advance for the days to first female flower anthesis, which supports the present findings. The days to first female/bisexual flower production showed significant positive genotypic correlation with days to first harvest in support of Deol et al. (1981). Therefore it can be concluded that cultivar early in female/bisexual flowering will be early in coming to harvest also. Significant positive correlation was also observed between the nodes at which first female/bisexual flowering and first harvest.

5.3 Yield parameters

The ultimate aim in the improvement of any crop is its yield. In any fruit bearing vegetable crop yield is dependant on a number of related attributes like days to first harvest, node of first harvest, number of fruits per plant, weight of fruits per plant and volume of fruit. In the present study, an attempt was made to throw light on the available variability, heritability, genetic advance and association among the characters with respect to dessert types of muskmelon.

Among the characters studied, the days to first harvest, the node at which first harvest was made, the total weight of fruits per vine and the volume of fruits exhibited significant treatment differences in the three months of sowing. This indicated that these characters can be utilized for selection from among the varieties included in the study. Nandpuri and Tarsem (1978) have reported similar findings with regard to the days to fruit maturity.

It was observed in the present investigations that the G x E interaction was significant for all the characters studied, except for the number of fruits per vine, which showed non-significant treatment differences for the January crop. Nandpuri and Tarsem (1978) have reported that all the characters except the number of fruits/vine studied by them exhibited significant varietal differences and the non-significant G x E interaction.

Among the yield parameters, moderate GCV was observed for total weight of fruits/vine and volume of fruit in the three sowing months. These two characters, thus, have considerable scope for improvement. Deol et al. (1981) and Swamy et al. (1985) have reported highest GCV for yield per plant among the characters they studied. Further, the two characters exhibited high values of heritability and genetic advance. The high heritability together with high genetic advance observed in the present studies indicate the predominance of additive gene effects. Thus the total weight of fruits per vine and the volume of fruit were identified as the yield parameters forming reliable index for selection. The observations are in conformity with the findings of Nandpuri et al. (1975) and Kalloo and Dixit (1981).

The yield/vine displayed significant positive association with volume of fruit and fresh weight of shoot. The volume of fruit in turn was strongly associated with the number of tertiary branches in the three trials. Yield was positively associated with the number of secondary branches; but was significant only in February crop. Hence, the present findings show that higher the number of secondary branches, higher the yield, as indicated in the reports of Kalloo & Sidhu (1981).

5.4 Quality parameters

In a fruit bearing vegetable crop like muskmelon, yield alone cannot be considered as the major criterion for selection. Selection should be made for quality traits like TSS, acidity, F/C ratio, Vitamin C content etc. Analysis of some of the above said parameters was made in the present investigation.

Significant genotypic differences were observed for F/C ratio, TSS, percentage of reducing sugars and acidity in the three sowing months which indicated the possibility for utilizing these characters for selection. Swamy et al. (1985) who reported varietal differences for these traits, also have commented on the scope of utilizing these characters in selection of promising muskmelon types.

Pooled analysis revealed non-significant G x E interaction for the quality parameters studied, which indicated the stability of these traits. The stability of muskmelon genotypes with respect to TSS and acidity has been observed by Gurdeep et al. (1987).

Moderate values of GCV were observed for F/C ratio, percentage of reducing and non-reducing sugars and acidity.

Therefore these characters could be improved by selection. However, earlier reports of Chhonkar et al. (1979) and Swamy et al. (1985) about F/C ratio are in contradiction to the current findings.

The low GCV for TSS obtained in the present studies is in agreement with the earlier reports of Chhonkar et al. (1979) and Swamy et al. (1985).

Although the quality traits showed moderate or high heritability values, the genetic advance was observed to be low. The low genetic advance limits the scope for improvement in these traits through selection. The findings reported by Deol et al. (1981) confirm the present findings as far as F/C ratio and TSS are concerned.

F/C ratio did not exhibit significant association with any of the traits studied. Deol et al. (1981) also obtained the same trend with respect to F/C ratio and the other traits they studied. TSS exhibited significant positive association with acidity in the present investigation. Gurdeep et al. (1977) also have recorded positive association of TSS with acidity.

5.5 Growth parameters

The growth parameters studied were the length of vine, fresh weight of shoot and the number of secondary and tertiary branches since the review of literature showed that these parameters may have direct influence on the productivity of the genotypes.

The characters exhibited significant treatment differences in the three months of sowing. This indicated the usefulness of selection as a successful tool for improvement of the characters in the population.

The characters except the number of secondary branches showed significant G x E interaction. The significant G x E interaction of vine length observed in the present studies was in confirmity with the findings of Nandpuri et al. (1976).

Moderate values of GCV were obtained for the fresh weight of shoot and the number of secondary and tertiary branches. As such, by using these characters for selection among the genotypes, improvement can be expected only to a limited scale. The length of vine exhibited high heritability and genetic advance. Hence the length of vine can be successfully used in selection.

The association of length of vines was positive and significant with fresh weight of shoot and the number of tertiary branches which in turn had significant positive correlation with the number of secondary branches. Therefore, it can be concluded that the longer the vine, more will be the number of branches, and higher will be the yield, as evidenced earlier.

5.6 Reaction towards pests

The genotypes differed significantly in their reaction to fruit fly infestation. Lucknow Safeda was the least attacked in December and January sown crops and Pusa Sharbathi in February sown crop. The G x E interaction was found to be non-significant. Hence it can be concluded that genotype has more influence on this character rather than environment. Comparison of pooled mean revealed Pusa Sharbathi and Lucknow Safeda as the least attacked varieties and Doublon as the most susceptible variety.

Significant varietal differences were observed for pumpkin beetle infestation also. Comparison of treatment means revealed Pusa Sharbathi and Iroquois as the least attacked varieties in December sowing and Pusa Sharbathi in January and February sowings.

5.7 Organoleptic test

Considerable variations occur in the eating quality of muskmelon. Davis and Schweers (1971) found off-flavoured and unpalatable fruits intermingled among good cantaloupes from the same growing area and reported that soluble solids content was not in all instances, a measure of quality. Aulenbach and Worthington (1974) have also questioned the use of soluble solids content as the sole criterion of quality because soluble solids content did not correlated well with acceptability, and they suggested the use of sensory evaluations together with soluble solids content for the expression of muskmelon quality. Therefore, in the present study, apart from the quality parameters like TSS, acidity etc. sensory evaluation was also done in assessing the quality of the different muskmelon varieties.

The organoleptic test was conducted by a panel of three judges and they gave the scores based on their personal judgement. An arbitrary scale 0-4 was given for the different taste categories. The average of the three scores of each variety was recorded. The data when subjected to analysis of variance revealed significant varietal differences. PMR-6 was observed as the best variety. Pusa Madhuras, Durgapura Madhu, M-4, Sanganeer Local and Mathuria were on par with it. Jaunpuri appeared to be the least accepted variety.

An attempt was made to identify the best month for sowing muskmelon in the southern zone of Kerala comprising the districts of Trivandrum, Quilon, Pathanamthitta and parts of Alleppey and Kottayam. For this, the mean values of the characters studied were thoroughly scrutinised. The characters which showed significant environmental interaction viz., days to first harvest, first fruiting node, total weight of fruits per vine, volume of fruit, length of vine, fresh weight of shoot and number of tertiary branches were selected.

With respect to the days to first harvest, the February sown crop took the least number of days (76.80) and the December sown crop the most (80.71). Pooled mean showed that Lucknow Safeda was the earliest fruiting variety (67.00) followed by Harela. Pusa Madhuras, Pusa Sharbathi, Durgapura Madhu, Chittidar and M-4 were on par with Lucknow Safeda. Among the three periods of sowing, the fruits were harvested from the lowest node (11.42) during the December sowing while February sowing recorded highest node of harvest. Pusa Madhuras was observed as the variety bearing fruits at the lowest node followed by Mathuria. Pusa Sharbathi, Lucknow Safeda, M-4, Jaunpuri, FM-1, Iroquois and PMR-6 were on par with Pusa Madhuras. The yield per plant was highest in December crop (490.40) and the lowest in January crop. The yield was the highest for Pusa Sharbathi followed by PMR-6.

The December sown crop displayed the highest fruit volume (209.71 cc), followed by January sown crop (203.58 cc). Doublon had the greatest volume (352.57 cc) followed by Pusa Sharbathi (346.88 cc). M-4 and Iroquois were on par with Doublon.

With regard to the length of vine and number of tertiary branches, December sowing registered highest values. Doublon and PMR-6 were the best varieties for the two characters respectively.

The present investigations revealed that December sown crop exhibited the majority of the desirable characters among the three sowing months. Therefore, it can be concluded that December is the best month of sowing muskmelon in the southern zone of Kerala.

Among the genotypes grown, in December crop, the highest yielder was Pusa Sharbathi followed by PMR-6. Even though M-4 was the variety showing highest mean value of TSS in December, Pusa Sharbathi, Pusa Madhuras, Durgapura Madhu and PMR-6 were on par with M-4. Therefore Pusa Sharbathi and PMR-6 were identified as the best varieties for December since they exhibited both high yield per vine and also high TSS along with higher score in organoleptic test.

SUMMARY

SUMMARY

The present investigation was undertaken with fifteen muskmelon varieties during the summer season (December-May) of 1989-'90 at the College of Agriculture, Vellayani. The evaluation was done in a randomised block design with three replications. Planting was carried out during three consecutive months (December 1989, January 1990 and February 1990). The experiment was designed to estimate the extent of variability of muskmelon in relation to growth, production and quality parameters and to test the available dessert types of muskmelon for their suitability to the southern region of Kerala.

The fifteen varieties showed significant differences for the number of daystaken for the first germination during the three sowing months. Doublon was the early germinator in December and February and Jaunpuri and Pusa Madhuras in January. Percentage germination had significant treatment differences only in January and February sowings. The pooled analysis revealed the stability of the germination parameters.

The flowering parameters studied showed significant differences among the varieties in the three trials. Environment was found to have significant influence on the number of days to first female/bisexual flower and its node.

It was found that the number of days for first female/bisexual flower production was reduced from December to February while it was borne at higher and higher nodes.

Days to first harvest and first fruiting node also exhibited significant varietal differences during the three trials. Significant effect of environment on these characters was also revealed. The number of days for first harvest and first fruiting node showed the same trend as the days for first female/bisexual flower production and its node as sowing was advanced from December to February.

Yield/vine and volume of fruit exhibited significant treatment differences in the three trials along with significant G x E interaction. F/C ratio, TSS and acidity showed significant treatment differences. However, environmental interaction was non-significant for these traits. All the growth parameters studied showed significant treatment differences in the three sowing months and significant G x E interaction except for the number of secondary branches. The genotypes tested differed in their reaction towards pumpkin beetle and fruit fly. However, genotype was found to have greater influence on this trait rather than environment. Organoleptic test was conducted and the analysis of variance revealed significant treatment differences.

Selection of best sowing month and variety

An attempt was made to find out the best sowing month with reference to the important characters which showed significant environmental interaction. Accordingly, days to first harvest, first fruiting node, total weight of fruits per vine, volume of fruit, length of vine, number of secondary branches and number of tertiary branches were the characters selected. It was observed that December sown crop exhibited the majority of the desirable characters among the three sowing months. Therefore it can be concluded that December is the best month of sowing muskmelon in the southern zone of Kerala. Pusa Sharbathi and PMR-6 were identified as the best varieties for December sowing as they exhibited maximum yield per vine and maximum TSS along with good acceptability among the fifteen varieties studied.

Genetic parameters

Among the germination parameters studied the percentage of germination exhibited moderate values of GCV and genetic advance and high heritability. Therefore percentage of germination seems to be a reliable index for selection. Significant positive association of this trait with yield per vine and number of fruits per vine was also observed.

All the flowering parameters studied registered low values of GCV indicating limited scope for the improvement of these traits. They exhibited moderate to high values of heritability but low genetic advance. Hence straight selection may have only limited scope for improving these traits. The significant positive association between days to first female/bisexual flower production and the days to first harvest observed, revealed that the variety early in flowering will be early in coming to harvest also.

Among the yield parameters studied total weight of fruits per vine and volume of fruit showed moderate GCV in the three sowing months indicating the scope for improving these characters. Further they displayed high values of heritability and genetic advance making them reliable selection indices.

Significant positive association of yield/vine with volume of trait and fresh weight of shoot was observed. The volume of fruit in turn was strongly associated with the number of tertiary branches.

Moderate values of GCV were observed for the quality parameters namely, F/C ratio, percentage of reducing and non-reducing sugars and acidity. Therefore these characters could be improved by selection. F/C ratio had no significant association with the remaining traits studied. TSS exhibited significant positive association with acidity.

The fresh weight of shoot and the number of secondary and tertiary branches displaced moderate values of GCV.

Since vine length exhibited high heritability and genetic advance it can be successfully used in selection. The correlation studies revealed that, the longer the vine, more will be the number of branches, and higher will be the yield.

The reaction of the varieties towards pests was assessed and it was concluded that Iroquois and Pusa Sharbathi were least attacked in January and February crops.

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* Original not seen

APPENDICES

APPENDIX I

Weather parameters during the cropping period (22-12-1989 to 23-5-1990)

Standard week	Period		Temperature (°c)		Rainfall (mm)	Relative humidity %
	From	To	Maximum	Minimum		
51	17-12-89	23-12-89	30.9	27.9	-	67.0
52	24-12-89	31-12-89	31.4	26.3	-	75.9
1	01-01-90	07-01-90	30.8	22.5	0.5	72.9
2	08-01-90	14-01-90	31.3	22.2	0.1	82.3
3	15-01-90	21-01-90	31.2	19.4	-	70.9
4	22-01-90	28-01-90	30-9	29.1	-	78.1
5	29-01-90	04-02-90	31.6	21.8	-	78.1
6	05-02-90	11-02-90	32.4	21.9	-	84.6
7	12-02-90	18-02-90	32.5	23.9	-	89.0
8	19-02-90	25-02-90	32.3	22.3	-	85.9
9	26-02-90	04-03-90	32.8	23.2	-	82.9
10	05-03-90	11-03-90	33.1	23.9	-	93.7
11	12-03-90	18-03-90	33.2	24.2	1.7	94.0
12	19-03-90	25-03-90	31.8	25.0	-	91.9
13	26-03-90	01-04-90	33.6	24.7	-	93.6
14	02-04-90	08-04-90	33.8	25.3	1.8	93.7
15	09-04-90	15-04-90	33.1	25.4	-	94.6
16	16-04-90	22-04-90	33.2	26.3	0.7	96.9
17	23-04-90	29-04-90	33.8	25.9	-	96.7
18	30-04-90	06-05-90	33.2	25.2	2.2	97.4
19	07-05-90	13-05-90	31.9	24.8	6.9	94.1
20	14-05-90	20-05-90	31.3	23.9	30.04	93.6
21	21-05-90	27-05-90	31.9	23.5	7.1	87.6

Source: Meteorological Observatory, College of Agriculture, Vellayani.

endix-I (Contd)

PHYSICO - CHEMICAL PROPERTIES OF SOIL OF THE EXPERIMENTAL SITE

A. Mechanical Composition

Constituent	Content in soil (%)
Coarse sand	13.8
Fine sand	33.5
Silt	28.0
Clay	24.7
Textural class	Sandy Clay Loam.

Chemical Composition

Constituent	Rating
Available Nitrogen	Low
Available phosphorus	Medium
Available potassium	Medium
PH - 5.2	Acidic

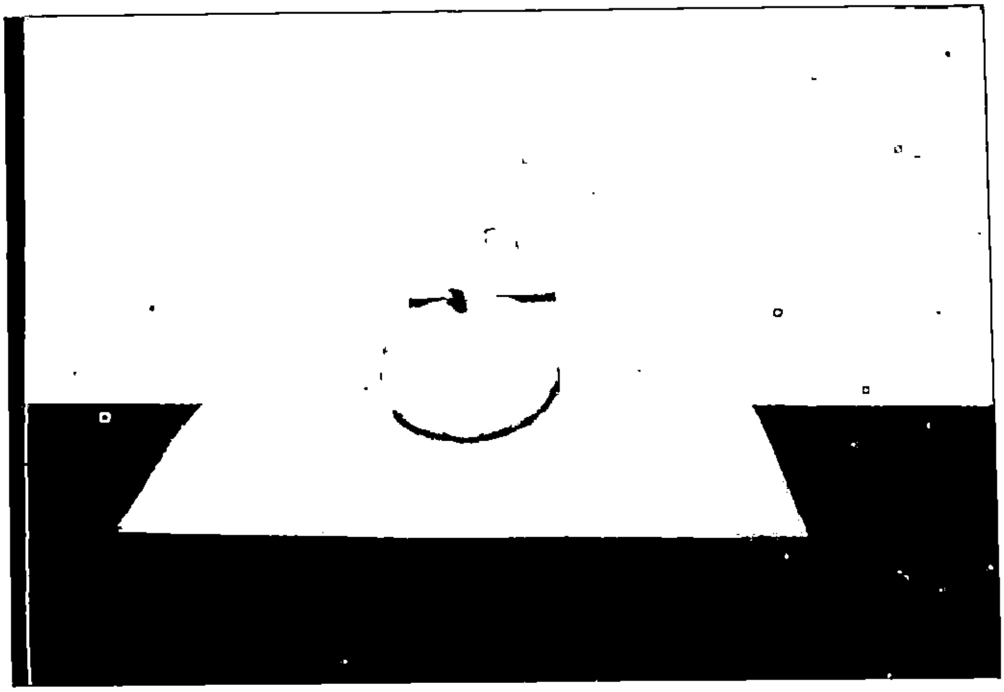
Source: Dept. of Soil Science & Agricultural Chemistry, College of Agriculture, Vellayani.

APPENDIX II

Names of varieties included in the experiment and their characteristic fruit shape

Sl. No.	Variety	Fruit shape
1	Pusa Madhuras	Round
2	Pusa Sharbathi	Round
3	Durgapura Madhu	Oblong
4	Lucknow Safeda	Round
5	Harela	Round
6	Chittidar	Round
7	M-4	Round
8	Sanganeer Local	Round
9	Mathuria	Round
10	Bhagpat	Round
11	Jaunpuri	Round
12	FM-1	Oblong
13	Iroquois	Oblong
14	PMR-6	Round
15	Doublon	Round

APPENDIX II (Contd.) - Variability in fruit shape



APPENDIX III Pooled analysis of variance for different germination and flowering parameters in 15 muskmelon varieties

Source of variation	df	Mean squares					
		Days to I germination	Percentage of germination	Days to I male flower	Node no. of I male flower	Days to I female / bisexual flower	Node no. of I female/bisexual flower
Season	2	9.24**	170.57**	196.57**	4.27**	64.64*	1.35^{NS}
Treatment	14	2.32**	2523.36**	64.30**	4.80**	39.01*	3.94^{NS}
Interaction	28	0.59^{NS}	58.83^{NS}	6.84^{S}	0.78^{NS}	16.43^{S}	3.12^{S}
Error	84	0.75	49.31	2.20	0.83	3.50	1.72

* Significant at 5% probability level

** Significant at 1% probability level

APPENDIX III (Contd) Pooled analysis of variance for different growth and yield parameters in 15 muskmelon varieties

Source of variation	df	Growth parameters: Length of vine	No. of secondary branches	No. of tertiary branches	Fresh weight of shoot	Yield parameters: Days to I harvest	Node no. of I harvest	Total weight of fruits/vine	Total no. of fruits/vine	Volume of a fruit
Season	2	1638.88 NS	0.94 NS	82.24 NS	6352.75 NS	73.55 NS	2.44 NS	34557.00 NS	unpooled.	3392.44 NS
Treatment	14	1443.87 NS	0.68 NS	204.63**	25347.11**	384.08**	5.32 NS	115837.20**		21812.37**
Interaction	28	1584.90 S	0.61 NS	47.42 S	7050.64 S	22.32 S	3.43 S	24903.57 S		2838.99 S
Error	84	362.10	0.58	6.57	441.60	7.12	1.70	4827.51		129.36

* Significant at 5% probability level

** Significant at 1% probability level

APPENDIX III (Contd.) Pooled analysis of variance for different quality parameters and pest attack scores in 15 muskmelon varieties

Source of variation	df	Quality parameters						Pest attack scores	
		Flesh/ cavity ratio	TSS	Total sugars	Reducing sugars	Non-reducing sugars	Acidity	Fruit fly attack scores	Pumpkin beetle attack scores
Season	2	0.01^{NS}	unpooled		0.01^{NS}	0.002^{NS}	unpooled	0.45^{NS}	2.49**
Treatment	14	0.08^{NS}			2.07*	0.02^{NS}		2.30**	1.42**
Interaction	28	0.004^{NS}			0.35^{NS}	0.004^{NS}		0.09^{NS}	0.07^{NS}
Error	84	1.45			1.10	2.51		0.34	0.30

* Significant at 5% probability level

** Significant at 1% probability level

APPENDIX IV - Variability in Vegetative growth

APPENDIX IV - Variability in Vegetative growth

APPENDIX IV (Contd.)

EVALUATION OF DESSERT TYPE OF MUSKMELON (*Cucumis melo* L.) FOR SOUTHERN REGION OF KERALA

By

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ABSTRACT OF A THESIS
submitted in partial fulfilment of the requirement
for the degree
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DEPARTMENT OF HORTICULTURE
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VELLAYANI, TRIVANDRUM

1992

ABSTRACT

The present investigation was carried out with fifteen muskmelon varieties during December-May (1989-90) at the College of Agriculture, Vellayani. The evaluation was done in a randomised block design with three replications and in three sowing months of December 1989, January 1990 and February 1990, to assess the variability available in dessert muskmelons with respect to growth, production and quality parameters, to study the interrelationships among yield components and to assess the suitability of the available dessert types of muskmelon for cultivation in the southern zone of Kerala during December-February season.

Significant differences were observed among the varieties in the three sowing months for the percentage of germination, number of days to first male/female/bisexual flower production, their node of production, days to first harvest and first fruiting node, yield per vine and volume of fruit, length of vine, number of branches, fresh weight of shoot, reaction towards pest and organoleptic test.

Pooled analysis revealed significant influence of environment on the characters viz., days to first harvest, first fruiting node, yield per vine, volume of fruit, length of vine and number of branches. It was observed that December sown crop possessed the majority of the desirable characters and the varieties suitable were Pusa Sharbathi and PMR-6.

The percentage of germination, total weight of fruits/vine, volume of fruit, F/C ratio, percentage of reducing and reducing sugars, acidity, fresh weight of shoot and number of branches exhibited moderate or high values of GCV. High heritability in conjunction with high genetic advance was observed for percentage of germination, yield/vine, volume of fruit and vine length. Therefore these characters form reliable index for selection.

Significant positive correlations were observed between percentage of germination and yield per vine and number of fruits per vine. The association between number of days for first female/bisexual flower production and first harvest revealed that early flowering variety will be early in coming to harvest also. Yield per vine displayed significant positive association with volume of fruit which in turn was strongly associated with number of tertiary branches and the number of branches with the length of vine. TSS exhibited significant positive association with acidity.