EVALUATION OF NETTED MUSK MELON (*Cucumis melo* var. *cantalupensis* Naudin.) FOR GROWTH, YIELD AND QUALITY

by

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(2017-12-026)

THESIS

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DECLARATION

I, hereby declare that this thesis entitled **"EVALUATION OF NETTED MUSK MELON (*Cucumis melo* var. *cantalupensis* Naudin.) FOR GROWTH, YIELD AND QUALITY"** is a bonafide record of research work done by me during the course of research and 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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Certified that this thesis entitled **"EVALUATION OF NETTED MUSK MELON (*Cucumis melo* var. *cantalupensis* Naudin.) FOR GROWTH, YIELD AND QUALITY"** is a record of research work done independently by Mr. Shivakumara Y.B. (2017-12-026) under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to him.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ANOVA	- Analysis of variance
CD (0.05)	- Critical difference at 5 per cent level
cm	- Centimetre
d.f.	- Degrees of freedom
et al.	- Co-workers/ Co-authors
Fig.	- Figure
g	- Gram
GA	- Genetic advance
GCV	- Genotypic coefficient of variation
h^2	- Heritability
ha	- Hectare
ha^{-1}	- Per hectare
IARI	- Indian Agricultural Research Institute
i.e	- That is
KAU	- Kerala Agricultural University
kg	- Kilogram
l	- Litre
m	- Metre
NHB	- National Horticultural Board
No.	- Number
PCV	- Phenotypic coefficient of variation
POP	- Package of practices
SEm	- Standard error of mean
t	- Tonnes
TSS	- Total soluble solids
viz.,	- Namely

LIST OF SYMBOLS

@	- at the rate of
β	- Beta
°C	- Degree Celsius
%	- Per cent

Introduction

1. INTRODUCTION

Netted musk melon (*Cucumis melo* var. *cantalupensis* Naudin.) is a dessert type of musk melon belonging to the family Cucurbitaceae, known by various names, *viz.*, Sweet melon, Rock melon, *Kalinga, Kharbooja, Kasturitarabuja etc.* in different parts of India. It is one of the most important dessert cucurbits of India and a highly relished summer fruit because of its nutritive, demulcent medicinal value, sweet taste, attractive flavour, aroma and refreshing effect. Netted muskmelon (2n=24) is one of the most admired cucurbitaceous fruit crops grown throughout the world, particularly in tropical and sub-tropical countries. It is a good cash crop in Asia and South American countries and is an unavoidable item of western dietary.

Netted muskmelon originated in tropical Africa in eastern region, south of Sahara desert. The secondary centers of diversity are Central Asia, southern Russia, Iran, Afghanistan, India and China. The true wild forms are found in eastern tropical Africa. The wild forms of muskmelon reported from India are feral escapes derived from local cultivars. Melon was cultivated in Egypt during 2400 BC and introduced into the USA by Coloumbus in1494. It is now grown both in the Old World and the New World.

India is considered as secondary center of diversity. Muskmelon was introduced in India probably during Mughal invasion around 14^{th} century from Central Asian region. Since then, it has spread to different parts of the country. In India, muskmelon occupies an area of 52,000 ha with an annual production of about of 11,35,000 metric tonnes during the year 2017-2018 (NHB, 2017) and is mostly grown in the states of Punjab, Tamil Nadu, Uttar Pradesh, Maharashtra and Andhra Pradesh.

Netted musk melon is an annual with climbing, creeping, or trailing vine. The fruits are round, sweet and musky in flavour and relished by millions with good export potential. The fruit flesh inside varies from white to cream-yellow, orange or green. At present, most of the commercial types have thin, reticulated, light-grey rind and thick orange pulp. It is normally eaten as a fresh fruit, as a salad, for making juice or as a dessert with ice cream or custard. Fruits are very good source of dietary fibre, vitamins and minerals. Muskmelon is rich in vitamin A, B and C, and minerals like calcium, phosphorus and iron. The yellow and orange fleshed muskmelons contain more than 2020 μg 100 g^{-1} of beta carotene, a precursor of vitamin A. Netted musk melon contains 26.7 mg of vitamin C 100 g^{-1} of edible portion (Lisa and Tian, 2011). Muskmelon is said to have obtained its name from the musky aroma it produces when ripe. The fruits are sweet and musky in flavour and relished by millions, as it is packed with a heavy minerals and antioxidants.

Consumption of netted muskmelon is associated with regulating heart beat and, possibly, preventing strokes. Netted muskmelon reduces the risk of developing kidney stones and age related bone loss. Netted muskmelons have been found to have sedative properties, making them beneficial for the people who are suffering from insomnia. The fruit has almost zero cholesterol and thus, is safe for the people who suffer from the problem of high blood cholesterol. Regular consumption of netted muskmelon juice can help to treat lack of appetite, acidity and water content. The fruit can reduce the heat in the body and thus, prevent heat related disorders.

Mature fruits may be eaten fresh as a dessert fruit, canned or used for syrup or jam. Melon seeds are dietary source of unsaturated vegetable oil and protein and sometimes are lightly roasted and eaten like nuts or even used in sweets in some parts of India. Immature melons are used fresh in salads, cooked or pickled in some parts of India.

Cultivation of dessert type of musk melon has not become popular in Kerala, where semi dessert types of musk melon, *i.e.* oriental pickling melon (*Cucumis melo*. var. *conomon*) and culinary melon (*Cucumis melo*. var. *acidulus*) are more popular. The demand for dessert vegetables in Kerala is heavy, especially during the summer season. Watermelon is the dessert cucurbit available in plenty. Netted musk melon is also available, brought mainly from neighbouring states. A number of netted muskmelon hybrids and varieties are grown in different regions of India.

Hence the present investigation was taken up with the objectives

1. To evaluate netted muskmelon for growth, yield and quality under Kerala conditions
2. To assess the genetic variability present in netted muskmelon
3. To study the adaptability of netted muskmelon in Kerala.

Review of Literature

2. REVIEW OF LITERATURE

Muskmelon (*Cucumis melo* var. *cantalupensis* Naudin.) is one of the most important, nutritious and highly remunerative dessert cucurbits known for its taste and delicacy. Possible improvement in yield and quality of muskmelon through use of F_1 hybrids, open pollinated varieties and improved cultural practices have been made in other states in India. Muskmelon varieties and hybrids significantly vary for the horticultural traits and growing environment.

A systematic evaluation of varieties and hybrids with different horticultural traits under different regions is essential to explore the possibility of popularising the netted muskmelon in the areas where it is under exploited and also helps to identify superior varieties and F_1 hybrids for commercial cultivation. In this chapter, an effort has been made to review the available literature concerning evaluation of varieties and hybrids in muskmelon and other cucurbitaceous vegetables for growth, yield and quality attributes. The review is presented under the following sections:

2.1 GROWTH PARAMETERS

2.1.1 Vegetative Characters

2.1.1.1 Vine Length

Deol *et al.* (1981) reported that in muskmelon, vine length ranged from 76.90 to 209.30 cm with a mean of 130.20 cm. Nandpuri *et al.* (1984) noticed maximum vigour in the F_1 hybrids of muskmelon for vine length (65.2%) over parents. Compared with 'Hara Madu', the standard and longest growing variety, vine length was invariably less and with a significant margin in 13 F_1 hybrids.

Among the muskmelon cultivars examined for salinity tolerance, maximum vine length of 144 cm was noticed in Galia by Mendlinger and Fossen (1993).

Gichimu *et al.* (2008) studied the agronomic performance of watermelon cultivars and observed a maximum vine length of 448 cm in Kakamega land race and minimum in 'Crimson Sweet' (201 cm). Vine length of 228 cm, 233 cm and

244 cm was recorded in 'Sugar Baby' 'Charleston Grey' and 'Yellow Crimson' respectively.

Watermelon variety 'Sugar Baby' performed better compared to 'Green Gold' 'Charleston Grey' and 'Crimson sweet' for vine length (Okonmah *et al.* 2011). Dantata (2014) evaluated the effect of planting distances and cultivars on growth and yield in watermelon and revealed that vine length significantly increased with planting distance.

Genetic studies on the performance of F_6 progenies, derived from the cross IVMM-3 x Punjab Sunheri of muskmelon was conducted by Gaikwad (2016) and recorded wide range of variability from 188.32 cm to 213.68 cm for average vine length. Wahocho *et al.* (2016) studied the performance of cucumber cultivars in response to Nitrogen levels, and recorded that the crop treated with a higher N level of 150 kg produced maximum vine length of 198.57 cm, while the control plots produced the lowest vine length was 105.62 cm.

Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and recorded a range of 118.33 cm to 435.50 cm for vine length under normal condition, whereas 104.50 cm to 399.11 cm under 50 % water stress condition. Ganiger *et al.* (2017) studied the performance of wild melon genotypes, the maximum vine length (124.33 cm) being noticed in T-18 followed by T-21 (121.33 cm) and T-23 (120.17 cm). The genotype T-2 recorded minimum vine length of 42.33 cm.

2.1.1.2 Number of branches vine^{-1}

An evaluation of muskmelon cultivars for salinity tolerance was done by Mendlinger and Fossen (1993). Maximum number of branches was obtained in the cultivar Topmark, while the minimum in BG-84-3.

Aravindkumar *et al.* (2005) studied the performance of 49 hybrids in muskmelon among which the highest number of branches vine^{-1} was recorded in Kajiri x IIHR-616-23 and lowest in Kajiri x IIHR-67. Maximum number of primary branches (10.37) vine^{-1} was noticed in VRBT-100. In a study trial comprising of twenty eight hybrids of cucumber, the number of primary branches vine^{-1} was observed to be ranging from 3.90 to 8.50 (Bairagi *et al.* 2005).

Gichimu *et al.* (2008) reported maximum number of branches vine^{-1} (11) in Kakamega landrace of watermelon and minimum (5) in 'Crimson Sweet'. Fergany *et al.* (2011) studied the variation in melon land races adapted to the humid tropics of southern India and found that the number of branches plant^{-1} ranged from 2 to 7.5. AM-5 and AM-7 were observed to be the most branched accessions.

Wide range of variability was observed for number of primary branches vine^{-1} (2.06 to 2.53) by Gaikwad (2016) on studying the performance of F_6 progenies derived from the cross IVMM-3 x Punjab Sunheri of muskmelon.

Ganiger *et al.* (2017) conducted a study on wild melon for agronomic traits and stated that maximum branching of 4.34 was observed in T-18 and least branching of 2.66 in T-7. Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and recorded a range of 4.17 to 8.94 for number of branches plant^{-1} under normal condition, whereas 3.50 to 6.83 under 50 % water stress condition.

A study on genetic improvement of yield and fruit traits in snake cucumber was conducted by Abed *et al.* (2018) and recorded that number of branches plant^{-1} significantly increased by individual plant selection in AS_2 (3.40), AS_3 (2.77), DK_1 (2.63) compared to their original populations.

2.1.2 Flowering Characters

2.1.2.1 Days to First Male Flower

According to Gichimu *et al.* (2008), the cultivar 'Sugar Baby' was the earliest to produce first male flower (45 days) and the cultivar Kaka Mega was late (63 days).

Wahocho *et al.* (2016) evaluated the response cucumber cultivars to different nitrogen levels and recorded that the cultivar Squees Green took 44.28 days for flowering, while the cultivar Sindh Wango took 41.32 days.

2.1.2.2 Node to First Male Flower

Samadia (2007) noticed difference in node to first staminate flower ranging from 2.24 in DPY-125 to 4.0 in PDVR-48 and KPT-3 in a trail which encompassed 18 genotypes of round melon. Bhagwat *et al.* (2018) observed that the minimum node number at which staminate flower appear in cucumber was 2.15.

2.1.2.3 Days to First Female Flower

Lal and Dhaliwal (1996) noticed that genotypes of muskmelon took 27.69 (MHL-10) and 41.92 (M-4) days to first female flower production.

Gichimu *et al.* (2008) conducted a study on agronomic performance of five cultivated watermelon accessions and reported that the opening of the first pistillate flower occurred 6 to 13 days after the opening of the first staminate flower. The shortest time to anthesis of first pistillate flower was recorded by Sugar Baby (51 days) whereas, the Kakamega landrace recorded significantly the longest time (74 days).

Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and recorded a range of 46.32 to 62.67 for female flower production under normal condition, whereas 45.44 to 61.50 under 50 % water stress condition.

The performance of three diverse genetic populations of snake cucumber for vegetative, yield and fruit traits was studied by Abed *et al.* (2018) and recorded that the genotypes AS3 was found to be earlier in flower production (33.63 days) than their corresponding base populations.

2.1.2.4 Node to First Female Flower

Manu (2014) conducted a study on flowering behaviour of 24 oriental pickling melon genotypes. The lowest node to female flower was observed in GR-4-1 (2.84), whereas GR-4 flowered in highest node (4.35).

2.1.2.5 Sex ratio

Venkatesan *et al.* (2016) studied muskmelon genotypes for growth, yield and quality. Highest sex ratio was recorded by in GWL-4 (4.54) which was on par with GWL-5 (3.81) and Dharwad local (3.79).

2.1.3 Fruit and Yield Characters

2.1.3.1Number of Fruits Plant^{-1}

Evaluation of muskmelon genotypes was done by Dhiman *et al.* (1995) and found that the number of fruits vine^{-1} was highest in Punjab Hybrid (1.80) and lowest in Hara Madhu (1.30).

Kultur *et al.* (2001) studied the influence of spacing and genotype on fruit yield and quality characters of muskmelon and reported that the fruit number vine^{-1} increased with increase in spacing. Highest fruit number plant^{-1} was recorded by Birdsnest2 (3.7). Number of fruits plant^{-1} in greenhouse musk melon cultivar 'Galia' ranged from 2.20 to 3.60 (Shaw *et al.,* 2001). Growth vigour, earliness and yield performance of promising F_1 hybrids in Egyptian melon were studied by Glala *et al.* (2002) and recorded highest number of fruits plant^{-1} in the cultivar Ano-4 (6.67) followed by P2 x P3 (6.41), P3 x P4 (6.35) and P2 x P4 (6.18).

Iathet and Piluek (2006) studied the performance of two inbred lines and the F_1 progeny of Thai slicing melon and reported that fruits vine^{-1} in the F_1 progeny was 30.60, which was higher than the mid parent value of 25.03. Mitchell *et al.* (2007) studied 18 melon cultivars for fruit yield and quality characteristics and found that the number of marketable fruits per square metre ranged from 2.5 in Gala to 5.5 in Galileo.

Gichimu *et al.* (2008) made a study on agronomic traits of five cultivated watermelon accessions and observed significant difference for number of fruits plant^{-1} in all accessions. The best yielder was Kaka mega landrace with 5.67 fruits plant^{-1} (1814 fruits ha^{-1}), 'Yellow Crimson' recorded an average of 3.45 fruits plant^{-1} (1104 fruits ha^{-1}) and 'Sugar Baby' produced 2.38 fruits plant^{-1} (764 fruits ha^{-1}).

Ijoyah and Koutatouka (2008) made a study on five newly introduced muskmelon varieties under field conditions. The experimental results revealed that the cultivar 'Joker F1' had the highest number and larger fruits.

Rakha *et al.* (2012) identified strain 6 as the best yielder on evaluation of regenerated strains from six *Cucurbita* interspecific hybrids obtained through anther and ovule *in vitro* cultures. However, two regenerated strains showed superiority to the local melon cultivar 'Eskandarani' for number of fruits as well as total fruit yield plot^{-1}.

Genetic studies on the performance of F_6 progenies derived from the cross IVMM-3 x Punjab Sunheri of muskmelon was conducted by Gaikwad (2016) and recorded wide range of variability from 2.45 to 2.91 for fruits plant^{-1}.

Genetic variability studies in response to drought under different water regimes in muskmelon was done by Mishra *et al.* (2017) and recorded a range of 3.50- 7.33 for fruit plant^{-1} under normal condition while 2.00- 4.67 under 50 % water stress condition.

2.1.3.2. Fruit Weight

Evaluation of muskmelon genotypes for multiple disease resistance, yield and quality characters was conducted by Dhiman *et al.* (1995) and observed that highest fruit weight was recorded in Punjab hybrid.

Growth vigour, earliness and yield performance of promising F_1 hybrids in Egyptian melon were studied by Glala *et al.* (2002) and reported maximum fruit weight of 986.00 g in Fal-6, P2 x P3 and P4 x P5.

The performance of two inbred lines and their F_1 progeny of Thai slicing melon were assessed by Iathet and Piluek (2006) and reported that the parent P_2 produced the highest fruit weight of 102.03 g, while the parent P_1 produced lower fruit weight of 70.13 g, which was on par with its F_1, F_2, and BC_1.

Mitchell *et al.* (2007) conducted a research on 18 speciality muskmelon varieties for mean fruit weight plant^{-1} which ranged from 0.70 kg in Charentais to

1.90 kg in Girlie. Erdinc *et al.* (2008) compared the local genotypes and commercial muskmelon cultivars for growth and quality parameters and recorded that the Rambo F1 registered highest fruit weight (1375 g) in the first year and second year (1032 g). 65 ER 02 recorded the lowest fruit weight (787 g).

A study on performance of five cultivated watermelon accessions for growth and quality was conducted by Gichimu *et al.* (2008) and found that the accessions differed significantly for fruit weight. 'Yellow Crimson' recorded the highest fruit weight of 3.01 kg, while 'Crimson Sweet' recorded the lowest (1.44 kg).

Ijoyah and Koutatouka (2008) assessed the yield characters of five introduced muskmelon varieties. The results revealed that cultivar Joker F1's fruit weight was significantly higher by 14.70 per cent in 2005 and 25.20 per cent in 2006, when compared to cultivar 'Hales Best'.

Variation in melon landraces adopted to the humid tropics of southern India was studied by Fergany *et al.* (2011) and observed that the average fruit weight of accessions ranged between 0.174 and 1.731 kg. A study on morphologic variation in different Iranian melon cultivars was conducted by Nasrabadi *et al.* (2012) and reported maximum fruit in the variety Jafarabadi and minimum in Zin Abad (2.31 kg). Rakha *et al.* (2012) evaluated regenerated strains from six *Cucurbita* interspecific hybrids and recorded the maximum fruit weight of 127 g in the variety Eskandarani.

Gaikwad (2016) studied the performance of F_6 progeny, derived from the cross IVMM-3 x Punjab Sunheri of muskmelon and recorded wide range of variability from 642.35 g to 892.12 g for average fruit weight.

Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and recorded a range of 266.67 g to 3191.67 g for fruit weight under normal condition, whereas 208.33 g to 2666.67 g under 50 % water stress condition.

2.1.3.3 Fruit Yield

Rodriguez *et al.* (2002) reported that Galia type muskmelon, the leading melon in Europe, produced a marketable yield between 24.4 and 28.7 kg m^{-2} under green house.

Performance of six Iranian local melon cultivars and their diallel crosses were studied by Feyzian *et al.* (2009) and observed that among the parents, Nahavand recorded the highest yield of 3.54 kg while among the F_1 hybrids, the cross Eyvanaki x Nahavand recorded the highest yield of 4.62 kg.

Rakha *et al.* (2012) evaluated regenerated strains from six *Cucurbita* interspecific hybrids and reported that Eskandarani cv. Strain 5 recorded the highest total yield $plot^{-1}$ of 45.10 kg. However, two regenerated strains were found superior to the local cultivar 'Eskandarani' for total fruit yield $plot^{-1}$.

Genetic studies on the performance of F_6 progenies, derived from the cross IVMM-3 x Punjab Sunheri of muskmelon was conducted by Gaikwad (2016) and recorded wide range of variability from 1.48 kg to 2.87 kg for average yield $vine^{-1}$.

2.1.3.4 Fruit Shape

Correlation studies were conducted for fruit characters in indigenous germplasm lines of watermelon by Yadav and Asati (2005) and observed variation in fruit shape from round to flat cylindrical. Eleven accessions exhibited desirable round fruit shape. Four types of fruit shapes *viz*., pyriform, elongated, elliptical, and oblate were reported in melon landraces adapted to the humid tropics of southern India by Fergany *et al.* (2011).

2.1.3.5 Fruit Diameter

Iathet and Piluek (2006) studied the performance of two inbred lines and the F_1 progeny of Thai slicing melon and reported that the F_1 progeny recorded fruit width of 4.06 cm, which was lesser than the mid parent value (4.17 cm).

Evaluation of muskmelon cultivars was done by Ohashi *et al.* (2009) for quality characters. Maximum fruit diameter was documented in Andes (13.70 cm) and minimum in Picasso melon (9.0 cm). A study on morphological variation of different Iranian melon cultivars was conducted by Nasrabadi *et al.* (2012) and recorded significant variation for fruit diameter. Highest fruit diameter was recorded in Zemestani (19.56 cm), while the lowest in Jabari (15.15 cm).

Performance studies on oriental pickling melon genotypes was done by Ganiger *et al.* (2014) revealed that maximum fruit breadth was recorded in BCMCO-04 (14.96 cm) and Sirsi-1 (14.78 cm). Manu (2014) conducted genetic variability studies in 24 genotypes of oriental pickling melon and observed that fruit diameter ranged from 7.39 cm (BMSCO-1) to 13.17 cm in (Sirsi-2-13) with grand mean of 10.13 cm.

2.1.3.6 Flesh Thickness

A study on the utilization of first generation muskmelon hybrids was conducted by Munger *et al.* (1942) and observed that the hybrids produced a high proportion of flesh than the parent. More and Seshadri (1980) conducted heterosis studies in muskmelon and observed that maximum estimate of vigour for flesh proportion was 17.58 per cent. Genetic variability and character association studies in muskmelon conducted by Kalloo (1989) recorded flesh thickness in Jaunpuri (3.9 cm) and minimum in Aroma (2 cm).

Studies on the performance of muskmelon hybrids by Bokashi *et al.* (1992) revealed that mesocarp thickness ranged from 0.97 to 2 cm with SM14 recording the highest. Yadav and Asati (2005) reported a range from 9.6 to 34.5 cm for flesh thickness in indigenous germplasm lines of watermelon.

Erdinc *et al.* (2008) compared the local and improved melon cultivars for their growth and quality attributes and observed that the Rambo F_1 and Makdimon F_1 had the densest fleshes (29.32 mm and 28.37 mm, respectively in the first year) and 34.81 mm and 30.82 mm, respectively in the second year. Twenty five oriental pickling melon hybrids were evaluated by Tyagraj *et al.* (2014) for yield and quality and reported that the flesh thickness ranged from 1.73 cm to 3.81 cm.

2.1.3.7 Cavity Size

Sharma and Lal (2004) conducted studies on the varietal differences in physicochemical characteristics of muskmelon and recorded the smallest cavity size in Punjab Hybrid, among the F_1 hybrids and in KPPM-2-31, among the varities on assessing twenty four genotypes of muskmelon. Singh and Lal (2005) reported lowest cavity polar diameter in IC- 320173 (3.21 cm) and equatorial diameter in EC- 399937.

2.1.3.7 Seeds Fruit^{-1}

Edelstein and Nerson (2002) assessed the effect of genotype and plant density on watermelon grown for seed production and observed that the breeding line 203 produced (186) seeds fruit^{-1} and line 239-4 produced (232).

Evaluation of four watermelon varieties was done by Okonmah *et al.* (2011) and recorded highest number of seeds fruit^{-1} at harvest for Sugar Baby (203.4). Ganiger *et al.* (2017) evaluated wild melon for growth yield and quality traits and recorded that selection from Bagalkot Local exhibited highest number of seeds fruit^{-1} (210.50) which is was on par with collection from Nimbalgundi Local (195.00).

2.1.4 QUALITY PARAMETERS

2.1.4.1 β- carotene

Cantaloupe contains many biologically active molecules such as carotenoids which are natural pigments with desirable health benefits and nutraceutical properties. Fergany *et al.* (2011) conducted a study on melon landraces adopted to the humid tropics of southern India and observed that the total carotenoid content ranged between 30.70 and 146.20 μg/ 100 g of fresh fruit weight. Total carotenoids in peel and flesh in cantaloupe were 0.33 mg/ g and 0.22 mg/ g of dry powder respectively (Aflaki, 2012). Norrizah *et al.* (2012) recorded β-carotene content of three different rock melon cultivars and reported that Honey Moon gave the maximum β- carotene content (0.00097%).

2.1.4.2 TSS content of fruit

Mean performance of parents and hybrids in cucumber was assessed by Dogra *et al.* (1997) and observed that the cross LC-11 x K-75 was recorded highest total soluble solids (3.22° B) which was on par with EC-173934 (3.13° B) and least in the cross K-75 x Gyn. 1 (2.88° B). Gala *et al.* (2002) evaluated five superior inbred lines and ten hybrids of Egyptian melon under low tunnel and reported highest TSS in GW4 (13.86° B) and lowest in Ano- 4 (12° B). Rodriguez *et al.* (2002) studied high tunnel cantaloupe and speciality melon cultivars and recorded that the cultivar Galia 152 had a TSS content of 14 %.

A study on the varietal differences in physico-chemical characteristics of muskmelon was conducted by Sharma and Lal (2004) accessed the differences in performances of muskmelon and observations showed that the TSS content exhibited from 7.8° B to 10.3° B among the open-pollinated varieties.

Pandey *et al.* (2008) reported a new muskmelon cultivar Kashi Madhu with high TSS content of 13.24 % compared to other cultivars recommended for cultivation. Field evaluation of five local vellari melon types was conducted by Subramanian (2008) and recorded TSS range from 4.05 to 5.14 per cent.

Fergany *et al.* (2011) studied the variation in melon landraces adapted to the humid tropics of southern India and recorded that the TSS ranged between 2.1 and 6.40° B. Nasrabadi *et al.* (2012) recorded the maximum sugar content in Jafarabadi cultivar (13.33 %) among the different Iranian melon cultivars.

Genetic variability and divergence studies in oriental pickling melon was done by Manu (2014) and recorded a range between 2.360° B to 6.98° B, minimum in Udupi Local and maximum in GR-2-1.

Ganiger *et al.* (2017) reported that in wild melon highest TSS content was recorded in the treatment T-16 (7.37° B), which was on par with T-23 (6.13° B), while the lowest in T-18 (3.65 °B).

2.1.4.3 Total sugars

Variation for total sugar content among twenty watermelon genotypes was recorded by Yoo *et al.* (2012) and observed that the red fleshed genotype Rio Gray recorded maximum total sugar content of 91 mg g^{-1}

Nasrabadi *et al.* (2012) made a study on nutritional quality parameters of muskmelon during different stages of ripening and reported that the maximum amount of total sugars was found to be accumulated in the ripened fruit of muskmelon.

Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and recorded a range from 1.06 to 2.80 for total sugars under normal condition, whereas 1.38 to 3.04 under 50 % water stress condition.

2.2 COEFFICIENT OF VARIATION

Pandey *et al.* (2005) recorded the observations on genetic variability for 13 characters in muskmelon. The phenotypic (PCV) and genotypic (GCV) coefficience of variation was recorded high for fruit weight and yield.

Rakhi and Rajamony (2005) reported high GCV and PCV in culinarymelon for yield $plant^{-1}$, average fruit weight, fruits $plant^{-1}$, keeping quality of fruits and 1000 seed weight, leaf area index and sex ratio.

Torkadi *et al.* (2007) assessed genetic variability among 51 genotypes of muskmelon for 16 traits. High magnitudes of GCV and PCV were recorded for average fruit weight, fruit cavity, number of fruits $vine^{-1}$ and weight of fruits $vine^{-1}$, which showed the presence of significant amount of variation for these traits. Mehta *et al.* (2010) observed high GCV and PCV for fruit yield $plant^{-1}$followed by acidity percentage, fruits $plant^{-1}$ and total soluble sugars percentage, while moderate estimates were observed for number of node to first pistillate flower appearance and fruit weight in muskmelon.

Nasrabadi *et al.* (2012) studied the field performance, variability, characters association and genetic divergence of fifty-eight cucumber accessions. High GCV was recorded for yield plant^{-1} (42.7 %) number of fruits plant^{-1} (33.4 %), fruit length (27.5 %), number of lateral shoots (24.19 %), average fruit weight (22.1 %), petiole length (16.10 %) and node order at which male and female flower opened (13.2 % and 12.6 %). Reetu *et al.* (2010) assessed genetic variability, heritability and genetic advance in 44 divergent muskmelon genotypes and recorded high genotypic and phenotypic coefficient of variation for fruit yield plant^{-1}, followed by percent acidity, fruits plant^{-1} and total soluble sugars.

Choudhary *et al.* (2011) reported genetic variability in 70 muskmelon genotypes for 15 characters. Considerable amount of genetic variability was present for all the traits studied. Yield plant^{-1}, flesh weight fruit^{-1} and average fruit weight exhibited higher values of GCV and PCV. Ibrahim (2012) recorded high estimates of PCV and GCV for weight of fruit followed by fruit yield plant^{-1} and fruit length in muskmelon. The estimates of PCV in general were higher than GCV for all the traits.

Genetic variability study in 22 genotypes of muskmelon was conducted by Potekar *et al.* (2014) and recorded high GCV and PCV for the characters *viz.*, percentage of fruit set, vine length, fruit weight, rind thickness and yield plant^{-1}. Mali *et al.* (2015) studied variability for 24 characters in F_3 generation of muskmelon and recorded high genotypic and phenotypic coefficients of variation for vine length, number of branches vine^{-1}, number of staminate and pistillate flowers vine^{-1}, sex ratio, node to first female flower, number fruits vine^{-1}, average fruit weight, average length of fruit, average rind thickness, T.S.S. and non reducing sugar.

Pushpalatha *et al.* (2016) assessed the variability in 24 diverse cucumber genotypes and recorded high PCV and GCV for yield plant^{-1}, fruit flesh thickness, number of fruits plant^{-1}, number of nodes plant^{-1}, number of branches plant^{-1}, average fruit weight, internode length and vine length.

Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and reported high genotypic and phenotypic coefficient of variations for fruit yield plant^{-1}, fruit weight plant^{-1}, vine length, total sugar and proline content under normal and water stress conditions.

Babu and Rao (2018) conducted studies on genetic variability, heritability and genetic advance in oriental pickling melon genotypes and reported high PCV and GCV were recorded for node number of first female flower, fruit weight (g), placenta weight per fruit (g,) seed cavity width (cm), seed cavity length (cm), number of fruits vine^{-1}, 100 seed weight (g) and fruit yield vine^{-1} (kg).

2.3 HERITABILITY AND GENETIC ADVANCE

Somkuwar *et al.* (1997) recorded high heritability and moderate genetic advance for flesh cavity ratio, per cent disease intensity of downey mildew, fruit yield vine^{-1}, number of fruits vine^{-1} and fruit weight in muskmelon.

High heritability coupled with high genetic advance as per cent of mean were observed by Tarsem and Sanjay (1997) in muskmelon for node to first female flower, average fruit weight, marketable yield vine^{-1} and total yield vine^{-1}. Vishwanatha (2003) revealed that high heritability and genetic gain was observed for fruit yield vine^{-1}, average fruit weight, number of fruits vine^{-1}, however the number of primary branches, vine length, total soluble solids and flesh thickness recorded high heritability with moderate genetic gain.

Prasad *et al.* (2004) reported that heritability and genetic advance as per cent of mean in muskmelon was higher for days to first female flower appearance, number of male and female flower vine^{-1}, node to male flower and yields plot^{-1}.

Arvindakumar (2005) assessed heritability and genetic advance of 15 quantitative characters in 49 muskmelon hybrids and revealed that high heritability along with high genetic advance as per cent of mean was recorded for sex ratio, number of fruits vine^{-1}, average fruit weight, fruit length, fruit diameter, rind thickness and flesh thickness.

Singh and Lal (2005) reported high heritability associated with high genetic advance as per cent of mean for node to first female flower followed by rind thickness and fruit weight which implies that these traits are more reliable for improvement through selection in muskmelon. Chamnan and Kasem (2006) evaluated two inbred lines of slicing melon (*Cucumis melo* L. var. *conomon Makino*) and their progenies and observed that heritability based on fruit width, fruit length, fruit shape index and fruit weight were relatively high.

Reetu *et al.* (2010) assessed genetic variability, heritability and genetic advance in 44 divergent muskmelon genotypes and recorded high heritability estimates for total soluble sugars, total soluble solids and fruit yield plant^{-1}. Genetic variability for 15 yield contributing characters in 70 genotypes of muskmelon was studied by Choudhary *et al.* (2011). High estimates of heritability and genetic advance were observed for yield plant^{-1} and average weight of fruit.

Ibrahim (2012) got high estimates of heritability coupled with high genetic advance for fruit weight and yield plant^{-1} in Egyptian sweet melon. Mishra *et al.* (2012) evaluated 30 long melon genotypes and recorded that all the traits showed moderate to high heritability. Heritability estimates was high for vine length, days taken to first female flower appearance and length of fruit. The highest estimate of genetic advance was recorded for number of nods vine^{-1}.

A study conducted by Reddy *et al.* (2013) to understand the genetics of yield information traits in muskmelon revealed that the traits like days to first staminate flower, fruit length, average fruit weight, fruit cavity length and width, rind thickness, T.S.S. and seed yield in muskmelon recorded high genetic advance as a per cent of mean associated with high heritability estimates.

Patil (2014) recorded high heritability coupled with high genetic advance for most of the traits like vine length, days to male and female flower production, node to first pistillate flower, number of female flowers vine^{-1}, days to first harvest, yield vine^{-1}, weight of fruit, length of fruit, fruit diameter, rind thickness, pulp thickness, fruit cavity, weight of pulp fruit^{-1}, weight of seed fruit^{-1}, TSS, acidity, downey mildew, powdery mildew, fruit fly and leaf miner.

Mali *et al.* (2015) reported heritability and genetic advance for 24 characters in genotypes of muskmelon for the cross Hara Madhu x IVMM-3 in F_3 generation. High heritability estimates accompanied with high genetic advance were observed for vine length, number of primary branches vine^{-1}, number of male and female flowers vine^{-1}, sex ratio, node to first pistillate flower, number of fruits vine^{-1}, fruit yield vine^{-1}, mean fruit weight, mean length of fruit, mean rind thickness, average pulp thickness, average fruit cavity, average weight of pulp fruit^{-1}, average weight of seed fruit^{-1}, T.S.S. and non reducing sugar.

Pushpalatha *et al.* (2016) recorded high heritability, associated with high genetic advance in cucumber for all the traits studied except days to first female-flower opening, days to 50% flowering and days to first-fruit harvest.

Genetic variability studies in response to drought under different water regimes in muskmelon was conducted by Mishra *et al.* (2017) and reported high estimate of heritability along with high genetic advance for fruit weight, proline content and fruit yield plant^{-1} in both the non-stress and stress conditions.

Babu and Rao (2018) conducted studies on genetic variability, heritability and genetic advance in oriental pickling melon genotypes and reported high heritability (>60 %) and high genetic advance for node number of first male flower, node number of first female flower, fruit weight, fruit length, fruit girth, flesh thickness, seed cavity width and length, number of fruits vine^{-1}, , number of primary branches vine^{-1}, 100 seed weight and fruit yield vine^{-1}.

2.4 CORRELATION STUDIES

Correlation study conducted by Somkuwar *et al.* (1997) revealed that improvement in muskmelon is possible by selecting genotypes for number of fruits plant^{-1}, days to first harvest of fruit and total soluble solids.

Correlation analysis among growth, yield and quality characters in *Cucumis melo* L. was conducted by Taha *et al.* (2003) and recorded significant correlation of number of fruits vine^{-1} with the number of primary branches (+0.82), earliness with flavor (+0.42), earliness with TSS (-0.71), and earliness with netting development (-0.82).

Choudhary *et al.* (2004) reported that yield plant^{-1} had significant positive correlation with fruit weight, fruits plant^{-1}, rind thickness and vine length in muskmelon. Iathet and Piluek (2006) studied the correlation of different characters in F_2 progenies of Thai slicing melon and recorded high positive correlation coefficients for fruit number plant^{-1} and marketable yield.

Reddy *et al.* (2007) conducted correlation and path analyses for growth, yield, and fruit quality traits in 30 snapmelon accessions. Yield plant^{-1} was positively and significantly correlated with weight of the fruit, length of the vine, flesh thickness, fruit length, fruit diameter, node to first pistillate flower, length of fruit cavity, ascorbic acid, and maturity period. Vine length, non-reducing sugars, and total carotenoids had high direct effect on yield plant^{-1} in Path analysis.

Tomar *et al.* (2008) studied 50 germplasms of muskmelon for correlation, path analysis and divergence for yield and its contributing traits. Genotypic correlations were higher than phenotypic correlation coefficients in most of the cases. Path analysis based on genotypic association reported that number of fruits plant^{-1} and moisture percentage was the main yield attributing characters in fruit yield of muskmelon. Total soluble solids exhibited positive direct effect on fruit yield plant^{-1}. Thus, number of fruits plant^{-1}, moisture percentage and total soluble solids may be given more weight age for an effective selection to improve fruit yield in muskmelon.

Character association study in muskmelon conducted by Choudhary *et al.* (2010) revealed that fruit equatorial diameter, seed cavity diameter, average fruit weight and flesh weight fruit^{-1} had highly significant positive correlation with fruit yield plant^{-1}.

Cheema *et al.* (2011) assessed the variability present in muskmelon and reported that yield plant^{-1} was positively and significantly correlated with number of lateral branches plant^{-1}, number of green leaves plant^{-1}, fruit weight, number of fruit plant^{-1} and total number of leaves plant^{-1}.

Materials and Methods

3. MATERIALS AND METHODS

The present investigation entitled "Evaluation of netted muskmelon (*Cucumis melo* var. *cantalupensis* Naudin.) for growth, yield and quality" was carried out at the Department of Vegetable Science, College of Agriculture, Vellayani, during 2018- 2019. The study aimed to evaluate netted muskmelon in Kerala for growth, yield and quality and thereby its adaptability.

3.1 EXPERIMENTAL SITE

The experimental plot was located at 8.5^0 North latitude and 76.9^0 East longitude, at an altitude of 29.00 m above mean sea level. Predominant soil type of experimental site was red loam belonging to Vellayani series, texturally classified as sandy clay loam. The area enjoys warm humid tropical climate. Weather data for the cropping period is given in Figure 1 and Appendix I.

3.2 MATERIALS

Twenty netted muskmelon varieties/ hybrids were collected from various sources. Details of netted muskmelon genotypes used for evaluation is given in Table 1 and Plate 1.

3.3 METHODS

3.3.1 Design and Layout

Seeds of twenty varieties/ hybrids of netted muskmelon were collected from different states in India and sown under open field conditions Plate 2.

The experiment was laid out as follows:

Design : RBD

Treatments : 20

Replication : 2

Spacing : 2 x 1.5

Plants/ plot : 8

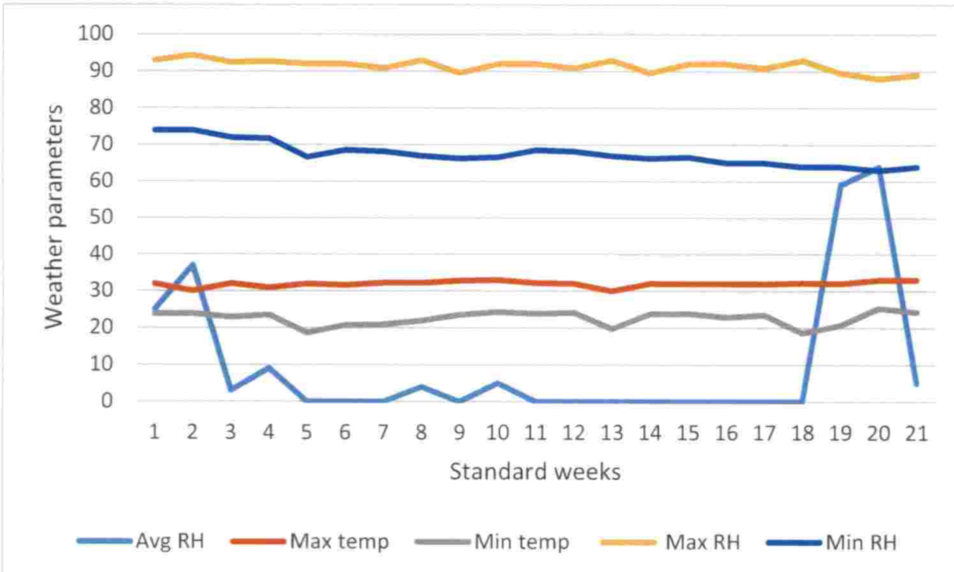


Fig. 1. Weathers parameters in open field during the cropping period in December to April 2019

Plot size : 12 m^2

Season : December 2018– March 2019

Pits of 60 cm diameter and 30 cm depth were taken and two seeds were sown in each pit.

3.3.2 Cultivation

The crop was raised according to the package of practices recommendations (KAU, 2016) for oriental pickling melon.

3.4 OBSERVATIONS

3.4.1 Vegetative Characters

Four plants were randomly selected from each plot and tagged for recording the biometric observations.

3.4.1.1 Vine Length (m)

The vine length was measured from soil surface to the growing tip of the longest branch at the final harvest and expressed in meters.

3.4.1.2 Number of Branches Vine^{-1}

Number of branches arising from the main stem was counted at final harvest and recorded.

3.4.1.3 Days to First Male Flower

Number of days from sowing of seeds to opening of flower were counted and recorded.

3.4.1.4 Node to First Male Flower

The node number at which first male flower appeared was noted by counting its position from the first true leaf at the vine.

Table 1. Details of netted muskmelon genotypes used for evaluation.

Treatment	Name of genotype	Variety/ hybrid	Source
1	Pusa Madhuras	Variety	IARI, New delhi
2	Gujarat Local	Variety	Gujarat
3	Kashi Madhu	Variety	IIVR, Varanasi
4	Gujarat Muskmelon-3	Variety	AAU, Gujarat
5	Madhuras	Variety	Rajastan
6	Rajastan Local-1	Variety	Durgapur, Rajastan
7	Rajastan Local-2	Variety	Kota, Rajastan
8	NS-915	Hybrid	Namdhari Seeds, Bengaluru
9	NS-910	Hybrid	Namdhari Seeds, Bengaluru
10	Jindal	Hybrid	Jindal Crop Sciences Pvt. Ltd. Karnataka
11	Hita	Hybrid	Sakura Seed Corporation, Karnataka
12	Pahuja	Hybrid	Pahuja Seeds Pvt. Ltd. Tamilnadu
13	Pyramid	Hybrid	Icon Seeds, Gujarat
14	G-kart	Hybrid	Marvel Globe Seeds, Bengaluru
15	National Garden	Hybrid	Bengaluru, Karnataka
16	Novel	Hybrid	Novel Seeds Private Ltd, Jalgaon
17	Syed	Hybrid	Creative Farmer seeds, Bengalore
18	Avtar	Hybrid	Splendour Seeds, Bengaluru
19	Sugar Summer	Hybrid	Shine Brand Seeds, Madhya pradesh
20	Airex	Hybrid	Airex Seeds Pvt. Ltd. Agra, Uttar pradesh

Pusa Madhuras

Gujarat Local

Kashi Madhu

Gujarat Muskmelon-3

Madhuras

Rajastan Local-1

Rajasthan Local-2

NS-915

Plate 1. Fruits of twenty netted muskmelon genotypes.

NS910

Jindal

Hita

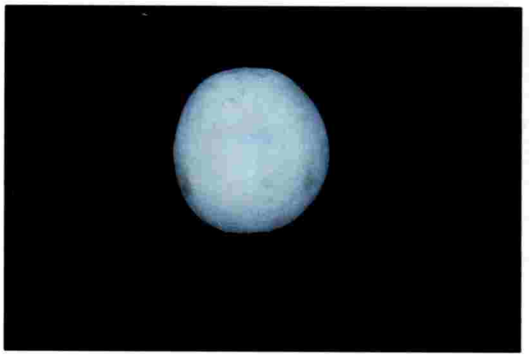
Pahuja

Pyramid

G-kart

Plate 1. Continued

National Garden



Novel

Syed

Avtar

Sugar Summer

Airex

Plate 1. Continued

Plate 2. General view of experimental field.

3.4.1.5 Days to First Female Flower

Number of days taken from the day of sowing to the onset of first female flower were counted and recorded.

3.4.1.6 Node to First Female Flower

The node number at which first female flower appeared was noted by counting its position from the first true leaf at the vine.

3.4.1.7 Sex ratio

Number of male and female flowers produced were counted starting from the commencement of flowering till its completion.

The sex ratio was calculated using the formula

$$\text{sex ratio} = \frac{\text{Number of male flowers plant}}{\text{Number of female flowers per plant}}$$

3.4.2 Fruit and Yield Characters

3.4.2.1 Fruit Diameter (cm)

Fruits were cut in the middle at vertical axis and the girth of the fruit was measured across the fruit for three randomly selected fruits of tagged plants and the average was worked out and expressed in centimetre.

3.4.2.2 Rind Thickness (cm)

Rind thickness was measured using Vernier Callipers after separating the flesh from the skin of the fruit and expressed in centimetre.

3.4.2.3 Fruit Weight (kg)

Randomly selected matured fruits from tagged plants of each genotype were selected, the weight of the fruits taken and expressed in kilograms.

3.4.2.4 Days to First Harvest

Number of days taken from the date of sowing to the date of first harvest were counted and recorded.

3.4.2.5 Node to First Fruit

The node number at which first fruit appeared was noted by counting its position from the base of the vine excluding the cotyledonary node.

3.4.2.6 Fruits Plant^{-1}

The total number of fruits harvested from each plant of each treatment were counted and recorded.

3.4.2.7 Yield Plant^{-1} (kg)

Fruit yield plant^{-1} was computed by adding the fruit weight from all harvests and expressed in kilograms.

3.4.2.8 Yield Plot^{-1} (kg)

Fruit yield plot^{-1} was computed by adding the fruit weight from all harvests in a plot and expressed in kilograms.

3.4.2.9 Crop Duration

Number of days taken from sowing to final harvest was recorded.

3.4.2.10 Seeds Fruit^{-1}

One well ripened fruit from each plant was selected at random and seeds with the mucilage was extracted, washed, cleaned and the number of seeds counted and recorded.

3.4.2.11 Hundred Seed Weight (g)

Hundred seeds from the fruit were collected and weight of the seeds recorded using an electronic weighing balance and expressed in grams.

3.4.3 Quality Characters

3.4.3.1 Flesh/ Cavity (F:C) *ratio*

The Flesh cavity ratio was calculated using the formula

$$\text{F:C ratio} = \frac{\text{Flesh thickness}}{\frac{1}{2}\ \text{cavity diameter}}$$

3.4.3.2 Total Soluble Solids (^{0}Brix)

Flesh of the fruit was grind with pestle and mortar to extract the juice and total soluble solid content was recorded in ^{0}brix with the help of Erma Hand Refractometer (0-32).

3.4.3.3 Beta Carotene

β-carotene content of fruits was estimated by adopting the procedure as suggested by Srivastava and Kumar (2006). Reagents like acetone, anhydrous sodium sulphate and petroleum ether were used for estimation. Five gram of fresh sample was taken and crushed in 10-15 ml acetone by adding a few crystals of anhydrous sodium sulphate with the help of pestle and mortar. Supernatent was decanted into a beaker. The process was repeated twice and the combined supernatant was transferred to a separator funnel, then 10-15 ml of petroleum ether was added and mixed thoroughly. Two layers separated out on standing and lower layer was discarded. The upper layer was collected in a 100 ml volumetric flask and volume was made up to 100 ml using petroleum ether and optical density was recorded at 452 nm of wave length by using petroleum ether as blank in a spectrophotometer.

$$\beta - \text{carotene (mg/100g)} = \frac{\text{O.D X 13.9 X 104 X 100}}{\text{Weight of sample (g) X 560 X 1000}}$$

O.D - Optical density

3.4.3.4 Total Sugars

Clarified juice of 25 ml was taken in a 250 ml volumetric flask. 5 ml of citric acid and 50 ml distilled water was added. Solution was neutralized with 40 percent NaOH using pH indicator and solution was kept at room temperature for 24 hrs. Next day the solution was titrated against Fehlings solution.

$$\text{\% of total sugars} = \frac{0.05}{\text{titre value}} \times \frac{250}{25} \times \frac{250 \times 1000}{25}$$

3.4.3.5 Reducing Sugars

Clarified juice of 25 ml was taken in a 250 ml volumetric flask. 100 ml distilled water was added. Solution was neutralized with 1 N NaOH using pH indicator and the solution was titrated against Fehlings solution and the estimated reducing sugar content expressed in percentage.

$$\text{\% of reducing sugars} = \frac{0.05}{\text{titre value}} \times 250 \times \frac{100}{25}$$

3.4.3.6 Non Reducing Sugars

Non reducing sugars were estimated by deducting reducing sugars from total sugars (% of total sugars - % of reducing sugars).

3.4.3.7 Acidity

Five gram of ground sample was taken and diluted with 100 ml distilled water and the solution was boiled for 30 minutes. From this, 25 ml solution was taken and two drops of phenolphthalin indicator was added and the solution was titrated against 0.1 N NaOH solution and the estimated acidity was expressed in percentage.

3.4.3.7 Sensory Analysis

Muskmelon slices from different genotypes were evaluated for sensory characteristics *viz.*, appearance, colour, flavour, taste, texture and overall acceptability by ten members. Each attribute was given score from 1 to 9 according to Hedonic rating (Ranganna, 1986) (Appendix II). The score was statistically analyzed using Kruskal-Wallis test (Chi square value) and ranked (Shamrez *et al.*, 2013).

3.4.4 Incidence of Pests and Diseases

Muskmelon genotypes were monitored for incidence of pests and disease in field condition. Major pest noticed was fruit fly and no major diseases were noticed.

3.4.4.1 Fruit Fly Incidence

Number of fruits infected plant^{-1} were counted and the percentage infestation was caluculated. Further, the genotypes were grouped in to different categories based on per cent fruit infestation (Babu, 2002) as given below.

Fruit fly incidence reaction category

Fruit infestation (%)	Reaction category
0-10	Resistant
11-25	Moderately resistant
26-50	Moderately susceptible
51-75	Susceptible
>75	Highly susceptible

3.5 STATISTICAL ANALYSIS

The data recorded were processed using the following statistical procedures.

3.5.1 Analysis of Variance

The observations recorded were subjected to ANOVA (Panse and Sukhatme, 1985) for comparison among various treatments and to estimate variance components.

ANOVA for each character

Sources of variation	Degrees of freedom	Mean sum of squares	F ratio
Replication	r-1	MSR	MSR/MSE
Treatment	t-1	MST	MST/MSE
Error	(r-1) (t-1)	MSE	
Total	rt-1		

Where, r = number of replications

t = number of treatments

MSR = mean sum of replication

MST = mean sum of treatments

MSE = mean sum of error

Critical difference (CD) = $t\alpha \sqrt{\frac{2MSE}{r}}$

Where, $t\alpha$ = Student's 't' table value at error degrees of freedom at α level of significance.

3.5.2 Estimation of Genetic Parameters

3.5.2.1 Genetic component of variance

The phenotypic and genotypic variances were calculated by utilizing the respective mean square values (Johnson *et al.*, 1955).

i) Genotypic variance (VG)

$$VG = \frac{MST - MSE}{r}$$

ii) Environmental variance (VE)

VE = MSE

iii) Phenotypic variance (VP)

$VP = VG + VE$

3.5.2.2 Coefficient of variation

The genotypic and phenotypic coefficients of variation are calculated as per Burton (1952).

i) Phenotypic coefficient of variation (PCV)

$$PCV = \frac{\sqrt{V_P}}{\bar{X}} \times 100$$

ii) Genotypic coefficient of variation (GCV)

$$GCV = \frac{\sqrt{V_G}}{\bar{X}} \times 100$$

$\bar{X}$ = General mean of characters

Categorization of the range of variation was followed as proposed by Sivasubramanian and Menon (1973).

Low	: Less than 10 per cent
Moderate	: 10 to 20 per cent
High	: More than 20 per cent

3.5.2.3 Heritability

Heritability in the broad sense refers to the proportion of genotypic variance to the total observed variance in the total population. Heritability in broad sense was estimated for various characters and expressed in percentage (Allard, 1960).

$$\text{Heritability } (h^2) = \frac{V_G}{V_P} \times 100$$

As suggested by Johnson *et al.* (1955) heritability in broad sense estimates were categorized as,

Low	: Less than 30 per cent
Moderate	: 30 to 60 per cent
High	: More than 60 per cent

3.5.2.4 Genetic Advance

Genetic advance refers to the expected genetic gain or improvement in the next generation by selecting superior individuals under certain amount of selection pressure. It depends upon standardized selection differential, heritability and phenotypic standard deviation (Allard, 1960). The genetic advance was calculated in per cent by the formulae suggested by Johnson *et al.* (1955).

Genetic advance (GA) = k x h2 $\sqrt{V_P}$

GA as percentage of mean = $\frac{GA}{\overline{X}}$ x 100

where, k = standardized selection differential (2.06 at 5% selection intensity)

h2 = heritability

The range of genetic advance as per cent of mean was classified as suggested by Johnson *et al.* (1955).

Low : Less than 10 per cent

Moderate : 10 to 20 per cent

High : More than 20 per cent

3.5.2.5 Correlation Analysis

Phenotypic and genotypic correlation coefficients were calculated using the respective variance and covariance of the characters which showed significant variation in ANOVA.

Phenotypic correlation coefficient, ($r_{PX,Y}$) = $\frac{Cov_P\,(X,Y)}{\sqrt{V_P\,(X),V_P(Y)}}$

Genotypic correlation coefficient, ($r_{GX,Y}$) = $\frac{Cov_G\,(X,Y)}{\sqrt{V_G\,(X),V_G(Y)}}$

where, CovP (X,Y) = phenotypic variance between two traits X and Y

CovG (X,Y) = genotypic covariance between two traits X and Y

VP(X) and VP(Y) = phenotypic variance for X and Y respectively

VG(X) and VG(Y) = genotypic variance for X and Y respectively

3.5.2.6 Path Coefficient Analysis

To study the cause and effect relationship of yield and its component characters, direct and indirect effects were analyzed using path coefficient analysis as suggested by Dewey and Lu (1959).

3.5.3 Selection Index

The selection index developed by Smith (1937) using discriminant function of Fisher (1936) was used to discriminate the genotypes based on all the characters.

The selection index is described by the function, $I = b_1 x_1 + b_2 x_2 + \ldots + b_k x_k$ and the merit of a plant is described by the function, $H = a_1 G_1 + a_2 G_2 + \ldots + b_k G_k$ where x1, x2.......x_k are the phenotypic values and G_1, G_2.....G_k are the genotypic values of the plants with respect to characters, x_1, x_2,......x_k and H is the genetic worth of the plant. It is assumed that the economic weight assigned to each character is equal to unity i.e a_1, a_2....$a_{k=1}$

The regression coefficients (b) are determined such that the correlation between H and I is maximum. The procedure will reduce to an equation of the form, $b = p^{-1}$ Ga where, P is the phenotypic variance- covariance matrix and G is the genotypic variance- covariance matrix.

Results

4. RESULTS

The present investigation was conducted at the Department of Vegetable Science, College of Agriculture, Vellayani from December 2018 to March 2019 to evaluate the performance of netted muskmelon genotypes for growth, yield and quality characteristics. The experimental data were analyzed statistically and the results are presented below.

4.1 ANALYSIS OF VARIANCE

The results pertaining to the analysis of variance (ANOVA) for the experimental design indicated that the mean square (MS) due to genotypes were significant at $P \leq 0.05$ for all the characters studied. The mean sum of squares for twenty six characters is presented in Table 2.

4.1.1 Vegetative and Flowering Characters

The mean performance of 20 muskmelon varieties/ hybrids for vegetative and flowering characters like vine length, number of branches vine^{-1}, days to first male flower, node to first male flower, days to first female flower, node to first female flower and sex ratio were recorded and are presented in Table 3.

4.1.1.1 Vine Length

Significant difference was observed among the treatments for vine length. The average vine length ranged from 0.83 m to 1.84 m. Avtar produced the longest vine of 1.84 m which was at par with Pahuja (1.74 m) and Gujarath muskmelon-3 (1.68 m). Kashi Madhu recorded the lowest vine length of 0.83 m.

4.1.1.2 Number of Branches Vine^{-1}

The genotypes varied significantly for number of primary branches vine^{-1} and it ranged from 2.20 to 4.80 with an overall mean of 3.31. Highest number of primary branches plant^{-1} was recorded in Kashi Madhu (4.80) and Airex (4.12), NS-910 (4.01) and G-kart (4.00) were on par with it. Minimum number of primary branches plant^{-1} was noticed in Syed (2.20).

Table 2. Analysis of variance for characters in netted muskmelon

Source of variation	Replication	Genotypes	Error
Vine length (m)	0.133	0.175**	0.018
Number of branches vine^{-1}	0.488	0.766**	0.268
Days to first male flower	1.201	15.738**	1.295
Node to first male flower	1.529	3.138**	0.423
Days to first female flower	3.139	20.853**	1.818
Node to first female flower	0.710	2.288**	0.181
Sex ratio	0.979	2.287**	0.216
Fruit diameter (cm)	0.361	7.613**	0.561
Rind thickness (cm)	0.011	0.074**	0.006
Fruit weight (g)	1,862.892	41,788.673**	482.112
Days to first harvest	1.215	22.91**	0.892
Node to first fruit	0.534	3.945**	0.282
Fruits per plant	0.175	0.78**	0.133
Yield plant^{-1} (kg)	0.031	0.664**	0.030
Yield plot^{-1} (kg)	3.733	23.500**	0.981
Crop duration	2.031	16.918**	1.170
Seeds fruit^{-1}	228.102	8550.577**	291.178
100 seed weight (g)	0.376	0.823**	0.130
Flesh/ cavity ratio	0.035	0.130**	0.014
T.S.S (0 Brix)	0.331	1.793**	0.073
Beta carotene	0.578	51.273**	0.089
Total sugars	0.043	0.340**	0.055
Reducing sugars	0.009	0.312**	0.019
Non-reducing sugars	0.092	0.255**	0.034
Acidity (%)	0.002	0.023**	0.001

Data represent mean sum of squares; * significant at $P \leq 0.05$; **significant at $P \leq 0.01$

Table 3. Mean performance of netted muskmelon genotypes for vegetative and flowering characters

	Genotypes	Vine length (m)	Number of branches vine^{-1}	Days to first male flower	Node to first male flower	Days to first female flower	Node to first female flower	Sex ratio
T1	Pusa Madhuras	0.99	3.30	31.59	4.22	41.56	6.46	6.00
T2	Gujarat Local	1.42	3.10	34.41	4.33	39.32	6.56	6.80
T3	Kashi Madhu	0.83	4.80	39.00	6.85	46.13	8.23	5.23
T4	Gujarat Muskmelon-3	1.68	2.68	31.22	4.28	38.46	6.40	6.42
T5	Madhuras	1.53	2.88	30.15	3.60	36.35	6.33	6.71
T6	Rajasthan Local-1	1.47	3.48	36.00	6.27	40.16	8.36	6.41
T7	Rajasthan Local-2	1.46	2.48	30.22	3.54	37.46	6.23	6.29
T8	NS-915	0.88	3.34	34.67	5.86	37.98	7.14	6.88
T9	NS-910	1.33	4.01	30.34	4.11	35.46	5.13	7.23
T10	Jindal	1.51	3.67	36.56	7.19	42.12	8.12	6.43
T11	Hita	1.47	3.25	29.52	3.30	44.02	5.46	5.97
T12	Pahuja	1.74	3.19	33.56	5.56	40.67	8.00	8.82
T13	Pyramid	1.43	3.35	34.89	5.89	40.46	6.93	8.07
T14	G-kart	0.87	4.00	33.00	5.56	42.46	7.00	7.83
T15	National Garden	1.32	2.56	32.87	5.89	45.34	7.79	8.12
T16	Novel	0.96	3.38	30.12	3.86	37.12	5.24	8.74
T17	Syed	1.34	2.20	31.52	4.86	39.02	6.46	8.23
T18	Avtar	1.84	3.35	33.00	4.33	40.24	6.79	7.89
T19	Sugar Summer	1.39	2.93	35.00	6.10	43.13	8.05	8.62
T20	Airex	0.95	4.12	27.56	2.80	34.01	4.98	8.32
	Mean	1.32	3.31	32.81	4.92	40.07	6.78	7.25
	SEm (±)	0.10	0.32	0.805	0.46	0.95	0.30	0.33
	CD (0.05)	0.29	0.93	2.38	1.37	2.82	0.89	0.973

Plate 3A. Female Flower

Plate 3B. Male flower

Plate 3. Flowering in netted muskmelon

4.1.1.3 Days to First Male Flower

The genotypes varied significantly for days to first male flower appearance. Number of days ranged from 27.56 to 39.00 days with a mean of 32.81 days. Airex took least number of days to first male flower appearance (27.56 days) (Plate 3A) followed by Hita (29.52 days), which were on par. On contrary, Kashi Madhu took maximum number of days to first male flower appearance (39.00 days).

4.1.1.4 Node to First Male Flower

Significant difference was observed among the genotypes for node to first male flower. The node at which first male flower appeared varied from 2.80 to 7.19. Lowest node number was recorded in Airex (2.80) and the genotype Hita (3.30), Rajasthan local-2 (3.54), Madhuras (3.60) and Novel (3.86) were on par with it. The highest node number of 7.19 was recorded in Jindal.

4.1.1.5 Days to First Female Flower

Number of days taken to first female flower production was found significantly different among the genotypes. Number of days ranged from 34.01 to 46.13 days with a mean of 40.07 days. Airex was the earliest to first female flower production (34.01 days) (Plate 3B) which was on par with NS-910 (35.46 days) and Madhuras (36.35 days), While Kashi Madhu was late to first female flower appearance (46.13 days).

4.1.1.6 Node to First Female Flower

The genotypes differed significantly for the node to first female flower production with an average of 6.78. The lowest node number was registered by Airex (4.98) which was statistically on par with NS-910 (5.13), Novel (5.24) and Hita (5.46). The highest node number was recorded in Rajasthan Local-1 (8.36).

4.1.1.7 Sex ratio

Significant difference was observed among the treatments for sex ratio. The average sex ratio ranged from 5.23 to 8.82. Kashi Madhu recorded the lowest sex ratio (5.23) followed by Hitá (5.97) and Pusa Madhuras (6.00). Pahuja produced the highest sex ratio of 8.82.

4.1.2. Fruit and Yield Characters

Table 4. presents the average values for fruit and yield characters like fruit diameter, rind thickness, fruit weight, days to first harvest, node to first fruit, fruits plant^{-1}, yield plant^{-1}, yield plot^{-1}, crop duration, seeds fruit^{-1} and weight of 100 seeds and fruit shape.

4.1.2.1 Fruit Diameter

Significant difference was noticed among the genotypes for fruit diameter. Highest fruit diameter was observed in NS-915 (11.78 cm). The lowest diameter of 4.85 cm was recorded in Pusa Madhuras. The average fruit diameter was 7.13 cm.

4.1.2.2 Rind Thickness

The genotypes differed significantly for fruit rind thickness. The lowest rind thickness was recorded in Pusa Madhuras, Rajasthan Local-1 and Rajasthan Local-2 (0.10 cm) the highest in G-kart (0.73 cm). The average rind thickness was 0.40 cm. Twelve genotypes had lesser rind thickness than the general mean.

4.1.2.3 Fruit Weight

There was a significant difference among the genotypes with respect to fruit weight. Values ranged from 168 to 625.86 g with an overall mean of 348.75 g. Maximum fruit weight was noticed in NS-915 (625.86 g) which was on par with Jindal (600.26 g) and NS-910 (594.73 g). Minimum fruit weight was noticed in Pusa Madhuras (168.00 g).

4.1.2.4 Days to First Harvest

The genotypes varied significantly for days to first harvest, which ranged from 71.15 days to 87.38 days. Syed was the earliest to harvest (71.15 days) followed by NS-910 (72.35 days) which were on par. The genotype Kashi Madhu took maximum days for first harvest (87.38 days).

4.1.2.5 Node to First Fruit

Significant difference was observed among the genotypes for node to first fruit. The node at which first fruit appeared varied from 5.30 to 10.40. Lowest node number was recorded in Novel (5.30) and Hita (6.00) was on par with it. The highest node number of 10.40 was recorded in Sugar summer.

4.1.2.6 Fruits Plant^{-1}

There was significant difference among the genotypes for number of fruits plant^{-1}. Number of fruits plant^{-1} was highest in Hita (3.66) which was on par with NS-915 (3.64), Airex (3.15) and Novel (2.95). The treatment Gujarat muskmelon-3 recorded the lowest fruit number (1.62).

4.1.2.7 Yield Plant^{-1}

The genotypes differed significantly for yield plant^{-1} with a general mean of 0.60 kg. The highest yield of 1.20 kg was recorded for NS-915 which was on par with Jindal (1.10 kg), Pahuja (1.00 kg) and Hita (0.99 kg). The lowest yield of 0.20 kg was recorded for Rajasthan Local-2. Among the twenty genotypes evaluated, eight registered higher yield plant^{-1} than the overall mean.

4.1.2.8 Yield Plot^{-1}

Significant difference was observed among the genotypes for fruit yield plot^{-1}. Highest yield plot^{-1} of 2.14 kg was recorded in NS-915. Two genotypes, *viz.*, Jindal (1.95 kg) and Hita (1.77 kg) were on par with it. The lowest yield plot^{-1} was observed in Rajasthan Local-1 (0.62 kg). The average yield plot^{-1} was 1.25 kg.

4.1.2.9 Crop Duration

The genotypes differed significantly for crop duration. The genotype G-kart took maximum number of days for final harvest (106.00 days). The lowest crop duration of 92.10 days was expressed by NS-915. The average crop duration was 96.01days.

Table 4. Mean performance of netted muskmelon genotypes for fruit and yield characters

Genotypes		Fruit diameter (cm)	Rind thickness (cm)	Fruit weight (g)	Days to first harvest	Node to first Fruit
T1	Pusa Madhuras	4.85	0.10	168.00	78.75	7.50
T2	Gujarat Local	6.50	0.51	280.00	74.05	7.67
T3	Kasi Madhu	5.07	0.30	220.00	87.38	9.83
T4	Gujarat Muskmelon-3	6.59	0.40	295.40	76.50	6.92
T5	Madhuras	5.50	0.21	220.36	73.35	6.83
T6	Rajasthan Local-1	4.90	0.10	180.75	77.30	8.97
T7	Rajasthan Local-2	5.11	0.10	194.62	73.80	7.00
T8	NS-915	11.78	0.61	625.86	74.02	8.33
T9	NS-910	10.07	0.66	594.73	72.35	7.33
T10	Jindal	10.02	0.69	600.26	76.15	9.80
T11	Hita	9.07	0.40	496.69	75.60	6.00
T12	Pahuja	9.02	0.52	490.30	75.10	8.33
T13	Pyramid	8.13	0.35	440.30	73.87	8.67
T14	G-kart	7.50	0.73	379.63	74.95	8.83
T15	National Garden	6.86	0.50	350.00	79.38	10.00
T16	Novel	6.50	0.56	311.13	75.35	5.30
T17	Syed	6.07	0.37	288.54	71.15	8.45
T18	Avtar	6.42	0.33	297.11	75.15	9.16
T19	Sugar Summer	6.36	0.35	268.12	77.85	10.40
T20	Airex	6.29	0.29	273.21	74.75	6.65
Mean		7.13	0.40	348.75	75.87	8.10
SEm (±)		0.53	0.05	15.53	0.67	0.38
CD (0.05)		1.58	0.16	46.30	1.99	1.12

Table 4. Continued

	Genotypes	Fruits $plant^{-1}$	Yield $plant^{-1}$ (kg)	Yield $plot^{-1}$ (kg)	Crop duration	Seeds $fruit^{-1}$	100 seed weight	Fruit shape
T1	Pusa Madhuras	2.10	0.24	0.68	96.60	146.00	1.13	Round
T2	Gujarat Local	2.78	0.63	1.45	95.75	248.54	1.51	Flattened round
T3	Kasi Madhu	2.73	0.50	1.20	96.50	224.84	1.47	Flattened round
T4	Gujarat Muskmelon-3	1.62	0.36	0.92	97.30	183.67	1.55	Oblong
T5	Madhuras	2.56	0.44	1.08	95.55	176.44	1.48	Round
T6	Rajasthan Local-1	2.25	0.30	0.62	99.20	158.64	1.40	Flattened round
T7	Rajasthan Local-2	1.78	0.20	0.81	94.15	169.50	1.52	Oval
T8	NS-915	3.64	1.20	2.14	92.10	348.33	3.33	Flattened round
T9	NS-910	1.80	0.90	1.68	93.45	365.50	3.37	Flattened round
T10	Jindal	2.87	1.10	1.95	94.00	323.88	3.23	Oval
T11	Hita	3.66	0.99	1.77	95.60	225.66	2.02	Oval
T12	Pahuja	2.60	1.00	1.64	96.10	318.24	1.99	Round
T13	Pyramid	1.67	0.59	1.28	96.80	312.43	1.97	Round
T14	G-kart	1.80	0.55	0.97	106.00	251.15	1.91	Round
T15	National Garden	2.15	0.43	1.20	94.35	278.88	1.91	Round
T16	Novel	2.95	0.60	1.34	95.15	292.58	1.82	Oval
T17	Syed	2.07	0.32	1.00	98.10	303.84	1.76	Oval
T18	Avtar	1.79	0.42	0.79	93.20	243.46	1.71	Round
T19	Sugar Summer	2.53	0.52	1.13	94.70	218.86	1.69	Round
T20	Airex	3.15	0.64	1.38	95.56	285.44	1.60	Round
	Mean	2.42	0.60	1.25	96.01	253.79	1.92	
	SEm (±)	0.26	0.08	0.14	0.77	12.07	0.26	
	CD (0.05)	0.77	0.23	0.43	2.28	35.72	0.75	

41

4.1.2.10 Seeds Fruit^{-1}

There was significant difference among the genotypes for the number of seeds fruit^{-1}. The number of seeds fruit^{-1} varied from 146.00 to 365.50. The highest seed number was observed in NS-910 (365.50) which was on par with NS-915 (348.33). Least number of seeds were observed in Pusa Madhuras (146.00).

4.1.2.11 Weight of 100 Seeds

Significant difference was observed among the genotypes for 100 seed weight. The treatment NS-910 recorded the highest 100 seed weight of 3.37 g which was at par with NS-915 (3.33 g) and Jindal (3.23 g) while Pusa Madhuras had the lowest 100 seed weight of 1.13 g.

4.1.2.12 Fruit Shape

Among the 20 genotypes, nine genotypes *viz.*, Pusa Madhuras, Madhuras, Pahuja, Pyramid, G-kart, National Garden, Avtar, Sugar Summer and Airex exhibited round shaped fruits, five genotypes *viz.*, Gujarat Local, Kasi Madhu, NS-915, Rajasthan Local-1 and NS-910 exhibited flattened round shape and five genotypes *viz.*, Rajasthan Local-2, Jindal, Hita, Novel and Syed displayed oval shape. Gujarath Muskmelon-3 exhibited oblong shaped fruits.

4.1.3 Quality Characters

Mean values for quality characters like TSS, beta carotene, total sugars, reducing sugar, non reducing sugar and acidity are furnished in Table 5.

4.1.3.1 Flesh Cavity Ratio (F:C)

The genotypes differed significantly for flesh cavity ratio. F:C ratio varied from 0.46 to 1.52. Highest F:C ratio was observed in NS-915 (1.52). Least F:C ratio was recorded Pusa Madhuras (0.46). Average F:C ratio was 0.78.

4.1.3.2 TSS

Total soluble solids (TSS) content varied significantly among different genotypes and it ranged from 4.23° to 8.07° B with an overall mean of 5.58° B. The highest TSS content was recorded in the fruit of NS-915 (8.07° B). The lowest TSS content was recorded in Rajasthan local-2 (4.23° B).

4.1.3.3 Beta Carotene

The genotypes differed significantly with regard to beta carotene content. The range varied from 2.50 to 9.92 mg/100 g with an overall mean of 5.40 mg/100 g Among the genotypes, highest beta carotene content was obtained in the genotype Kashi Madhu (9.92 mg/ 100 g), which was on par with G-kart (9.74 mg/100 g) and NS-910 (9.30 mg/100 g) Lowest beta carotene content was obtained in pyramid (2.50 mg/100 g).

4.1.3.4 Total Sugars

Significant variation was observed among the different genotypes with respect to total sugars which ranged from 2.44 to 4.06 per cent with an overall mean of 2.95 per cent. The highest total sugar content was recorded in Pusa Madhuras (4.06 %) followed by Syed (4.00 %) which were on par. Lowest total sugar content was recorded in Novel (2.44 %).

4.1.3.5 Reducing Sugars

The genotypes differed significantly with regard to reducing sugar content. It ranged from 1.74 to 3.36 per cent with an overall mean of 2.25 per cent. Among the genotypes, highest reducing sugar content was noticed in the genotype Syed (3.36 %) and Sugar Summer (3.03 %) was on par with it. Lowest reducing sugar content was noticed in Jindal (1.74 %).

4.1.3.6 Non Reducing Sugars

Observations on non reducing sugar content showed that there was a significant difference among the genotypes. The values ranged from 0.25 to 1.53 per cent with an overall mean of 0.55 per cent. Among the genotypes, Pusa Madhuras registered highest non reducing sugar content (1.53 %). The lowest non reducing sugars was recorded in the genotype Novel (0.25 %).

Table 5. Mean performance of netted muskmelon genotypes for quality characters

	Genotypes	Flesh cavity ratio	T.S.S (^{0} Brix)	Beta carotene (mg/100 g)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Acidity (%)
T1	Pusa Madhuras	0.46	5.40	8.69	4.06	2.53	1.53	0.12
T2	Gujarat Local	0.53	5.85	4.79	2.67	2.03	0.64	0.10
T3	Kasi Madhu	0.52	4.60	9.92	2.81	2.11	0.70	0.34
T4	Gujarat Muskmelon-3	0.55	5.43	4.20	2.77	1.94	0.83	0.12
T5	Madhuras	0.52	6.56	3.55	2.77	1.96	0.81	0.09
T6	Rajasthan Local-1	0.49	4.54	3.64	2.84	2.09	0.75	0.29
T7	Rajasthan Local-2	0.51	4.23	3.46	2.88	2.09	0.79	0.33
T8	NS-915	1.52	8.07	3.42	3.01	2.31	0.70	0.06
T9	NS-910	0.88	6.28	9.30	2.91	2.13	0.78	0.08
T10	Jindal	0.93	5.39	5.89	2.50	1.74	0.76	0.12
T11	Hita	0.90	7.22	3.52	2.94	2.11	0.83	0.07
T12	Pahuja	0.96	5.87	8.56	2.81	2.11	0.70	0.10
T13	Pyramid	1.02	4.95	2.50	2.83	2.08	0.75	0.29
T14	G-kart	0.88	4.60	9.74	2.83	2.11	0.72	0.19
T15	National Garden	0.92	5.50	3.60	2.70	2.02	0.68	0.18
T16	Novel	0.80	4.80	6.09	2.44	2.19	0.25	0.16
T17	Syed	0.84	5.20	2.99	4.00	3.36	0.64	0.14
T18	Avtar	0.88	6.20	3.29	2.81	2.13	0.68	0.09
T19	Sugar Summer	0.77	5.60	6.09	3.56	3.03	0.53	0.13
T20	Airex	0.77	5.30	4.86	2.83	2.15	0.68	0.06
	Mean	0.78	5.58	5.40	2.95	2.25	0.74	0.15
	SEm (±)	0.08	0.19	0.21	0.14	0.13	0.03	0.02
	CD (0.05)	0.25	0.57	0.62	0.43	0.39	0.10	0.04

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4.1.3.7 Acidity

Acidity content varied significantly among different genotypes and it ranged from 0.06 to 0.34 per cent, with an overall mean of 0.15 per cent. The treatment Kashi Madhu recorded the highest acidity content of 0.34 per cent, which was on par with Rajasthan Local-2 (0.33 per cent). The least acidity was recorded in NS-915 and Airex (0.06 %).

4.2 EVALUATION OF SENSORY PARAMETERS OF MUSKMELON GENOTYPES

Sensory parameters were statistically analysed using Kruskal - Wallis test and found that the genotypes showed significant difference in organoleptic qualities and acceptability (Table 6). Evaluation of organoleptic qualities of muskmelon genotype showed highest mean score for appearance, taste, colour, flavour and texture for the genotype NS-915. The genotypes, Jindal and NS-910 ranked second and third in appearance and colour. But for the parameters flavour, taste and texture, the genotypes Jindal and Gujarath muskmelon-3 ranked second and third. Regarding overall acceptability, the highest mean score was recorded by the genotypes NS-915 (8.6) followed by Jindal (8.3) and Gujarath muskmelon-3 (8.00).

4.3 PEST AND DISEASE INCIDENCE

The crop was monitored for the incidence of pests and diseases during the cropping period. At the initial stage of crop growth, incidence of Red pumkin beetle (*Aulacophora faveicollis*) was noticed and was controlled by spraying Quinolphos 25 EC @ 0.1ml l^{-1}.

Relative response of different genotypes to fruit fly infestation is presented in Table 7. Percentage of fruits infested ranged from 40.00 to 65.07 per cent. Fruit fly traps were kept in field and chemical Malathion 50 EC @ 0.1ml l^{-1} was sprayed as a control measure (Plate 4).

HS

Table 6. Evaluation of sensory parameters of netted muskmelon genotypes

Genotypes		Sensory parameters					
		Appearance		Colour		Flavour	
		Mean score	Rank	Mean score	Rank	Mean score	Rank
T1	Pusa Madhuras	5.20	17	5.20	17	6.50	11
T2	Gujarat Local	5.50	15	5.50	15	7.50	6
T3	Kasi Madhu	5.00	18	5.00	18	5.00	18
T4	Gujarat Muskmelon-3	5.80	14	5.80	14	7.80	3
T5	Madhuras	5.50	16	5.50	16	6.70	10
T6	Rajasthan Local-1	4.70	19	4.70	19	4.70	19
T7	Rajasthan Local-2	4.50	20	4.50	20	4.50	20
T8	NS-915	8.30	1	8.50	1	8.30	1
T9	NS-910	7.80	3	7.80	3	7.60	4
T10	Jindal	8.20	2	8.00	2	8.00	2
T11	Hita	7.60	5	7.60	5	6.30	12
T12	Pahuja	7.60	4	7.60	4	7.30	7
T13	Pyramid	7.50	6	7.50	6	5.50	15
T14	G-kart	6.70	10	6.70	10	5.20	17
T15	National Garden	6.50	11	6.50	11	7.20	8
T16	Novel	7.30	7	7.30	7	5.50	16
T17	Syed	6.00	13	6.00	13	5.80	14
T18	Avtar	6.30	12	6.30	12	7.60	5
T19	Sugar Summer	7.00	9	7.00	9	7.00	9
T20	Airex	7.20	8	7.20	8	6.00	13
Chi square (KW test)		127.22**		138.46**		139.42**	

** Significant at 1 per cent level

H6

Table 6. Continued

Genotypes		Sensory parameters					
		Taste		Texture		Overall acceptability	
		Mean score	Rank	Mean score	Rank	Mean score	Rank
T1	Pusa Madhuras	6.50	11	6.50	11	6.50	11
T2	Gujarat Local	7.50	6	7.30	7	7.60	6
T3	Kasi Madhu	5.00	18	5.00	18	5.00	18
T4	Gujarat Muskmelon-3	7.80	3	7.80	3	8.00	3
T5	Madhuras	6.70	10	6.70	10	6.70	10
T6	Rajasthan Local-1	4.70	19	4.70	19	4.70	19
T7	Rajasthan Local-2	4.50	20	4.50	20	4.50	20
T8	NS-915	8.30	1	8.50	1	8.60	1
T9	NS-910	7.60	4	7.60	4	7.80	4
T10	Jindal	8.00	2	8.00	2	8.30	2
T11	Hita	6.30	12	6.30	12	6.30	12
T12	Pahuja	7.30	7	7.50	6	7.30	7
T13	Pyramid	5.50	15	5.50	15	5.50	15
T14	G-kart	5.20	17	5.20	17	5.20	17
T15	National Garden	7.20	8	7.20	8	7.20	8
T16	Novel	5.50	16	5.50	16	5.50	16
T17	Syed	5.80	14	5.80	14	5.80	14
T18	Avtar	7.60	5	7.60	5	7.60	5
T19	Sugar Summer	7.00	9	7.00	9	7.00	9
T20	Airex	6.00	13	6.00	13	6.00	13
Chi square (KW test)		137.34**		136.73**		134.52**	

** Significant at 1 per cent level

Table 7. Intensity of pest among netted muskmelon genotypes

Genotypes		Fruit fly incidence (%)
T1	Pusa Madhuras	41.30
T2	Gujarat Local	40.00
T3	Kasi Madhu	41.75
T4	Gujarat Muskmelon-3	44.99
T5	Madhuras	41.75
T6	Rajasthan Local-1	59.90
T7	Rajasthan Local-2	48.24
T8	NS-915	48.24
T9	NS-910	51.48
T10	Jindal	45.00
T11	Hita	48.24
T12	Pahuja	44.99
T13	Pyramid	50.00
T14	G-kart	53.24
T15	National Garden	51.48
T16	Novel	51.48
T17	Syed	65.07
T18	Avtar	41.75
T19	Sugar Summer	44.99
T20	Airex	44.00

Plate 4A. Fruit fly

Plate 4B. Red pumpkin beetle

Plate 4. Incidence of pests

4.4 GENETIC VARIABILITY PARAMETERS

The genetic parameters such as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance of twenty genotypes were studied. The population means, range, GCV, PCV, heritability and genetic advance are presented in Table 8.

4.4.1 Vegetative and Flowering Characters

A high estimate of PCV (24.15) and GCV (21.87) were recorded for vine length. This trait also exhibited high heritability (81.99 per cent) and high genetic advance (40.80).

High PCV and moderate GCV values (21.77 and 15.12 respectively) coupled with moderate heritability (48.23 per cent) and high genetic advance (21.63) were evident for number of branches vine^{-1}

Low PCV and GCV values (8.63 and 7.90 respectively) coupled with high heritability (83.87 per cent) and moderate genetic advance (14.91) was evident for days to first male flower production.

Node to first male flower exhibited high PCV (27.12) and GCV (23.68) values with high heritability (76.24 per cent) as well as genetic advance estimates (42.60).

Low PCV and GCV values with narrow difference between them (8.40 and 7.70 respectively) coupled with high heritability (83.96 per cent) and moderate genetic advance (14.53) were recorded for days to first female flower.

Node to first female flower exhibited a moderate PCV (16.39) and GCV (15.13) with high estimates of heritability (85.32 per cent) and high genetic advance (28.80).

Moderate PCV and GCV values (15.44 and 14.04) coupled with high heritability (82.73 %) and high genetic advance (26.31) were recorded for sex ratio.

4.4.2. Fruit and Yield Characters

For fruit diameter a high PCV and GCV were noticed (27.60 and 25.55 respectively) with high heritability (85.71 per cent) and high genetic advance (48.73).

High PCV and GCV were noticed (49.44 and 45.89 respectively) with high heritability (86.16 per cent) and high genetic advance (87.75) for rind thickness.

Fruit weight exhibited high PCV (41.69) and GCV (41.21) along with high heritability estimates (97.72 per cent) and high genetic advance (83.92).

A low PCV of 4.55 and GCV of 4.37 were recorded for days to fruit harvest. The estimates of heritability (92.50 per cent) was high and genetic advance (8.67) was low for days to first harvest.

Node to first fruit exhibited a moderate PCV (17.96) and GCV (16.71) with high estimates of heritability (86.66 per cent) and moderate estimates of genetic advance (32.05).

The estimates of PCV (27.88) and GCV (23.47) were high along with high estimates of heritability (70.88 per cent) and higher genetic advance (40.71) for fruits plant^{-1}.

High PCV and GCV with (50.91 and 47.59 respectively) along with higher heritability (87.39 per cent) and genetic advance (91.64) was expressed for yield per plant.

The estimates of PCV (35.59) and GCV (31.69) were high for fruit yield per plot. High heritability (79.26 per cent) and genetic advance (58.11) were also recorded.

For crop duration, low PCV of 3.13 and GCV of 2.93 were recorded. The estimates of heritability (87.20 per cent) was high with low genetic advance (5.63).

The PCV and GCV estimates were high (26.20 and 25.32 respectively) for seeds per fruit. A high heritability of 93.41 per cent and genetic advance of 50.41 per cent were noticed.

High PCV (35.97) and GCV (30.68) were noticed with high heritability (72.78 per cent) and a higher genetic advance as per cent of mean (53.92) for weight of 100 seeds.

The PCV and GCV estimates were high (34.35 and 30.88 respectively) for flesh cavity ratio. A high heritability of 80.82 per cent and a higher genetic advance of 57.18 were noticed.

4.4.3. Quality Characters

A moderate PCV (17.31) and GCV (16.62) were recorded along with high heritability (92.18 per cent) and high genetic advance (32.87) for TSS.

Beta carotene content showed high value for PCV (46.32) and GCV (45.99) along with high heritability (98.58 per cent) and genetic advance (94.07) estimates.

Moderate PCV (15.60) and GCV (13.43) were recorded for total sugar content. Estimates of heritability (74.17 per cent) and genetic advance (23.83) were high.

High PCV (22.09) and GCV (20.56) estimates coupled with high heritability (86.59 per cent) and genetic advance (39.40) was exhibited for reducing sugar.

For reducing sugar, the estimates of PCV (40.00 per cent) and GCV (38.82 per cent) were high. A high heritability (94.19 per cent) and high genetic advance (77.61) were also recorded.

High PCV (34.68) and GCV (34.27) were noticed with high heritability (97.62 pe cent) and genetic advance as per cent of mean (69.74) for acidity.

4.5 CORRELATION ANALYSIS

Genotypic and phenotypic correlation coefficients between yield and various yield components and interrelationship among the traits were computed and

Table 8. Estimates of genetic parameters for various characters in netted muskmelon

Character	Range	Mean	PCV	GCV	Heritability (%)	Genetic Advance	GA as per cent of mean
Vine length	1.14	1.32	24.15	21.87	81.99	0.54	40.80
Number of branches per vine	3.36	3.30	21.77	15.12	48.23	0.71	21.63
Days to first male flower	13.54	32.81	8.63	7.90	83.87	4.89	14.91
Node to first male flower	4.91	4.92	27.12	23.68	76.24	2.10	42.60
Days to first female flower	13.82	40.07	8.40	7.70	83.96	5.82	14.53
Node to first female flower	4.70	6.77	16.39	15.13	85.32	1.95	28.80
Sex ratio	3.85	7.27	15.44	14.04	82.73	1.91	26.31
Fruit diameter	8.01	7.17	27.60	25.55	85.71	3.50	48.73
Rind thickness	0.73	0.40	49.44	45.89	86.16	0.35	87.75
Fruit weight	495.86	348.75	41.69	41.21	97.72	292.65	83.92
Days to first harvest	17.73	76.38	4.55	4.37	92.50	6.57	8.67
Node to first fruit	6.00	8.05	17.96	16.71	86.66	2.60	32.05
Fruits per plant	3.00	2.42	27.88	23.47	70.88	0.99	40.71
Yield per plant	1.11	0.60	50.91	47.59	87.39	0.55	91.64
Yield per plot	1.77	1.25	35.59	31.69	79.26	0.73	58.11
Crop duration	16.75	95.98	3.13	2.93	87.20	5.4	5.63
Seeds per fruit	246.80	253.79	26.20	25.32	93.41	127.95	50.41
100 seed weight	2.69	1.92	35.97	30.68	72.78	1.03	53.92
Flesh/ cavity ratio	1.45	0.78	34.35	30.88	80.82	0.45	57.18
T.S.S	4.4	5.58	17.31	16.62	92.18	1.83	32.87
Beta carotene	8.2	5.40	46.32	45.99	98.58	5.08	94.07
Total sugars	1.82	2.95	15.60	13.43	74.17	0.70	23.83
Reducing sugars	2.12	2.30	22.09	20.56	86.59	0.91	39.40
Non-reducing sugars	0.87	0.50	40.00	38.82	94.19	0.38	77.61
Acidity	0.35	0.12	34.68	34.27	97.62	0.08	69.74

are presented in Table 9 and Table 10. In general, genotypic correlation coefficients were higher than the phenotypic correlation coefficients.

4.5.1 Genotypic Correlation

The fruit yield plant^{-1} had significant positive association at genotypic level with fruit diameter (0.988), fruits plant^{-1}(0.726), fruit weight (0.945), seeds fruit^{-1} (0.741) and weight of 100 seeds (0.925). Vine length, days to first female flower, node to first female flower, days to first harvest had a negative but not significant relationship with yield.

Vine length had a significant positive genotypic correlation with node to first female flower (0.686). while, it showed negative non significant correlation with fruits plant^{-1}, seeds fruit^{-1}, weight of 100 seeds and yield plant^{-1}.

The days to first female flower exhibited significant positive genotypic correlation with node to first female flower (0.665) and days to first harvest (0.712), while it had a non significant negative correlation with fruit diameter (-0.033), fruits plant^{-1} (-0.018), fruit weight (-0.013), seeds fruit^{-1} (-0.297) and weight of 100 seeds (-0.177).

The first female flowering node had significant positive genotypic correlation with days to first harvest (0.752), while it had significant negative association with fruits plant^{-1} (-0.637).

The fruit diameter had significant positive genotypic correlation with fruit weight (0.992), number of seeds fruit^{-1} (0.822) and weight of 100 seeds (0.912).

The number of fruits plant^{-1} exhibited a highly significant negative correlation with node to first female flower (-0.637) at the genotypic level.

Fruit weight manifested a highly significant positive genotypic correlation with number of seeds fruit^{-1} (0.820), fruit diameter (0.992) and weight of 100 seeds (0.924) while, it exhibited negative significant genotypic correlation with days to first harvest (-0.481).

At genotypic level days to first harvest had highly significant positive correlation with days to first female flower (0.712). Node to first female flower showed highly significant positive correlation at genotypic level (0.752). The genotypic correlation was significant and negative with fruit diameter and fruit weight (-0.453 and -0.481).

Number of seeds fruit^{-1} exhibited significant positive correlation with fruit diameter (0.822), and fruit weight (0.820) at genotypic level. But a significant negative correlation was associated with days to first harvest (-0.764).

Weight of 100 seeds showed a positive significant correlation for fruit diameter (0.912), fruit weight (0.924) and seeds fruit^{-1} (0.840) at genotypic level. The genotypic correlation was significant and negative with days to first harvest (-0.465).

4.5.2 Phenotypic Correlation

The fruit yield plant^{-1} had significant positive association at phenonotypic level with fruit diameter (0.835), fruits plant^{-1}(0.607), fruit weight (0.871), seeds fruit^{-1} (0.694) and weight of 100 seeds (0.720). Vine length, days to first female flower, node to first female flower, days to first harvest had a negative but not significant relationship with yield.

Vine length had a significant positive phenotypic correlation with node to first female flower (0.537). while, it showed negative non significant correlation with fruits plant^{-1}, seeds fruit^{-1}, weight of 100 seeds and yield plant^{-1}.

The days to first female flower exhibited significant positive phenotypic correlation with node to first female flower (0.530) and days to first harvest (0.631).

The first female flowering node had significant positive phenotypic correlation with days to first harvest (0.402), while it had significant negative association with fruits plant^{-1} (-0.554).

The fruit diameter had significant positive phenotypic correlation with fruit weight (0.949), number of seeds fruit-1 (0.693) and weight of 100 seeds (0.802).

Table 9. Genotypic correlation coefficients between yield and yield components

Character	Vine length	Days to 1st female flower	Node to 1st female flower	Fruit diameter	Fruits $plant^{-1}$	Fruit weight	Days to first harvest	Seeds $fruit^{-1}$	Weight of 100 seeds	Yield $plant^{-1}$
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	1	0.336	0.686**	0.046	-0.365	0.055	0.315	-0.119	-0.041	-0.075
X2		1	0.665**	-0.033	-0.018	-0.013	0.712**	-0.297	-0.177	-0.036
X3			1	-0.019	-0.637**	0.025	0.752**	-0.041	0.061	-0.112
X4				1	0.345	0.992**	-0.453*	0.822**	0.912**	0.988**
X5					1	0.372	0.036	0.278	0.373	0.726**
X6						1	-0.481*	0.820**	0.924**	0.945**
X7							1	-0.764**	-0.465*	-0.303
X8								1	0.840**	0.741**
X9									1	0.925**
X10										1

Table 10. Phenotypic correlation coefficients between yield and yield components

Character	Vine length	Days to 1st female flower	Node to 1st female flower	Fruit diameter	Fruits $plant^{-1}$	Fruit weight	Days to first harvest	Seeds $fruit^{-1}$	Weight of 100 seeds	Yield $plant^{-1}$
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	1	0.335	0.537*	0.022	-0.298	0.039	0.153	-0.131	-0.057	-0.030
X2		1	0.530*	-0.006	-0.079	-0.005	0.631**	-0.278	-0.095	-0.080
X3			1	0.007	-0.554*	0.009	0.402*	-0.088	0.043	-0.098
X4				1	0.387	0.949**	-0.274	0.693**	0.802**	0.835**
X5					1	0.299	-0.008	0.225	0.202	0.607**
X6						1	-0.304	0.787**	0.863**	0.871**
X7							1	-0.473*	-0.287	-0.177
X8								1	0.736**	0.694**
X9									1	0.720**
X10										1

The number of fruits plant^{-1} exhibited a highly significant negative correlation with node to first female flower (-0.554) at the phenotypic level.

Fruit weight manifested a highly significant positive phenotypic correlation with number of seeds fruit^{-1} (0.787), fruit diameter (0.949) and weight of 100 seeds (0.863).

At phenotypic level days to first harvest had highly significant positive correlation with days to first female flower (0.631) and node to first female flower (0.402). The phenotypic correlation was non significant and negative with fruit diameter and fruit weight (-0.274 and -0.304).

Number of seeds fruit^{-1} exhibited significant positive correlation with fruit diameter (0.693), and fruit weight (0.787) at phenotypic level. But a significant negative correlation was associated with days to first harvest (-0.473).

Weight of 100 seeds showed a positive significant correlation for fruit diameter (0.802), fruit weight (0.863) and seeds fruit^{-1} (0.736) at phenotypic level.

4.6 PATH COEFFICIENT ANALYSIS

Genotypic correlation coefficients of yield plant^{-1} with yield contributing characters were partitioned into different components to find out the direct and indirect contribution of each character on fruit yield. Vine length, days to first female flower, node to first female flower, fruit diameter, fruits plant^{-1}, fruit weight, seeds fruit^{-1} and weight of 100 seeds were selected for path coefficient analysis in muskmelon. The results are furnished in Table 11. And Fig. 2.

Among the various yield components, fruit weight exerted the highest positive direct effect (2.999) on yield plant^{-1} followed by number of fruits plant^{-1} (0.472) and days to first harvest (0.443). Node to first female flower (0.341), fruit diameter (0.163) and seeds fruit^{-1} (0.076) also had positive direct effect on yield. Vine length (-0.189), days to first female flower (-0.621) and weight of 100 seeds (-0.713) exhibited negative direct effect on yield plant^{-1}.

Regarding the indirect effects, vine length had positive effects through node to first female flower (0.234), fruit weight (0.168), days to first harvest (0.140) and weight of 100 seeds (0.030) and negative indirect effects *via*. Days to first female flower (-0.209), fruit diameter (-0.067), fruits plant^{-1} (-0.173) and seeds fruit^{-1} (-0.009).

Days to first female flower exerted positive indirect effect through node to first female flower (0.227), fruit diameter (0.049), days to first harvest (0.316) and weight of 100 seeds (0.127) and negatively through vine length (-0.064), number of fruits plant^{-1} (-0.009), fruit weight (-0.039) and seeds fruit^{-1} (-0.023).

Indirect influence of node to first female flower on yield was observed through fruit diameter (0.028), fruits weight (0.076) and days to first harvest (0.334) in the positive direction and through vine length (-0.130), days to first female flower (-0.413), fruits plant^{-1} (-0.301), seeds fruit^{-1} (0.003) and weight of 100 seeds (-0.044) in the negative direction.

The indirect effect of fruit diameter was positive through days to first female flower (0.021), fruits plant^{-1} (0.163), fruit weight (2.004) and seeds fruit^{-1}(0.062). The effect was negative through vine length (-0.009), node to first female flower (-1.436), days to first harvest (-0.201) and weight of 100 seeds (-0.650).

Indirect effect of fruits plant^{-1} was positive through vine length (0.069), days to first female flower (0.011), fruit weight (1.116), days to first harvest (0.016) and seeds fruit^{-1} (0.021). The effect was negative through node to first female flower (-0.217), fruit diameter (-0.496) and weight of 100 seeds (-0.266).

Fruit weight positively influenced yield indirectly through days to first female flower (0.008), node to first female flower (0.009), fruits plant^{-1} (0.176) and seeds fruit^{-1} (0.062) and the effect was negative through vine length (-0.011), fruit diameter (-1.425), days to first harvest (-0.214) and weight of 100 seeds (-0.659).

Days to first harvest exerted positive indirect effect through node to first female flower (0.257), fruit diameter (0.651), fruits plant^{-1} (0.017) and weight of

Table 11. Direct and indirect effects of yield components on fruit yield

Character	Vine length	Days to 1st female flower	Node to 1st female flower	Fruit diameter	Fruits plant^{-1}	Fruit weight	Days to first harvest	Seeds fruit^{-1}	Weight of 100 seeds	Genotypic correlation with yield
Vine length	**-0.189**	-0.209	0.234	-0.067	-0.173	0.168	0.140	-0.009	0.030	-0.075
Days to 1st female flower	-0.064	**-0.621**	0.227	0.049	-0.009	-0.039	0.316	-0.023	0.127	-0.036
Node to 1st female flower	-0.130	-0.413	**0.341**	0.028	-0.301	0.076	0.334	-0.003	-0.044	-0.112
Fruit diameter	-0.009	0.021	-1.436	**0.163**	0.163	2.044	-0.201	0.062	-0.650	0.988**
Fruits plant^{-1}	0.069	0.011	-0.217	-0.496	**0.472**	1.116	0.016	0.021	-0.266	0.726**
Fruit weight	-0.011	0.008	0.009	-1.425	0.176	**2.999**	-0.214	0.062	-0.659	0.945**
Days to first harvest	-0.060	-0.442	0.257	0.651	0.017	-1.444	**0.443**	-0.058	0.331	-0.303
Seeds fruit^{-1}	0.023	0.185	-0.014	-1.181	0.132	2.459	-0.339	**0.076**	-0.599	0.741**
Weight of 100 seeds	0.008	0.110	0.021	-1.310	0.176	2.775	-0.206	0.064	**-0.713**	0.925**

Residual effect= 0.011

Bold letters= Direct effects

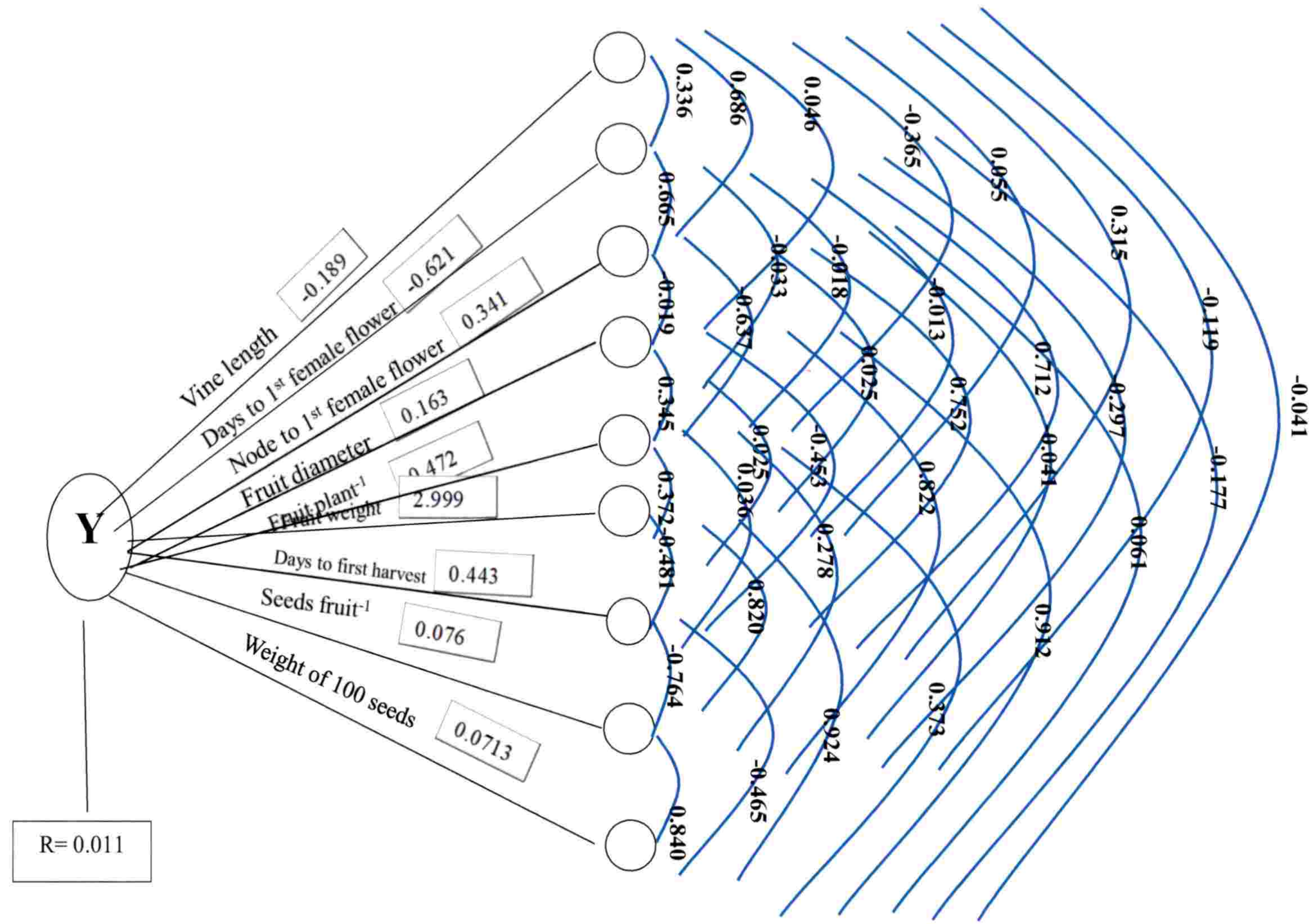


Figure 1. Genotypic path diagram

100 seeds (0.331) and negative through vine length (-0.060), days to first female flower (-0.442), fruit weight (-1.444) and seeds fruit^{-1} (-0.058).

The indirect effect of seeds fruit^{-1} was positive through vine length (0.023), days to first female flower (0.185), fruits plant^{-1} (0.132) and fruit weight (2.459). It was negative through node to 1st female flower (-0.014), fruit diameter (-1.181), days to first harvest (-0.339) and weight of 100 seeds (-0.599).

Hundred seed weight exhibited positive indirect effect through vine length (008), days to first female flower (0.110), node to first female flower (0.021), fruits plant^{-1} (0.176), fruit weight (2.775) and seeds fruit^{-1} (0.064).

4.7 SELECTION INDEX

Discriminant function analysis was adopted for the construction of selection index. Selection index was computed based on 10 characters *viz.*, vine length (X_1), days to first female flower (X_2), node to first female flower (X_3), fruit diameter (X_4), fruits plant^{-1} (X_5), fruit weight (X_6), days to first harvest (X_7), seeds fruit^{-1} (X_8), 100 seed weight (X_9) and yield plant^{-1} (X_{10}).

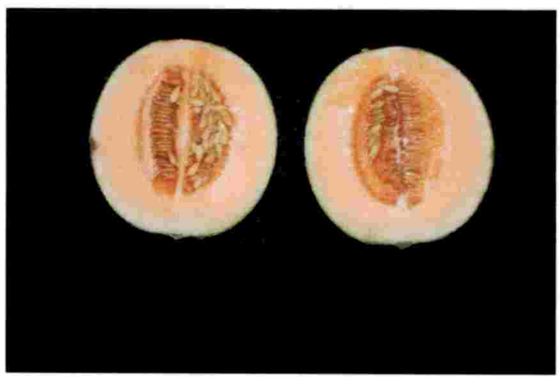
The index value for each treatment was determined and they were ranked. The values obtained for the treatments based on the selection index are given in Table 12.

Based on selection index, NS-915 ranked first with a value of 803.04, followed by Jindal (748.25) (Plate 4). Pahuja and NS-910 obtained the next two positions with indices of 653.24 and 607.93 respectively. Minimum value was obtained for Pusa Madhuras (106.84)

Table 12. Netted muskmelon genotypes ranked according to selection index (Based on discriminant function analysis)

Genotypes	**Selection index score**	**Rank**
Pusa Madhuras	106.84	20
Gujarat Local	316.21	12
Kasi Madhu	280.45	15
Gujarat Muskmelon-3	246.80	16
Madhuras	210.81	18
Rajasthan Local-1	216.07	17
Rajasthan Local-2	128.25	19
NS-915	803.04	1
NS-910	607.93	4
Jindal	748.25	2
Hita	534.96	6
Pahuja	653.24	3
Pyramid	535.75	5
G-kart	414.51	8
National Garden	436.11	7
Novel	371.06	10
Syed	372.56	9
Avtar	283.24	14
Sugar Summer	300.76	13
Airex	336.38	11


NS-915

Jindal

Plate 5. Top performing hybrids

Discussion

5. DISCUSSION

The present investigation was carried out at the Department of Vegetable Science, College of Agriculture, Vellayani, during 2018-2019 to evaluate netted muskmelon genotypes for the adaptability in Kerala based on growth, yield and quality. The extent of variability, heritability of the commercially important characters, genetic advance under selection and correlations among the traits were assessed with a view to suggest measures to bring about genetic improvement for yield and its components. The salient results of the present investigation are discussed under the following headings.

5.1 Mean performance of varieties / hybrids

5.2 Coefficient of variation

5.3 Heritability and genetic advance

5.4 Correlation analysis

5.5 Selection index

5.1 MEAN PERFORMANCE OF VARIETIES / HYBRIDS

5.1.1 Vegetative and Flowering Characters

In the present study, significant variation was recorded for all the vegetative and flowering characters *viz.* vine length, number of branches vine^{-1}, days to first male and female flower, node to first male and female flower and sex ratio.

There was significant difference among the genotypes for vine length with a range of 0.83 m in the variety Kashi Madhu to 1.84 m in the hybrid Avtar. Similar varietal variation in vine length was also reported by Sivakami and Choudhary (1974), Nandpuri *et al.* (1974) and Bokashi *et al.* (1992) in muskmelon; Ganiger *et al.* (2017) in wild melon which might be attributed to the specific genetic constitution and vigour of different genotypes.

Highest number of primary branches plant^{-1} was recorded by Kashi Madhu (4.80) and the lowest by Syed (2.20). These are in conformity with the results reported by Swamy *et al.* (1985) and Fergany *et al.* (2011) in muskmelon. Highest vine length resulting in highest number of primary branches in the variety Kashi Madhu might be due to the diversion of higher amount of metabolites for exhibiting high vegetative vigour as reported by Ganiger *et al.* (2017) in wild melon

In the present study, early male flower production was noticed in Airex (28.56 days) which was on par with Hita (29.52 days). Kashi Madhu recorded late flowering (39.00 days). Similar range of 28.33 to 44.34 days for days taken to male flower production was reported in muskmelon by Bokashi *et al.* (1992). Significant variation in number of days taken to male flowering might be due to genetic differences among the genotypes, since all were exposed to same environmental condition. Samadia (2007) reported sufficient variation for nodal position of male flower with a range of 2.25 to 4.00 in round melon and Bhagwat *et al.* (2018) in cucumber. The lowest node number of 2.80 was recorded by the hybrid Airex and the highest by Jindal (7.19).

Number of days taken for the first appearance of female flowers as well as the nodal position plays an important role in deciding the earliness of the crop. Airex and NS-910 were the earliest to produce female flower and also in the lower node compared to other genotypes. Similar varietal variation was also reported by Shivaprasad (2013) in muskmelon and Vijayakumari *et al.* (1991) in cucumber, which may be attributed to the genotypic capacity to make available the assimilates. Wehner *et al.* (2001) reported that in muskmelon, the sequence of flowering follows a set pattern, namely; (i) Male phase: first few nodes bear only the staminate flowers, (ii) Mixed phase: both pistillate and staminate flowers appear in few nodes in the main axis and secondary branches in cycles and (iii) Female phase: few nodes produce mostly the pistillate flowers. Most accessions produced their first female flower in less than a fortnight after producing their first male flower. All the genotypes produced the first female flower in less than a fortnight after producing the first male flower as reported by Shivaprasad (2013) in muskmelon and Gichimu *et al.* (2008) in water melon

Sex ratio is one of the important traits for crop improvement in cucurbits. In the present investigation, Kashi Madhu exhibited the lowest sex ratio of 5.23 and Pahuja the highest of 8.82. Besides the genetic composition, environmental conditions like light, moisture, tempertaure etc have an impact on sex ratio (Frankel and Galun, 1977; Heslop and Harrison, 1972 and Singh *et al*., 1996). According to Whitaker (1971), cucurbits generally produce more number of male flowers, which may be due to the inherent qualitative type of sex expression and the proportion of staminate to pistillate flowers could be materially changed by environmental conditions. Variation in sex ratio from 5.59 to 7.19 was reported by Gaikwad (2016) in muskmelon. Similar variation in sex ratio were reported by several earlier workers like Venkatesan *et al.* (2016) in muskmelon and Rakha *et al.* (2012) in cucumber.

5.1.2 Fruit and Yield Characters

Significant difference was noticed among the genotypes for fruit and yield characters such as fruit diameter, rind thickness, fruit weight, days to first harvest, node to first fruit, fruits plant^{-1}, yield plant^{-1}, yield plot^{-1}, crop duration, seeds fruit^{-1}, 100 seed weight and fruit shape. Ohashi *et al.* (2009) in muskmelon and Ganiger *et al.* (2014) and Manu (2014) in oriental pickling melon reported sufficient variation among genotypes for fruit size. Rind thickness is an important character associated with availability of edible flesh. The lowest rind thickness of 0.10 cm was recorded in the varieties Pusa Madhuras, Rajasthan Local-1 and Rajasthan Local-2. The hybrid G-kart recorded the highest rind thickness of 0.73 cm.

Fruit weight is a primary character to be considered in any crop improvement programme, as it directly contributes towards yield. The variation in fruit weight ranged from 168.00 g to 625.86 g. Maximum fruit weight of 625.86 g was noticed in NS-915 which was on par with Jindal (600.26 g) and NS-910 (594.73 g). Minimum fruit weight was noticed in Pusa Madhuras (168.00 g) (Fig 3). Generally medium sized (400 g to 700 g) muskmelon fruits are preferred in South Indian markets. Kalloo *et al.* (1989) reported variation of 324 g to 845 g for fruit weight in muskmelon. Results of the present findings are in corroboration with the

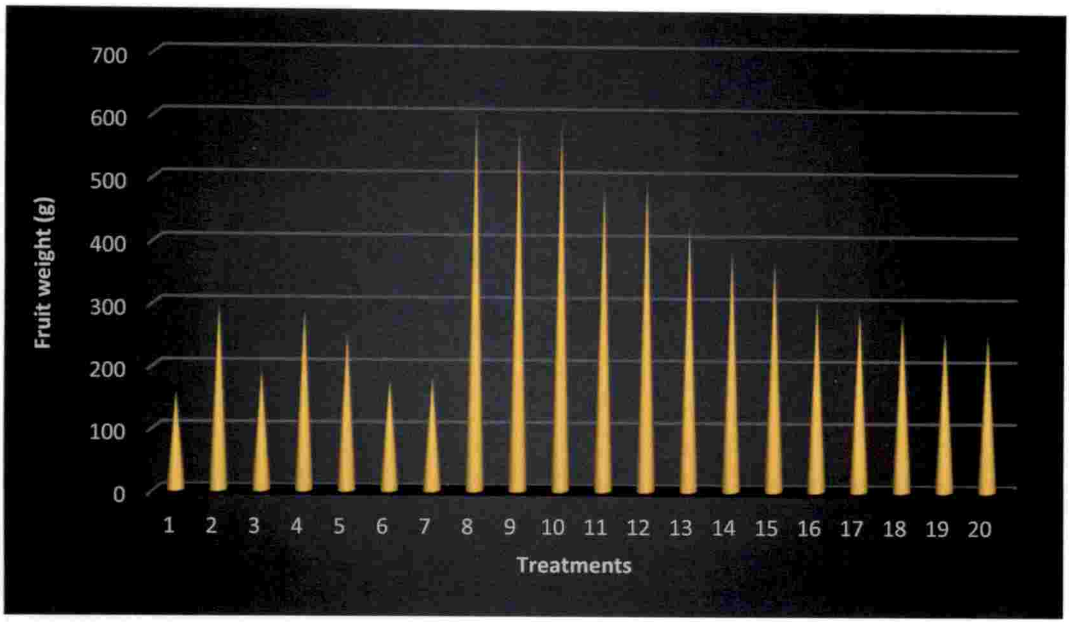


Fig 3. Mean performance of genotypes for fruit weight (g)

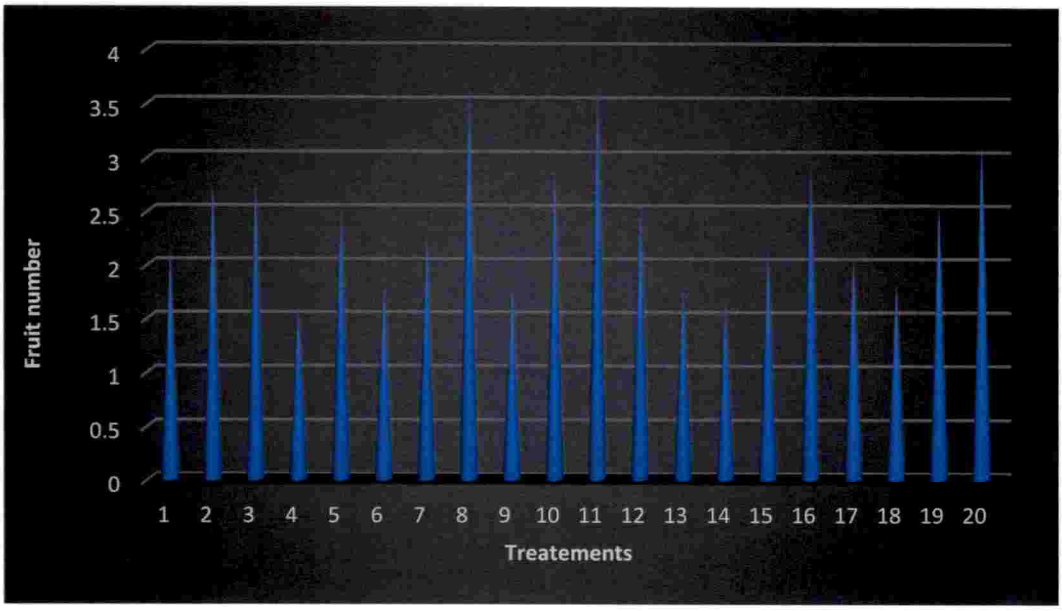


Fig 4. Mean performance of genotypes for fruits plant^{-1}

X axis:

1. Pusa Madhuras 2. Gujarat Local 3. Kashi Madhu 4. Gujarat Muskmelon-3 5. Madhuras 6. Rajastan Local-1 7. Rajastan Local-2 8. NS-915 9. NS-910 10. Jindal 11. Hita 12. Pahuja 13. Pyramid 14. G-kart 15. National Garden 16. Novel 17. Syed 18. Avtar 19. Sugar Summer 20. Airex

findings of Sharma and Lal (2004) and Fergany *et al.* (2011) in muskmelon. Maximum fruit weight might be because of genetic capacity of the genotype to make available higher assimilates for fruit development.

In the present investigation, the genotype Hita produced the highest number of fruits plant^{-1} which was on par with NS-915 where the least number of fruits was recorded in Gujarat Muskmelon-3 (Figure 4). This could be mainly attributed to the genetic composition of the plant. These results are in line with the findings of Chadha and Nandpuri (1980) and Bokashi *et al.* (1992) in muskmelon and Gichimu *et al.* (2008) in watermelon.

The highest yield plant^{-1} and yield plot^{-1} were recorded by the hybrid NS-915 (1.20 kg and 2.14 kg) which was on par with Jindal (1.10 kg and 1.95 kg) (Fig 5 and Fig 6.). The significant variation in yield plant^{-1} might be due to difference in fruit weight and number of fruits plant^{-1}, which are important components of yield. These findings were supported by Bokashi *et al.* (1992) in muskmelon.

Maximum crop duration was observed in G-kart (106 days) and the minimum in NS-915 (92.10 days). Significant difference in the crop duration may be due to genetic composition of the genotypes. Variations in days to final harvest in different genotypes have been reported by Nisha (2017) in watermelon.

Number of seeds fruit^{-1} ranged from 146.00 to 365.00 and 100 seed weight from 1.13 g to 3.37 g. The increase in seed number fruit^{-1} may be attributed to the increased pollination. On the other hand, lower seed number may be because of fluctuating temperatures which resulted drying of ovaries, poor fruit set and desiccation of tender fruits there by reducing the seed formation and yields as opined by Samadia, 2002. The present findings are in consistent with those reported by Ganiger *et al.* (2017) in muskmelon and Edelstein and Nerson (2002) in watermelon.

5.1.3 Quality Characters

The genotypes recorded significant difference for quality characters such as flesh cavity ratio, TSS, beta carotene, total sugars, reducing sugar, non reducing

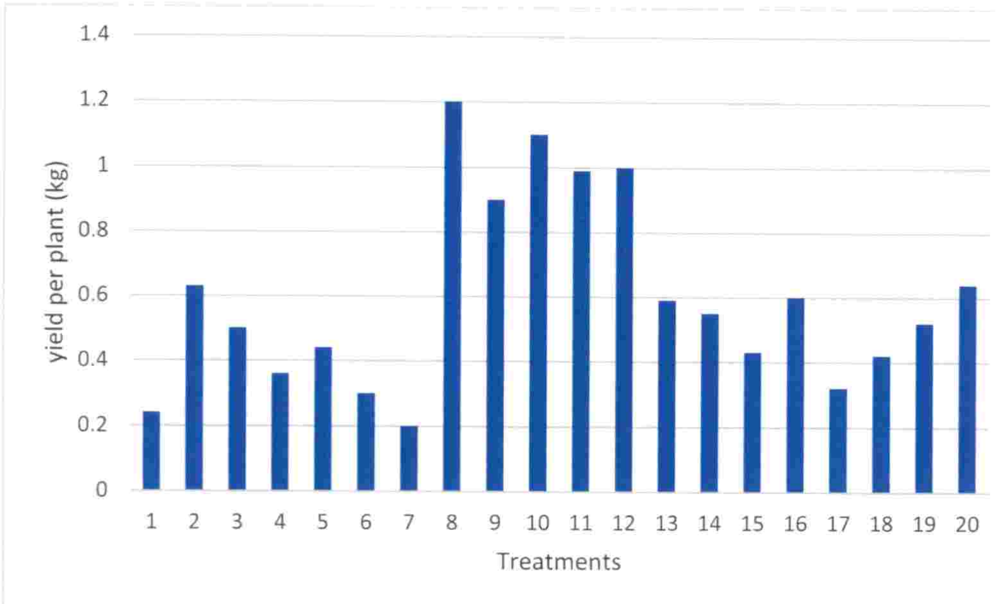


Fig 5. Mean performance of genotypes for yield plant^{-1}

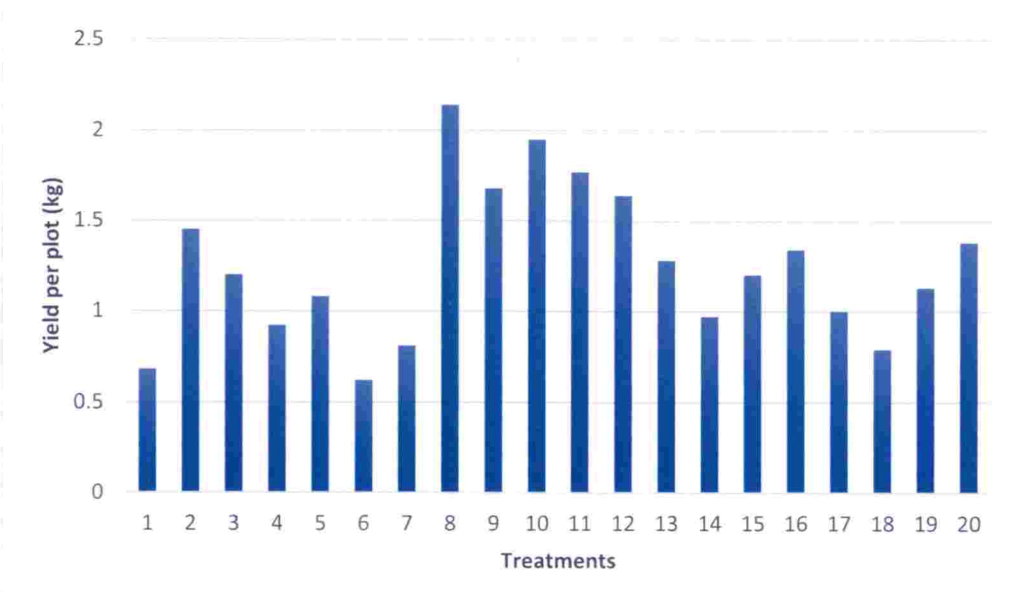


Fig 6. Mean performance of genotypes for yield plot^{-1}

X axis:

1. Pusa Madhuras 2. Gujarat Local 3. Kashi Madhu 4. Gujarat Muskmelon-3 5. Madhuras 6. Rajastan Local-1 7. Rajastan Local-2 8. NS-915 9. NS-910 10. Jindal 11. Hita 12. Pahuja 13. Pyramid 14. G-kart 15. National Garden 16. Novel 17. Syed 18. Avtar 19. Sugar Summer 20. Airex

sugar and acidity. Highest flesh thickness is a desirable character in cucurbits. Highest flesh cavity ratio was noticed among the genotypes for flesh cavity ratio. Highest flesh cavity ratio was recorded in NS-915 (1.520) and least flesh cavity ratio in Pusa Madhuras (0.460). More *et al.* (1980) reported sufficient variation from 0.34 to 1.57 for flesh cavity ratio in muskmelon genotypes. This may be attributed to inherent characters of genotype. Fruit flesh thickness in muskmelon increased with increase in size of the fruit *i.e* more thick flesh was observed in bigger sized fruits and less in small fruits (Shivaprasad, 2013).

In muskmelon, TSS is an important character determining quality and market preference. TSS is a measure of the concentration of the reducing sugars fructose and glucose and the non reducing sugar- sucrose. Higher value of TSS in muskmelon is a desirable character since it contributes to sweetness. In the present study, the hybrid NS-915 was significantly superior to other genotypes with a TSS of 8.07^0 B (Fig 7). Sharma and Lal (2004) reported a variation of 7.8° B to 10.3° B in muskmelon. Similar variation has been reported by Manu (2014) in oriental pickling melon, Ganiger *et al.* (2017) in wild melon and Yadav and Asati (2005) in watermelon.

The genotype Kashi Madhu recorded highest beta carotene content of 9.92 mg/100 g and Pyramid (2.50 mg/100 g) the lowest (Fig 8). This difference in Beta carotene content could be attributed to the inherent character of the genotypes. Venkatesan *et al.* (2016) reported a variation of 0.75 mg 100 g^{-1} to 17.97 mg 100 g^{-1} in muskmelon.

Consumers prefer high sweetness in muskmelon fruits. Total sugars varied significantly among different genotypes which ranged between 2.44 to 4.06 %. The variation in total sugars constituent of fruit can be attributed to the genetic makeup of the plant and the environmental conditions. Similar reports were made by Chacko *et al.* (1992), Venkatesan *et al.* (2016) in muskmelon. Presence of high reducing and non reducing sugar is a preferred quality trait in muskmelon. Syed recorded the highest reducing sugar content of 3.36 % and Pusa Madhuras non reducing sugar content of 1.53 %. The relative concentration of sugars is influenced by the cultivar

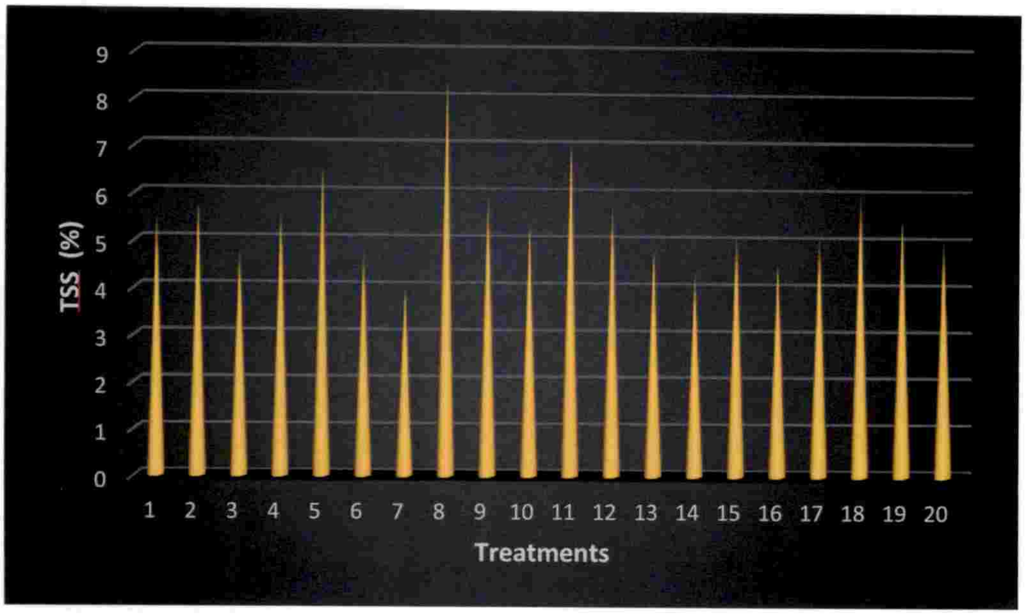


Fig 7. Mean performance of genotypes for TSS

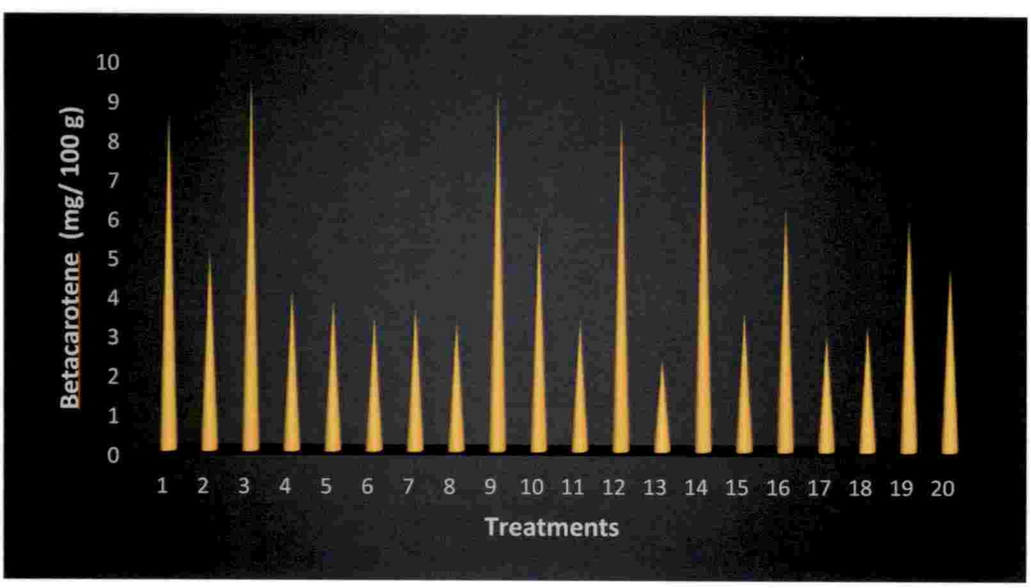


Fig 8. Mean performance of genotypes for Beta carotene

X axis:

1. Pusa Madhuras 2. Gujarat Local 3. Kashi Madhu 4. Gujarat Muskmelon-3 5. Madhuras 6. Rajastan Local-1 7. Rajastan Local-2 8. NS-915 9. NS-910 10. Jindal 11. Hita 12. Pahuja 13. Pyramid 14. G-kart 15. National Garden 16. Novel 17. Syed 18. Avtar 19. Sugar Summer 20. Airex

and stage of maturity. Sugar import in vine ripened fruit increase in the later stages of ripening (Carrari *et al.,* 2006). Variations in sugar content in different cultivars have been reported by Chacko (1992) in muskmelon and Gondi (2015) in oriental pickling melon.

Highest acidity content was observed in Kashi Madhu (0.34 %) which was on par with Rajasthan Local-2 (0.33 %). Variations in acidity percentage in different cultivars have been reported by Chacko (1992) and Indraja (2018) in muskmelon.

5.1.4 Sensory Evaluation of Muskmelon Genotypes

The quality of fresh cut fruits and vegetables can be measured by sensory and instrumental methods. In general, sensory methods are more useful in determining product standards (Shewfelt, 1993)

The sensory analysis of twenty muskmelon genotypes was conducted and Kruskal wallis test confirmed significant difference among the genotypes. Mean sensory score values revealed that the hybrid NS-915 was superior to other genotypes in organoleptic qualities like appearance, taste, colour, flavour, texture and overall acceptability. Barrett *et al.* (2010) also reported that the color, flavor, texture, and the nutritional value of fresh-cut fruit and vegetable products are factors critical to consumer acceptance.

5.2 COEFFICIENT OF VARIATION

The magnitude of variability present in a population is of utmost importance as it provides the basis for effective selection. The phenotypic coefficient variation (PCV) and genotypic coefficients variation (GCV) are the components used to measure the variability present in a population. In the present study, even though phenotypic coefficient of variation was higher than the corresponding genotypic coefficient of variation for all the characters, only a slight difference was observed between PCV and GCV. This revealed greater stability of the characters against environmental fluctuation, thus making selection based on phenotypic performance reliable. A major portion of PCV was contributed by GCV for most of the characters suggesting that the observed variation was mainly due to genetic factors. This similarity between PCV and GCV was reported earlier by Rakhi and Rajamony (2005) in culinary melon, Choudhary *et al.* (2011) and Pushpalatha *et al.* (2016) in muskmelon.

High GCV and PCV were recorded for vine length, node to male flower, fruit weight, fruit diameter, rind thickness, fruits plant^{-1}, yield plant^{-1}, yield plot^{-1}, weight of 100 seeds, number of seeds fruit^{-1} flesh cavity ratio, beta carotene content, reducing sugar, non reducing sugar and acidity clearly indicating that selection will be rewarding for the traits. These results are in agreement with the findings of Rakhi and Rajamony (2005) in culinary melon and Mali *et al.* (2015) and Torkadi *et al.* (2007) in muskmelon.

Moderate PCV and GCV were recorded for number of branches, node to first female flower, sex ratio, days to first fruit, TSS and total sugar content. Similar results were reported by Tomar *et al.* (2008) in muskmelon and Pushpalatha *et al.* (2016) in cucumber. Lower PCV and GCV were recorded for days to first male flower, days to first female flower, days to first harvest and crop duration which is consistent with the findings of Rakhi and Rajamony (2005) in culinary melon and Pandey *et al.* (2005) in muskmelon.

5.3 HERITABILITY AND GENETIC ADVANCE

The genotypic coefficient of variation does not offer full scope to estimate the variation that is heritable and, therefore, estimation of heritability becomes necessary. The knowledge of heritability along with genetic advance aid in drawing valuable conclusions for effective selection based on phenotypic performance (Johnson *et al*., 1955).

In the present investigation, high heritability was observed for all the characters studied except number of branches vine^{-1}. The magnitude of heritability ranged from 48.23 to 98.58%. Highest heritability was recorded for beta carotene followed by fruit weight, non reducing sugars, seeds fruit^{-1}, days to first harvest, TSS, days to first female flower, days to first male flower, fruit weight, ascorbic acid and fruits plant^{-1}. High heritability indicates that phenotype of the trait strongly reflects the genotype and suggests the major role of genotypic constitution in the expression of the character. Therefore, reliable selection could be made for these traits on the basis of phenotypic expression. This is in agreement with the findings of Choudhary *et al.* (2011), Ibrahim (2012) and Reddy *et al.* (2013).

High heritability combined with high genetic advance as per cent of mean was observed for characters like yield plant^{-1}, rind thickness, fruit weight, non reducing sugars, acidity, yield plot^{-1}, flesh cavity ratio, 100 seed weight and seeds fruit^{-1}. The result showed that these characters were controlled by additive gene effects and phenotypic selection for these characters is likely to be effective. Similar results were reported by Choudhary *et al.* (2011), Reddy *et al.* (2013) and Patil (2014) in muskmelon.

5.4 CORRELATION STUDIES

Yield is a result of interactions of a number of interrelated characters. For rational approach towards the improvement of yield, selection will be more rewarding when it is based on the components of yield. The efficiency of selection for yield mainly depends on the direction and magnitude of association between yield and its components and among themselves. Correlation coefficient analysis measures the mutual relationship between various characters and is used to determine the component character on which selection can be done for improvement of yield. It also helps to understand the nature of interrelationships among the component traits.

In the present study, for all the characters, genotypic correlation coefficient was higher than respective phenotypic correlation coefficient, which may be ascribed to the low effect of environment on the character expression (Dey *et al.*, 2005; Said and Fatiha, 2015).

Yield plant^{-1} was found to be significantly and positively associated with fruit diameter, fruit weight, fruits plant^{-1}, seeds fruit^{-1} and weight of 100 seeds at genotypic and phenotypic levels. Positive correlation of fruit yield with fruits plant^{-}

[1] and fruit weight has also been reported by Choudhary *et al*. (2004) and Tomar *et al*. (2008) in muskmelon; Kumar and Wehner (2011) and Choudhary *et al*. (2012) in watermelon. Vine length was positively and significantly correlated with node to first female flower. Days to first female flower exhibited positive and significant correlation with days to first harvest and node to first female flower. This is in agreement with the findings of Choudhary *et al*. (2010) in muskmelon and Sundaram *et al*. (2011) in watermelon. Days to first harvest exhibited significant negative correlation with fruits diameter and fruit weight. This confirms with Choudhary *et al.* (2004) in muskmelon. The correlation of fruit weight with fruit diameter was positive and significant (Choudhary *et al*., 2010) while it was negative with days to first harvest. Thus any improvement in fruit weight would improve fruit diameter.

5.4.1 Path Coefficient Analysis

Correlation studies give an idea about the positive and negative associations of different characters with yield and also among themselves. However, the nature and extent of contribution of these characters towards yield is not obtained. The total correlation between yield and its component characters may sometimes be misleading, as it might be an over-estimate or under-estimate of its association with other characters which are also associated with economic yield. Path coefficient analysis can provide a more realistic picture of relationships between different traits, as it takes into consideration direct as well as indirect effects of the different yield components. Determination of interrelationships between and among yield components and yield helps a plant breeder to easily identify traits that make the most significant contribution to yield.

In this study, path coefficient analysis was used to separate the genotypic correlation coefficients of yield plant^{-1} with vine length, days to first female flower, node to first female flower, fruit diameter, fruits plant^{-1}, fruit weight, days to first harvest, seeds fruit^{-1} and weight of 100 seeds, into direct and indirect effects.

Among yield attributes, fruit weight (2.999) exhibited the highest positive direct effect on fruit yield followed by fruits plant^{-1} (0.472). Fruit weight and fruits plant^{-1} also showed positive correlation with yield plant^{-1}. This indicated that direct selection based on fruit weight and fruits plant^{-1} would result in appreciable improvement of yield plant^{-1}. These findings are in agreement with Somkuwar *et al.* (1997) and Choudhary *et al.* (2004) in muskmelon; Rao *et al.* (2004) in cucumber and Choudhary *et al.* (2012) in watermelon.

Node to first female flower, fruit diameter and days to first harvest also exerted positive direct effect on yield which is in accordance with Reddy *et al.* (2007) in snapmelon. Vine length, days to first female flower, and weight of 100 seeds had negative direct effect on yield. Tomar *et al.* (2008) also reported negative direct effect of vine length on yield. Path coefficient analysis revealed that fruit diameter and fruits plant^{-1} had the highest indirect positive effect on yield plant^{-1} through fruit weight. The indirect effects suggested that selection for any of these two characters would improve the yield through the associated character.

Therefore, it can be inferred that fruit weight and fruits plant^{-1} were the main yield contributing characters in fruit yield of muskmelon because of its high, positive direct effect and positive correlation with fruit yield plant^{-1}. Since these characters also have high level of heritability and genetic advance, they can be considered dependable for improvement of yield in muskmelon.

5.5 SELECTION INDEX

Selection of genotypes based on suitable index is highly efficient in any breeding programme. Discriminant function analysis developed by Fisher (1936) gives information on the proportionate weightage to be given to a yield component. Thus, selection index was formulated to increase the efficiency of selection by taking into account the important characters contributing to yield. According to Hazel (1943), a selection index was more efficient than individual selection based on individual characters.

The same characters selected for path analysis *viz.*, vine length, days to first female flower, node to first female flower, fruit diameter, fruits plant^{-1}, fruit weight, days to first harvest, seeds fruit^{-1}, 100 seed weight and yield plant^{-1} were used for selection index. Based on the selection index values, top ranking genotypes namely NS-915 (803.04) and Jindal (748.25) were identified as superior ones. Identification of superior genotypes of muskmelon based on discriminant function using traits, especially fruit weight, was done by Rad *et al.* (2016).

Summary

SUMMARY

The present investigation entitled "Evaluation of netted muskmelon (*Cucumis melo* var. *cantalupensis* Naudin.) for growth, yield and quality" was carried out at the Department of Vegetable Science, College of Agriculture, Kerala Agricultural University, Vellayani, during 2017-2019 with the objective to evaluate netted muskmelon in Kerala for growth, yield and quality and thereby its adaptability.

In the experiment, twenty varieties/ hybrids of netted muskmelon, collected from public and private sectors, were evaluated for high yield and quality. The evaluation was done in randomised block design with two replications. The extent of variability, heritability and genetic advance of genotypes were assessed. The degree and direction of association between various traits and the direct and indirect effects of various components on yield were also analysed. The salient findings of the investigation are summarized below.

Observations were recorded on different biometric characters *viz.,* vine length (m), number of branches per vine, days to first male flower, node to first male flower, days to first female flower, node to first female flower, sex ratio, fruit diameter (cm), rind thickness (cm), fruit weight (g), fruits plant^{-1}, fruit yield plant^{-1} (kg), fruit yield plot^{-1} (kg), crop duration, number of seeds per fruit and 100 seed weight (g). In addition to this, quality characters *viz*., flesh thickness, β carotene, TSS, total sugars, reducing sugars, non reducing sugars, acidity and pest and disease observations were also taken.

The results pertaining to the analysis of variance for the experimental design indicated that the mean square due to genotypes were significant for all the characters studied. Avtar produced the longest vine of 1.84 m which was on par with Pahuja (1.74 m) and Gujarath muskmelon-3 (1.68 m). Highest number of primary branches per plant was recorded in Kashi Madhu (4.80) and Airex(4.12), NS-910 (4.01) and G-kart (4.00) were on par with it. Airex took least number of days to first male flower appearance (27.56 days) followed by Hita (29.52 days),

which were on par. Lowest node number to first male flower was recorded in Airex (2.80) and the genotypes Hita (3.30), Rajasthan local-2 (3.54), Madhuras (3.60) and Novel (3.86) were on par with it. Airex was the earliest to first female flower production (34.01 days) which was on par with NS-910 (35.46 days) and Madhuras (36.35 days), while Kashi Madhu was late to first female flower appearance (46.13 days). The lowest node number to first female flower production was recorded by Airex (4.98), which was statistically on par with NS-910 (5.13), Novel (5.24) and Hita (5.46). Lowest sex ratio was recorded in Kashi Madhu (5.23), which was on par with Hita (5.97) and Pusa Madhuras (6.00).

Highest fruit diameter was observed in NS-915 (11.78 cm). The lowest rind thickness was recorded in Pusa Madhuras, Rajasthan Local-1 and Rajasthan Local-2 (0.10 cm). Maximum fruit weight was noticed in NS-915 (625.86 g) which was on par with Jindal (600.26 g) and NS-910 (594.73 g). Syed was the earliest to harvest (71.15 days) and NS-910 (72.35 days) was on par with it. Lowest node number to first harvest was recorded in Novel (5.30), Hita (6.00) being on par with it. Highest number of fruits plant^{-1} was recorded in Hita (3.66) and it was on par with NS-915 (3.64), Airex (3.15) and Novel (2.95). The highest yield plant^{-1} of 1.20 kg was recorded for NS 915 followed by Jindal (1.10 kg), Pahuja (1.00 kg) and Hita (0.99 kg), which were on par. Highest yield plot^{-1} of 2.14 kg was recorded in NS-915. Two genotypes, *viz.*, Jindal (1.950 kg) and Hita (1.770 kg) were on par with it. The lowest crop duration of 92.10 days was expressed by NS-915. The highest seed number was observed in NS-910 (365.50), which was on par with NS-915 (348.33). The treatment NS-910 recorded the highest 100 seed weight of 3.37 g, which was on par with NS-915 (3.33 g) and Jindal (3.23 g).

Highest flesh cavity ratio was noticed in NS-915 (1.52) and highest total soluble solids content in NS-915 (8.07° B). Highest beta carotene content was obtained in the genotype Kashi Madhu (9.92 mg/100 g), which was on par with G-kart (9.74 %) and NS-910 (9.30 %). The highest total sugar content was recorded in Pusa Madhuras (4.06 %) followed by Syed (4.00 %) which were on par. Highest reducing sugar content was recorded in the genotype Syed (3.36 %) and Sugar

Summer (3.03 %) was on par with it. Pusa Madhuras recorded highest non reducing sugar content (1.53 %). The least acidity was recorded in NS-915 and Airex (0.06 %). Fruit fly was the major problem observed during the study. Sensory evaluation revealed the superiority of the hybrid NS-915 for appearance, colour, flavour, taste, texture and overall acceptability over other genotypes.

High phenotypic and genotypic coefficients of variation (PCV and GCV) were noticed for most of the yield contributing characters *viz*., fruit weight (41.69 and 41.21), yield plant^{-1} (50.91 and 47.59) and fruit diameter (27.60 and 25.55). GCV was near to PCV for most of the characters, indicating a highly significant effect of genotype on phenotypic expression, with very little effect of environment. High estimates of heritability coupled with high to moderate genetic advance as per cent of mean was recorded for all the yield components, indicating the presence of flexible additive gene effects and will be useful in selection for these characters.

Yield had positive and significant correlation at both genotypic and phenotypic level for the yield contributing characters such as fruit diameter (0.988 and 0.835), fruits plant^{-1} (0.726 and 0.607), fruit weight (0.945 and 0.871), seeds fruit^{-1} (0.741 and 0.694) and weight of 100 seeds (0.925 and 0.720) respectively. Path coefficient analysis revealed that average fruit weight showed the highest positive direct effect on fruit yield followed by fruits plant^{-1}, days to first harvest, node to first female flower, fruit diameter and seeds per fruit. The genotypes were ranked based on selection index score considering the major characters *viz*., vine length, days to first female flower, node to first female flower, fruit diameter, fruits plant^{-1}, fruit weight, days to first harvest, seeds fruit^{-1}, 100 seed weight and yield plant^{-1}. NS-915 recorded highest selection index score of (803.04) followed by Jindal (748.25).

Based on the mean performance of the genotypes for various characters and selection index score, the top ranking hybrids NS-915 and Jindal were found suitable for growing under south Kerala conditions.

FUTURE LINE OF WORK

The superior hybrids identified *viz.*, NS-915 and Jindal can be grown in the open field in a larger area for confirmation of the results and if found superior can be recommended for commercial cultivation

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APPENDICES

APPENDIX I

Standard week wise weather parameters during cropping period

Standard weeks	Month	Avg RF (mm)	Max temp (^{0}C)	Min temp (^{0}C)	Max RH (%)	Min RH (%)
1	Dec 03-09	25	31.90	23.70	92.90	73.90
2	Dec10-16	37	32.20	23.80	94.30	73.90
3	Dec 17-23	3	32.00	22.90	92.40	71.90
4	Dec 24-31	9	31.90	23.50	92.70	71.70
5	Jan 01-06	0	31.97	19.60	92.00	66.60
6	Jan 07-14	0	31.57	20.70	92.00	68.50
7	Jan 15-20	0	32.20	20.85	90.86	68.14
8	Jan 21-27	4	32.15	21.93	92.90	66.97
9	Jan 28-03	0	32.79	23.47	89.55	66.25
10	Feb 04-10	5	31.90	24.30	92.00	66.60
11	Feb 11-17	0	32.20	23.80	92.00	68.50
12	Feb 18-24	0	32.00	24.10	90.86	68.14
13	Feb 25-03	0	31.90	23.70	92.90	66.97
14	Mar 04-10	0	32.00	23.70	89.55	66.25
15	Mar 11-17	0	31.90	23.80	92.00	66.60
16	Mar 18-24	0	31.97	22.90	92.00	65.00
17	Mar 25-31	0	31.90	23.50	90.86	65.00
18	April 01-07	0	32.20	19.60	92.90	64.00
19	April 08-14	59	32.00	20.70	89.55	64.00
20	April 15-21	64	33.00	24.30	88.00	63.00
21	April 22-30	5.00	33.00	24.30	89.00	64.00

APPENDIX II

SCORE CARD FOR ORGANOLEPTIC EVALUATION

Name of the student: Shivakumara Y.B.

Date:

Characteristics	**Scores**				
	A	**B**	**C**	**D**	**E**
Appearance					
Colour					
Flavour					
Texture					
Odour					
Taste					
Overall acceptability					

9 point Hedonic scale

Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

Signature:

Abstract

EVALUATION OF NETTED MUSK MELON (*Cucumis melo* var. *cantalupensis* Naudin.) FOR GROWTH, YIELD AND QUALITY

by

SHIVAKUMARA Y.B.
(2017-12-026)

ABSTRACT
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Faculty of Agriculture
Kerala Agricultural University

DEPARTMENT OF VEGETABLE SCIENCE
COLLEGE OF AGRICULTURE
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2019

ABSTRACT

The present investigation entitled "Evaluation of netted musk melon (*Cucumis melo* var. *cantalupensis* Naudin.) for growth, yield and quality" was conducted at the Department of Vegetable Science, College of Agriculture, Vellayani, from December 2018- March 2019 to evaluate netted muskmelon in Kerala for growth, yield and quality and thereby its adaptability.

The experimental material consisted of 20 netted muskmelon genotypes, including seven varieties and thirteen hybrids. The experiment was laid out in RBD with two replications. Analysis of variance revealed significant difference among the twenty genotypes for all the characters studied. Avtar produced the longest vine of 1.84 m which was on par with Pahuja (1.74 m) and Gujarath muskmelon-3 (1.68 m). Airex was early in flowering, it took 34.01 days for female flower production and 27.56 days for male flower production respectively. The genotypes NS-910 (35.46 days) and Madhuras (36.53 days) were on par with Airex for female flower production. Lowest sex ratio was recorded in Kashi Madhu (5.23) which was on par with Hita (5.97) and Pusa Madhuras (6.00).

Maximum fruit diameter was observed in NS-915 (11.78 cm). Maximum fruit weight was noticed in NS-915 (625.86 g) which was on par with Jindal (600.26 g) and NS-910 (594.73 g). Syed was the earliest to harvest (71.15 days) and NS-910 (72.35 days) was on par with it. Highest number of fruits per plant was recorded in Hita (3.66) and it was on par with NS-915 (3.64), Airex (3.15) and Novel (2.95). Maximum yield plant^{-1} of 1.20 kg was recorded for NS-915 which was on par with Jindal (1.10 kg), Pahuja (1.00 kg) and Hita (0.99 kg). Maximum yield plot^{-1} of 2.14 kg was recorded in NS-915. Two genotypes, *viz*., Jindal (1.950 kg) and Hita (1.770 kg) were on par with it.

Highest flesh cavity ratio was noticed in NS-915 (1.52) and highest total soluble solids content was recorded in NS-915 (8.07° B). Highest beta carotene content was obtained in the genotype Kashi Madhu (9.92 mg/100 g) which was on par with G-kart (9.74 mg/100 g) and NS-910 (9.30 mg/100 g). The highest total

sugar content was recorded in Pusa Madhuras (4.06 %) which was on par with Syed (4.00 %). Highest reducing sugar content was noticed in the genotype Syed (3.36 %) and Sugar Summer (3.03 %) was on par with it. Pusa Madhuras recorded highest non reducing sugar content (1.53 %). Downy mildew and fruit fly were the major problems observed during the study. Sensory evaluation revealed the superiority of the hybrid NS-915 for appearance, colour, flavour, taste, texture and overall acceptability over other genotypes.

High phenotypic and genotypic coefficients of variation (PCV and GCV) were noticed for most of the yield contributing characters *viz*., fruit weight (41.69 and 41.21), yield plant^{-1} (50.91 and 47.59) and fruit diameter (27.6 and 25.55). High estimates of heritability coupled with high to moderate genetic advance as per cent of mean was recorded for all the yield components, indicating additive gene action.

Yield had positive and significant correlation at both genotypic and phenotypic level for the yield contributing characters such as fruit diameter (0.988 and 0.835), fruits plant^{-1} (0.726 and 0.607), fruit weight (0.945 and 0.871), seeds fruit^{-1} (0.741 and 0.694) and weight of 100 seeds (0.925 and 0.720) respectively. Path coefficient analysis revealed that average fruit weight showed the highest positive direct effect on fruit yield followed by fruits plant^{-1}, days to first harvest, node to first female flower, fruit diameter and seeds per fruit. The genotypes were ranked based on selection index score considering the major characters *viz*., vine length, days to first female flower, node to first female flower, fruit diameter, fruits plant^{-1}, fruit weight, days to first harvest, seeds fruit^{-1}, 100 seed weight and yield plant^{-1}. NS-915 recorded highest selection index score of (803.04) followed by Jindal (748.25).

Based on the mean performance of the genotypes for various characters and selection index score, the top ranking hybrid was NS-915 and variety Gujarat Local. The hybrids NS-915 and Jindal were found suitable for growing under south Kerala conditions.