PERFORMANCE OF ADVANCED BREEDING LINES OF BRINJAL (*Solanum melongena* L.) FOR BACTERIAL WILT DISEASE RESISTANCE, YIELD AND QUALITY ATTRIBUTES

SAHANA, K. P.

UHS16PGM839

DEPARTMENT OF VEGETABLE SCIENCE
COLLEGE OF HORTICULTURE,
UHS CAMPUS, GKVK, BENGALURU- 560065
UNIVERSITY OF HORTICULTURAL SCIENCES
BAGALKOT – 587 104

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By

SAHANA, K. P.

DEPARTMENT OF VEGETABLE SCIENCE
COLLEGE OF HORTICULTURE,
UHS CAMPUS, GKVK, BENGALURU- 560065
UNIVERSITY OF HORTICULTURAL SCIENCES
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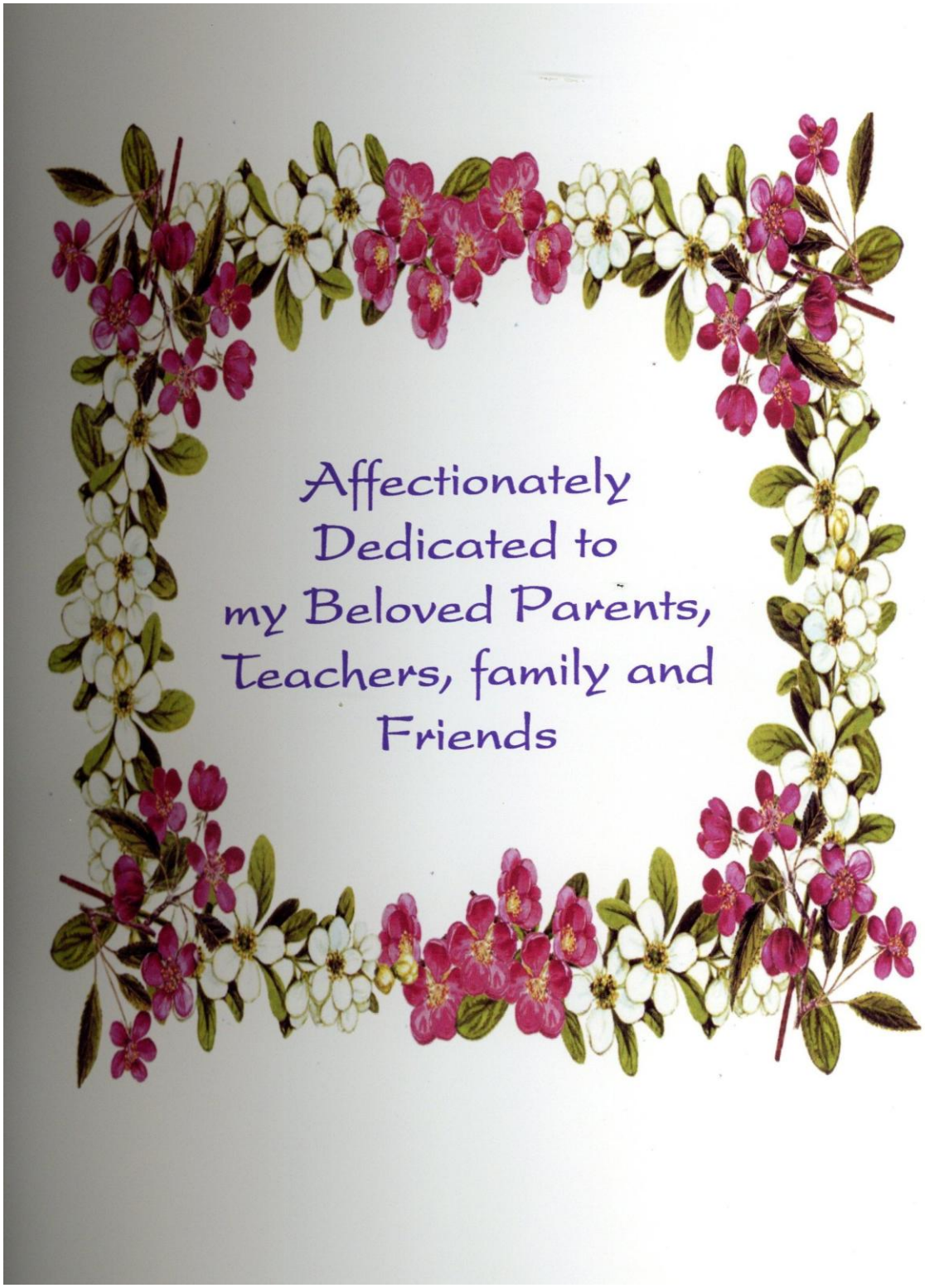
Affectionately
Dedicated to
my Beloved Parents,
Teachers, family and
Friends

UNIVERSITY OF HORTICULTURAL SCIENCES, BAGALKOT
COLLEGE OF HORTICULTURE, BENGALURU
DEPARTMENT OF VEGETABLE SCIENCE

CERTIFICATE

This is to certify that the thesis entitled **"PERFORMANCE OF ADVANCED BREEDING LINES OF BRINJAL (*Solanum melongena* L.) FOR BACTERIAL WILT DISEASE RESISTANCE, YIELD AND QUALITY ATTRIBUTES**" submitted by **Ms, SAHANA, K. P., ID No. UHS16PGM839** in partial fulfillment of the requirements for the award degree of **MASTER OF SCIENCE (Horticulture)** in **VEGETABLE SCIENCE** to the University of Horticultural Sciences, Bagalkot, is a record of bona fide research work done by him during the period of his study in this university under my guidance and supervision and no part of the thesis has been previously submitted for the award of any other degree, diploma, associateship, fellowship or any other similar titles.

Place: Bangalore
Date: July, 2018

(JYOTHI KATTEGOUDAR)
Major Advisor

Approved by:

CHAIRMAN : _____
(JYOTHI KATTEGOUDAR)

MEMBERS : 1. _____
(H.B. LINGAIAH)

2. _____
(C.G. SANGEETHA)

3. _____
(PADMANABHA, K.)

4. _____
(S.J. PRASHANTH)

5. _____
(JAYASHREE UGALAT)

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"Gratitude is a memory of the heart", no scientific endeavor is a result of individuals effect. Therefore it is a matter of pleasure at this endeavor to recall all the faces and spirits in the form of teachers, friends, near and dear once. But it is often difficult to put once feelings in to words and is the most difficult to accomplish and to express all my feelings and sense of gratitude in words.

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Bangalore Signature

July, 2018 **(Sahana, K. P.)**

PERFORMANCE OF ADVANCED BREEDING LINES OF BRINJAL (*Solanum melongena* L.) FOR BACTERIAL WILT DISEASE RESISTANCE, YIELD AND QUALITY ATTRIBUTES

ABSTRACT

A field experiment was carried out during 2017-18 at Department of Vegetable Science, College of Horticultural, Bengaluru to study the performance of advanced breeding lines of brinjal for bacterial wilt disease resistance, yield and quality attributes. The experiment was conducted separately for green long and green round genotypes of brinjal. Fourteen green long genotypes were evaluated in two replications in randomized complete block design along with parents (Green Long and IIHR-3) and checks (Arka Kusumakar and Arka Anand). In green round segment, ten genotypes along with parents (RGR and WCGR) were evaluated in three replications in randomized complete block design. In green long segment, highest yield (836.11g per plant) was obtained in the genotype 170-9-26, maximum number of branches per plant (6.56) were noticed in 170-19-26, least number of days to first and fifty per cent flowering (36.70 and 42.90 days respectively) in 46-6-4, maximum number of fruits per plant (26.31) in 170-19-26, highest average fruit weight (38.58 g) in 170-9-30, maximum fruit length (15.80cm) in 46-3-32, and maximum fruit width (3.10cm) in 170-9-11was observed. In green round segment, highest yield (754.64g per plant) was obtained in the genotype 30-2-7, maximum number of branches per plant (6.82) was noticed in 249-10-29, least number of days to first and fifty per cent flowering (37.53 and 44.30days respectively) in 30-1-42, maximum number of fruits per plant (20.44) in 30-2-12, highest average fruit weight (46.13g) in 30-1-18, maximum fruit length (5.80cm) in 30-1-41 and maximum fruit width (4.27cm) in 30-1-18 was noticed. Nine (46-3-32, 46-3-35, 170-11-1, 170-11-11, 170-9-11, 170-9-30, 170-9-15, 170-9-19 and 170-19-26) and five (30-2-7, 30-2-12, 30-1-7, 249-10-29 and 249-10-54) advanced breeding lines were resistant to bacterial wilt disease in green long and green round segments respectively. With respect to quality parameter, phenol content in fruit was lowest in the genotype 170-9-19 (2.02 GAE mg/g) among green long segment and 30-1-41 and 249-10-54 (1.55 GAE mg/g) among green round segment.

Sahana, K. P. Jyothi Kattegoudar

Chairman

ಮುಂದುವರೆಸಿದ ಬದನೆಯ ಸಂಕರಣ ತಳಿಗಳ ದುಂಡಾಣು ಸೊರಗುರೋಗ ನಿರೋಧಕತೆ, ಇಳುವರಿ ಮತ್ತು ಗುಣಮಟ್ಟದ ಮೌಲ್ಯಮಾಪನ

ಸಾರಾಂಶ

ಪ್ರಸ್ತುತ ಪ್ರಯೋಗವನ್ನು 2017-18 ರ ಅವಧಿಯಲ್ಲಿ ತರಕಾರಿ ವಿಜ್ಞಾನ ವಿಭಾU,À ತೋಟಗಾರಿಕಾ ಮಹಾವಿದ್ಯಾಲಯ, ತೋ.ವಿ..ವಿ., ಆವರಣ, ಜಿ.ಕೆ.ವಿ.ಕೆ. ಅಂಚೆ, ಬೆಂಗಳೂರಿನಲ್ಲಿ ಕೈಗೊಳ್ಳಲಾಯಿತು. ಈ ಪ್ರಯೋಗವನ್ನು ಹಸಿರು ಉದ್ದನೆ ಮತ್ತು ದುಂಡಾಕಾರದ ಬದನೆ ತಳಿಗಳಿಗೆ ಪ್ರತ್ಯೇಕವಾಗಿ ನಡಸಲಾಯಿತು. ಈ ಪ್ರಯೋಗದಲ್ಲಿ, ಗ್ರೀನ್‌ಲಾಂಗ್ ಮತ್ತು ಐ.ಐ.ಎಚ್.ಆರ್-3, ಹಾಗೂ ರಾಯದುರ್ಗ ಗ್ರೀನ್‌ರೌಂಡ್ ಮತ್ತು ವೆಸ್ಟ್‌ಕೋಸ್ಟ ಗ್ರೀನ್‌ರೌಂಡ್ ಸಂಕರಣ ತಳಿಗಳ ಎಫ್3:4 ಪೀಳಿಗೆಯಲ್ಲಿ ದುಂಡಾಣು ಸೊರಗುರೋಗ ನಿರೋಧಕತೆ, ಇಳುವರಿ ಮತ್ತು ಗುಣಮಟ್ಟದ ಕುರಿತು ಸಂಶೋಧನೆ ಕೈಗೊಳ್ಳಲಾಯಿತು. ಹಸಿರು ಉದ್ದ ಬದನೆಯ ತಳಿಗಳಲ್ಲಿ, ಹೆಚ್ಚಿನ ಇಳುವರಿ (830.11 ಗ್ರಾಂ. ಪ್ರತಿ ಗಿಡಕ್ಕೆ) 170-9-26 ತಳಿಯಲ್ಲಿ, ಮೊದಲ ಮತ್ತು ಶೇಕಡ 50ರಷ್ಟು ಹೂಬಿಡುವ ದಿನಗಳಾಗಿ (36.70 ಮತ್ತು 42.70 ದಿನಗಳು) 46-6-4 ತಳಿಯಲ್ಲಿ, ಪ್ರತೀ ಗಿಡ್ಡಕ್ಕೆ ಹೆಚ್ಚಿನ ಕಾಯಿಗಳ ಸಂಖ್ಯೆಯನ್ನು (26.31) 170-19-26 ತಳಿಯಲ್ಲಿ, ಹೆಚ್ಚಿನ ಪ್ರತಿ ಕಾಯಿಯ ಉದ್ದವನ್ನು (15.80 ಸೆಂ. ಮೀ.) 46-3-36 ತಳಿಯಲ್ಲಿ ಮತ್ತು ಹೆಚಿನ ಪ್ರತಿಕಾಯಿಯ ಅಗಲವನ್ನು (3.10 ಸೆಂ. ಮೀ.) 170-9-11 ತಳಿಯಲ್ಲಿ ಗುರುತಿಸಲಾಗಿದೆ. ಹಸಿರು ದುಂಡಾಕಾರದ ಬದನೆಯಲ್ಲಿ, ಹೆಚ್ಚಿನ ಇಳುವರಿ (754.64 ಗ್ರಾಂ. ಪ್ರತಿ ಗಿಡಕ್ಕೆ) 30-2-7 ತಳಿಯಲ್ಲಿ, ಮೊದಲ ಮತ್ತು ಶೇಕಡ 50ರಷ್ಟು ಹೂಬಿಡುವ ದಿನಗಳಾಗಿ (37.53 ಮತ್ತು 44.30 ದಿನಗಳು) 30-1-42 ತಳಿಯಲ್ಲಿ, ಪ್ರತೀ ಗಿಡ್ಡಕ್ಕೆ ಹೆಚ್ಚಿನ ಕಾಯಿಗಳ ಸಂಖ್ಯೆಯನ್ನು (20.44) 30-2-12 ತಳಿಯಲ್ಲಿ, ಹೆಚ್ಚಿನ ಪ್ರತಿ ಕಾಯಿಯ ಉದ್ದವನ್ನು (5.80 ಸೆಂ. ಮೀ.) 30-1-41 ತಳಿಯಲ್ಲಿ ಮತ್ತು ಹೆಚ್ಚಿನ ಪ್ರತಿಕಾಯಿಯ ಅಗಲವನ್ನು (4.27 ಸೆಂ. ಮೀ.) 30-1-18 ತಳಿಯಲ್ಲಿ ಗುರುತಿಸಲಾಗಿದೆ. ವಿವಿಧ ಬದನೆಯ ತಳಿಗಳಿಲಿ,ೆಲ 9 ಉದ್ದನೆಯ ತಳಿಗಳು (46-3-32, 46-3-35, 170-11-1, 170-11-11, 170-9-11, 170-9-30, 170-9-15, 170-9-19, 170-19-26) ಹಾಗೂ ಐದು ದುಂಡಾಕಾರದ ತಳಿಗಳು (30-2-7, 30-2-12, 30-1-7, 249-10-29, 249-10-54) ದುಂಡಾಣು ರೋಗ ನಿರೋಧಕ ಶಕ್ತಿಯನ್ನು ಹೊಂದಿವೆ. ಹಣ್ಣಿನ ಗುಣಮಟ್ಟಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಫೀನಾಲ್ ಅಂಶವು ಉದ್ದ ಬದನೆಯ 170-9-19 ತಳಿಯಲ್ಲಿ ಹಾಗೂ ದುಂಡಾಕಾರದ ತಳಿಯಾದ 30-1-41 ಮತ್ತು 249-10-54 ಗಳÀಲ್ಲಿ ಕಡಿಮೆ ಪ್ರಮಾಣದಲ್ಲಿ ಕಂಡುಬಂದಿದೆ.

ಸಹನಾ, ಕೆ. ಪಿ.

ಜ್ಯೋತಿ ಕಟ್ಟೇಗೌಡರ್
ಮುಖ್ಯ ಸಲಹೆಗಾರರು

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I. INTRODUCTION

Brinjal (*Solanum melongena* L.) is well known as eggplant or aubergine belongs to the family solanaceae, It is one of the major vegetable crops grown in the country. The name eggplant is derived from the shape of the fruit of most of the varieties, which are white in colour and similar to the shape of chicken eggs. The family solanaceae contains 90 genera and over 2800 species, out of which about 150-200 are tuber bearing. The majority of species of about 1800 are non-tuber bearing types. Among non tuber forms, 22 species are originated in India and are with diploid chromosome number 24. The origin and evolution process is preceded to evolving of several advanced cultivars and numerous landraces in India (Karihaloo and Gottileb, 1995).

Eggplant is a perennial, warm weather crop however grown commercially as an annual crop. Owing to its highest production potential and availability of the produce to consumers, it is also termed as poor man's vegetable. It is grown extensively in India, Bangladesh, Pakistan, China, Japan and Philippines. Major brinjal producing states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh. It is an important crop grown in India with a production of 12.40 million tonnes in an area of 0.67 million hectares with average productivity of about 18.50 t/ha (Anon., 2017).

India is regarded as primary centre of origin of brinjal (Vavilov, 1931). There are three main botanical varieties under the species *melongena.* The common brinjal, to which large, round or egg shaped fruit forms are botanically grouped under *esculentum* complex. The long, slender types are included under *serpentinum* complex and the dwarf brinjal plants are put under *depressum* complex. India is being primary centre of origin for brinjal, has a wide range of variability in plant type, stem colour, leaf size, leaf tip, midrib colour, fruit size, shape, colour, yield, fruit quality, cooking quality and tolerance to pests and diseases. Fruit colour varies from light to dark purple, almost black, green or white. Fruit length varies from 4-45 cm and thickness 2-35 cm, in different shapes and weight ranging between 15-1500 g. The fruits are set as solitaire or in clusters, up to five fruits per cluster. Physiologically ripened fruits turn brown followed by red or yellow (Swarup, 1995).

Brinjal is known to be affected by many diseases like bacterial wilt, fusarium wilt, little leaf, *etc.* and pests like shoot and fruit borer, jassids, thrips and other pests which cause damage throughout growth and reproductive stages. Among the diseases, bacterial wilt of eggplant has been treated as one of the major constraint in eggplant cultivation (Ali, 1993). Bacterial wilt [*Ralstonia solanacearum* (Smith)] and fungal wilts (*Fusarium solani* f.sp. *melongenae*, *Rhizoctonia solani, Verticillium dahliae* Kleb. and *Sclerotium rolfsii* Sacc.) are major wilt causing diseases in brinjal.

Most of commercially grown cultivars of brinjal are susceptible to bacterial wilt disease. Yield losses vary from 20-100 per cent because of disease incidence (Singh, 1995). Wilt problems are especially severe in the humid tropics (Rahman *et al.,* 2011). The bacterial wilt is caused by *Ralstonia solanacearum* (Smith). There are different sources of bacterial wilt disease resistance like, *S. melongena, S. torvum, S. sisymbrifolium, S. aethiopicum, S. xanthocarpum, S. toxicarum and S. nigrum* (Kalloo, 1994). Resistance is greatly affected by environmental factors, race and strain diversity of the pathogen apart from non acceptable fruit quality which makes it very difficult to utilize these resistant sources in different situations.

Bacterial wilt is a soil borne disease, which is caused by *Ralstonia solanacearum* (Smith) strains. It is classified into five races based on their host range and into five biovars on the basis of differential ability to produce acid from a panel of carbohydrates. It was first described in 1896 by E. F. Smith and later found that it has wide range of host. The solanaceous crops are mainly affected by race-1 and race-3. Infected seeds and tubers serve as primary source of inoculum

and infected soil, irrigation water and implements serves as secondary source of inoculum. The pathogen enters the plant through wounded roots and progressively invades the stem vascular tissues to a sudden wilting while the plant is still green and further leads to death of plant, the affected plant show vascular discoloration which may be accompanied by browning and rotting of tissues inside the vascular bundles. The disease can be confirmed by conducting ooze test where the cut surface of the infected plant's collar region is dipped in water which shows a white milky stream of bacteria ooze coming out.

The pathogen *Ralstonia* is a gram (-) negative bacterium, having single cell with a rod shaped structure with an average size of 0.5–0.7 × 1.5–2.5 µm (Jyothi *et al.,* 2012). It requires an optimum temperature of 27–35^{0}C for its growth. The growth of this bacterium is inhibited in acid medium, at elevated temperature (40^{0}C) and at lower temperature (4^{0}C).

Even though there are various cultural, biological and chemical control measures have been suggested for the management of bacterial disease, these are found to be less effective. Thus the resistant cultivars offer a satisfactory solution for the control of the disease. Unlike tomato, sweet pepper and brinjal has considerable regional preference for shape, size and colours of fruits. The purple colour fruits are most esteemed in northern parts of the country, long and green types are preferred in Bihar and southern Karnataka whereas, round and green types are preferred in Orissa. In northern parts of Karnataka people prefer green round or oval brinjal fruits with purple stripes. Therefore, brinjal breeders have to aim at evolving genotypes that are more preferred for each region and yet to be efficient and show substantial increase over the existing types with respect to yield and other economic characters.

Therefore, the development of resistant varieties having good horticultural attributes as well as suitable for particular region is most economic, eco-friendly and feasible method to ensure better productivity of brinjal. In this regard, the advanced breeding lines were developed in both green long and green round segments of brinjal. There is no improved variety in green round segments of brinjal and hardly few number of varieties in green long segments of brinjal. The present research is formulated to evaluate developed advanced breeding lines of both green round and green long segments of brinjal with the following objectives.

- To study the performance of advanced breeding lines of brinjal for growth, yield, and quality attributes.
- To study the comparative performance of advanced breeding lines of brinjal for bacterial wilt disease resistance.

II. REVIEW OF LITERATURE

Brinjal (*Solanum melongena* L.), is one of the most important solanaceous vegetable crop grown year round in tropical and sub-tropical regions of the world. Brinjal is a rich source of vitamins and minerals. However the production is hindered by many biotic and abiotic stress causing factiors. Among biotic stresses, bacterial wilt is one of the most devastating disease causing yield loss up to 86.14 per cent (Sabita *et al.,* 2000). It is caused by *Ralstonia solanacearum* (Smith), the gram negative bacterium, previously known as *Pseudomonas solanacearum* (Smith).

Disease incidence is a complex interaction between the environment, pathogen strains and host plants. During recent years, voluminous literatures on development of various varieties and modern technologies have been reported. Furthermore, due to lack of stable resistance, the identification of new bacterial wilt resistant lines or varieties with good horticultural traits is a basic prerequisite.

2.1 Performance of advanced breeding lines of brinjal for growth and yield attributes

Chaudhary and Pathania (1998) perused the fruit yield and yield attributing characters in eight genotypes (Arka Nidhi, Pusa Purple Cluster, SM6-6, Arka Keshav, Arka Neelkanth, Hisar Shyamal, Punjab Barsati and SM6-7) of aubergine and revealed the sufficient diversity for fruit diameter, fruit length, fruit weight, number of fruits per plant and total soluble solids. The fruit yield ranged from 0.91 (Punjab Barsati) to 1.67 kg per plant (Hissar Shyamal).

Asati (2001) evaluated brinjal varieties of round segment, results showed that CHBR-3 as well as ABR-1, KS-224 and DBR-8 proved their superiority for most of the yield contributing characters namely plant height, number of primary branches per plant, shoot diameter, number of flowers per cluster, percentage of medium styled flowers, weight per fruit, plant spread, plant stand and fruit diameter.

Paikra (2001) evaluated 22 brinjal hybrids. Among round segment Pusa Hybrid-6 was recorded highest plant height (69.38 cm) with the maximum number of branches (12.40), maximum number of fruits (14.90) and highest yield per plant (2529.83 g). Maximum fruit girth (32.82 cm) was also observed in Pusa Hybrid-6 with maximum average weight per fruit (345.16 g) resulting in highest yield (68.51 t/ha). BH-2 was found earliest to 50 per cent flowering (34.00 DAT), whereas the highest fruit set was recorded in JBH-1 (60.34%). Maximum plant height was recorded in NDBH-13 (75.14 cm). However ANK-541 recorded maximum number of fruits per plant (25.20), but the highest yield (95.17 t/ha) was obtained in KBHL-1.

Baswana *et al.* (2002) recorded the significant genotypic differences among the genotypes of brinjal, and registering the highest number of fruits per plant in Arka Sirish, whereas CHBR-1 had the highest fruit weight. H-17 showed the lowest number of days to 50 per cent flowering and however the highest fruit yield was recorded in AB-1 genotype.

Pusa Purple Cluster and Pusa Anupam recorded the highest yields, 0.53 and 0.49 kg per plant, respectively and are at par with each other. The yield was lowest in Arka Keshav (0.37 kg per plant). Pusa Purple Cluster exhibited the best performance among all cultivars. Katoch and Pathania (2002).

Osman *et al.* (2003) evaluated local types of brinjal. The differences in yields among local types are recoreded at place Shendi and yields are varied from 44.4 to 117.2 t/ha, where cultivar Black Beauty was found to be highest yielder. At Hudeiba, the maximum yields of 43.5 and 39.8

tons/ha were recorded by cultivars Fort Myer's Market and Florida Market. At the Gezira, Black Beauty (33.4 tons/ha) performed best, while at Sennar, the yields of local cultivars varied from 50.0 to 57.7 tons per hectare, were the cultivars found be better are Spherical (57.7), Wizzo (51.5) and Black Beauty (50.0), while at Jebel Marra the yield range from 27.4 to 32.0 tons/ha. The lowest yields were found at Shambat with ranging from 8.6 to 21.2 tons per hectare. The study concludes the performance of genotypes are varied with region to region, hence breeding straties are need outlined for particular location to enhance the genotype performance in terms of yield.

Illangakoon *et al.* (2004) the highest fruit numbers and yields were recorded in EGH-184 and EGH-314 (hybrids). Chaurasia *et al.* (2005) reported that the G × E linear interaction was found to be significant for plant height, fruit length, fruit diameter, fruit size, number of fruits per plant and ten fruit weight are indicated that linear and non-linear components were significant. Based on overall performance, KS-331, KS-224 and H-7 were found promising entries, recorded high yield and exhibited stable performance for most of the characters. KS-224 was superior in yield, followed by KS-331 and H-7. These lines can be recommended for general cultivation and utilized in breeding programmes to incorporate stability.

Maharana *et al.* (2006) evaluated 20 aubergine cultivars includes 15 hybrids and 5 open-pollinated cultivars for growth and yield performance at Bhubaneswar of Orissa in India. Saptarathi had the greatest leaf area, total dry matter accumulation, number of fruits, and yield. Its yield was 32 % higher than the average yield of the control cultivars. Nisha and Green Gold were the next best hybrids in terms of growth and yield. Ravaiya was inferior, recording a yield that was even lower than the yields of the five open-pollinated controls. The other 12 hybrids had lower yields than the open-pollinated cultivar BB 45C.

Seventeen cultivars of brinjal were evaluated by Meena *et al.* (2009). The highest yield of 4.15 kg per plant was obtained from Pusa Uttam. The cultivar Pusa Ankur was earliest which took 42.33 days to first flower from the date of transplanting. Cultivar Arka Kusumakar expressed the maximum number of fruits per plant (69.40) while cultivar Udaipur Local expressed the maximum fruit weight (110 g). The cultivars IC-90984, Udaipur Local, Pusa Purple Cluster and Pusa Bhairav with moderately high yield of 3.53, 3.42, 3.33 and 3.25 kg per plant respectively.

Ansari *et al.* (2011) found that the significant differences were observed for most of the traits. Mean performance showed that the cultivar IBWL recorded highest fruit yield of 1004 g per plant followed by PPC (974 g), GL (931 g), MK (918 g) and PPR (872 g) whereas, in F_1^s PPC×PPR registered a fruit yield of 1347 g per plant followed by WBPF×PPR (1317 g), IBWL×PPR (1293 g), IBWL×PPC, PPL×PPR (1287 g), WBPF×PPC (1282 g), IBWL×WBPF and PPL×PPC (1274 g).

Chattopadhyay *et al.* (2011) reported that the brinjal genotypes under study found highly significant variations among twelve quantitative traits. However, a wide range of days to 50 per cent of flowering (47-79), fruit length (8.70- 23.90 cm), fruit girth (2.67-10.30 cm), fruit weight (52.33-319.37 g), number of marketable fruit per plant (4.33-12.00) and marketable fruit yield per plant (0.39- 1.68 kg) among the genotypes was observed.

Praneetha *et al.* (2011) evaluated 81 brinjal genotypes. Results showed that marketable yield per plant had significant positive association for all the characters studied namely plant height, number of branches per plant, fruit girth, calyx length, number of fruits per plant, single fruit weight.

The study on performance of parents and their hybrids for different traits attributing for yield in Manjari Gota type of brinjal was conducted by Suresh *et al.* (2012). Among the parents used for investigation IIHR 571(T_3), IIHR-500A (T2) and IIHR- 574(L_3) were high yielding of 1.60,

1.30 and 1.26 kg per plant respectively. The hybrids IIHR-575 × IIHR-500A ($L_4 \times T_2$) , IIHR- 574× IIHR-500A($L_3 \times T_2$) and IIHR-570 × IIHR-438-2($L_7 \times T_1$) recorded high yield of 2.73, 2.41 and 1.86 kg per plant and showed highest estimated yield of 57.40, 53.70 and 41.40 tonnes per hectare respectively in Manjarigota type of brinjal. The promising hybrids IIHR-575 × IIHR-500A ($L_4 \times T_2$), IIHR- 574× IIHR-500A ($L_3 \times T_2$), and IIHR-570 × IIHR-438-2 ($L_7 \times T_1$) can be further subjected to selection to isolate desirable genotypes in Manjari Gota type of brinjal.

Kumar and Arumugam (2013) reported mean performance of different brinjal genotypes EP-27 (1.93 kg) registered the highest fruit yield per plant followed by EP-3 (1.83 kg). The genotype Keerikai showed the earliness of 75.00 (Keerikai Local), recorded highest ascorbic acid content of 13.87 mg per 100 g, followed by Kallampatty.

Panwar *et al.* (2013) evaluated eight brinjal varieties. Among them the variety PPL-74 took less number of days to flowering and first harvest with an average of 45 to 55 days after transplanting, respectively. The mean of two successive year PPL-74 was found superior over rest of other hybrids with respect to most of desirable characters fruit length (22.05 cm), fruit stalk length (6.98 cm), plant spread (126.16 cm), marketable fruit yield (712.96 t/ha), while minimum values for most of the parameters were observed in PB-67 and Chaya proved the second best hybrids in respect to the most of characters.

Sanas *et al.* (2012) studied the performance of thirteen local brinjal genotypes (*Solanum melongena* L.). All these thirteen brinjal genotypes showed significant variation in physical fruit characters and yield characters. Physical parameter *viz.,* weight of fruit, length and girth of fruit, shape of fruit and colour of fruit showed notable variation among all the genotypes of brinjal. The genotype SML-5 recorded significantly the highest fruit length (23.01 cm). However, the genotype SML-8 showed the longest fruit breadth (8.03 cm). The highest fruit weight was reported by the genotype SML-3 (178.94 g).

Hanchinmani and Imamsaheb (2015) evaluated six varieties of brinjal, among the different varieties, significantly higher plant height (61.83, and 94.13 cm at 60 and 90 DAT respectively) was observed in V_2 (Arka Shirish), followed by V_3 (Arka Kusmakar) (51.03 and 80.73 cm at 60 and 90 a DAT, respectively). Significantly higher fruit yield per hectare (13.01 t/ha) was recorded in V_5 (CVK) compared to all the other genotypes.

Jaswani *et al.* (2015) examined 15 genotypes, Pusa Purple Cluster was recorded significantly higher potential in most of traits *viz.,* highest plant height at 90 DAT(92.5cm), number of branches per plant at 90 DAT (19.9cm), Pusa Purple Cluster was observed significantly superior which recorded number of fruits per plant (24.6) followed by Green Express-666 (19.5), genotype Kanahiya was maximum in fruit weight(166.3 g) followed by Vijay SGS-548(153.4 g), Pusa Purple Cluster was superior and gave maximum (36.2 t/ha) (1.856 kg/plant) Green Express-666 (F_1) (34.5t/ha), (1.75 kg/plant) fruit yield/ha and yield/plant respectively, maximum fruit yield of (36.25 t /ha) was obtained in brinjal variety Pusa Purple Cluster.

Thirty brinjal genotypes were evaluated by Nirmala and Vethamoni (2016). ABSR-2 recorded the maximum number of fruits and fruit yield per plant. Whereas, EC316201 was found to be best for number of branches, number of fruits, fruit yield per plant next to ABSR-2. The genotype Devachinnampatti Local was found to be good for the earliest flowering, yield per plant and protein content. The three genotypes *viz.,* ABSR-2, EC316201 and Devachinnampatti local are found to be superior in terms of quality, yield, number of fruits per plant and other yield contributing characters.

Reshmika (2016) evaluated 36 genotypes of brinjal (*Solanum melongena* L.). Jawahar Brinjal-347 (41.47 t/ha) followed by IC-90123(36.00 t/ha), IC-90933(31.92 t/ha) and ABSR- 2 (29.69 t/ha) were superior for yield character. The genotype IC-89908 recorded highest early

yield per plant (0.165 kg) followed by Aruna (0.104 kg). The genotype Swetha recorded highest phenol content of 470 mg/100g followed by Rajendra Brinjal, and per cent dry matter of fruit ranged from 7.34 (IC-90123) to 14.20 % (IC -545920).

Malshe *et al.* (2016) evaluated the performance of brinjal highest plant height was recorded in Arka Nidhi (87.77 cm). The maximum fruit length (16.62 cm) was recorded in variety Bandhtivare while maximum fruit circumference (20.70 cm) was recorded in Manjari Gota variety. The maximum average fruit weight (94.34 g) was found in variety Bandhtivare and the minimum fruit weight (57.34 g) was in Arka Nidhi. The highest yield (19.0 t/ha) was recorded in the variety CHES-309 followed by Arka Nilkanth (16.87 t/ha). The incidence of bacterial wilt was maximum (66.50 %) in variety Manjari Gota.

Sharma and Banyal (2016) examined twenty three variable genotypes of brinjal, maximum yield per plant (2.08 Kg) was observed in Pant Samrat followed by Punjab Sadabahar (1.88K g) and Neelima (1.82 Kg). Highest fruit length (19.83 cm) was observed in LS-7 followed by LS-12 (17.25 cm). The highest number of fruits per plant (35.66) was recorded in Pant Samrat followed by Neelima (34.66). Average fruit weight among the genotypes ranged between 36.39 g to 190.50 g with maximum value in Hisar Shyamal followed by LS-3 (179.00 g). Least number of days to first picking were observed in LS-7 (68.00 days) followed by LS-1 (76.00 days).

Bhavana and Singh (2016) were examined one hundred germplasm of brinjal. The highest yield was recorded in IC285126 (3.29 kg/plant; fruit weight 200.0 g; fruit length 11.40 cm) followed by IC-809900 (1.81 kg/plant; fruit weight 200.0 g; fruit length 16.50 cm).

Chaturvedi *et al.* (2016) evaluated ten varieties. Plant height and fruit set percentage were found maximum in the variety HABL-1. Whereas, number of primary and secondary branches were found maximum in Oblong White. In the respect of yield and contributing characters *i.e.* number of flower clusters per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit yield per plant, fruit yield per plot and fruit yield per hectare were found maximum in variety JNDBH-01.

Tripathy *et al.* (2017) evaluated eighteen brinjal genotypes. The genotype 2013/BRLVAR-5 took the shortest period of days to 50 per cent flowering. The genotype 2013/BRLVAR-6 recorded significantly higher number of fruits (2.80). The genotypes namely 2013/BRLVAR-1 (2.16), 2014/BRLVAR-3 (1.80) and 2014/BRLVAR-1 (1.73). Fruit length was maximum in Kashi Taru (21.23 cm) followed by the genotype 2013/BRLVAR-4 (18.02 cm) which were significantly superior to other genotypes. The genotype 2014/BRLVAR-1 was found superior over rest of other genotypes with respect to most of desirable characters like plant height (91.31 cm), plant spread (100.06 cm), fruit yield per plant (2.77 kg), marketable fruit yield (971.50 q/ha), while minimum values for most of the parameters were observed in KS-224 and 2014/BRRVAR-2.

Chaudhary *et al.* (2017) evaluated the performance of 6 genotypes and 3 commercial checks namely PB-300, PB-301, PB-302, PB-303, PB-304, PB-305, Kashi Tarun, Punjab Sadabahar and Pant Samrat. Variety Kashi Tarun proved the best with respect to fruit yield (49.07 t/ha).

Das *et al.* (2017) evaluated and characterized twenty-one genotypes of brinjal for forty-seven characters. This variation may be due to the effect of genotype, environment or their interaction. The genotype BCB-27 has the highest yield per plant for two seasons followed by BCB-8 to other genotypes in total fruiting period, fruit length and number of fruits per plant.

Sanga *et al.* (2017) evaluated different wild brinjal genotypes for fruit yield and quality Characters. Among all the genotypes, fruit weight (27.86 g), CHFG-5 had highest number of fruits per plant (93.66), fruit yield per plant (1.97 kg), total phenol (15.27 mg/100 g).

Syed *et al.* (2018) evaluated the performance of fifty genotypes of brinjal for yield, quality and resistance to bacterial wilt. The highest number of fruits per plant were recorded in genotype A42 (39.07) and maximum fruit yield per plant was recorded by the genotype A19 (2104.50 g). A5 recorded the highest ascorbic acid content (9.11 mg/100g) and the genotype A48 recorded the lowest incidence of bacterial wilt (1.33%).

The study on mean performance for yield and its quality characters of fifty different local types of brinjal was conducted by Jayalakshmi and Praneetha (2018). Among the genotypes, Sevanthampatty Local (123.23 cm) recorded highest plant height. Pachai Round (8.80) had the highest number of branches per plant. Karur Local and Udumalai Samba recorded earliest to first flowering (47.65 and 47.73 days), 50% flowering (55.20 and 55.31 days) and days to first harvest (66.81 and 67.03 days). Highest marketable yield per plant was recorded by Karur local (2.97 kg) followed by Udumalai Samba (2.86 kg). Similarly Karur Local (19.82 per cent) had lowest fruit borer infestation followed by Udumalai Samba (20.57 per cent).

2.2 Bacterial wilt disease resistance in brinjal

Brinjal fruit yield is affected by pests mainly shoot and fruit borer, jassids and thrips, and diseases like bacterial wilt, fusarium wilt, phomopsis blight, little leaf, etc. biotic stress causes damage throughout the growth and reproductive stages. The most of the commercially grown cultivars of brinjal are susceptible to bacterial wilt disease. The first description of *Pseudomonas* E.F. Smith, causing wilt disease of solanaceous plants was reported by Smith (1896). In India the first report on bacterial wilt of brinjal was given by Das and Chattopadhyay (1953) in West Bengal.

The bacterial wilt is caused by *Ralstonia solanacearum* (Smith), previously known as *Pseudomonas solanacearurn* (Smith) (Yabuchi *et al.,* 1995) leading to yield loss ranging from 4.24 to 86.14 per cent (Sabita *et al.,* 2000). Resistance is greatly affected by environmental factors like temperature at 29-35^0 C the resistance is lost and plant shows the symptoms and added with soil moisture, organic matter content and pH.

There are different sources of bacterial wilt disease resistant have been identified namely *S. melongena, S. torvum , S. sisymbrifolium, S. aethiopicum, S. xanthocarpum, S. toxicarum* and *S. nigrum* (Kalloo, 1994). The resistance depends on the race prevalence in that particular geographical region. So far several races are noted namely race -1, -2, and -3. The prevalence of races diversity of the pathogen makes very difficult to breed elite resistant lines. *Ralstonia solanacearum* (Smith) strains are categorised into four genetically distinct *phylotypes* that correspond to their geographical origin are *phylotypes* I (Asia), *phylotypes* II (The America), *phylotypes* III (Africa), and *phylotypes* IV (Indonesia). The prevalence of varied races and strains makes complexity to develop stable bacterial wilt resistant lines, this could be due to the lack of sufficient knowledge about genetics of bacterial wilt disease resistance and resistant source. Knowledge of pathogen physiology, pathogenicity, virulance is very essential to develop superior resistant varieties. Pathogenicity of bacterial wilt is mainly through infected seeds and infected plant debris serve as primary source of inoculums and infected soil, irrigation water and implements serves as secondary source of inoculums.

Gogoi *et al.* (2018) evaluated brinjal varieties and Utkal Green recorded the highest per plant fruit yield (2.32 kg/plant) leading to the maximum total marketable yield (46.96 t/ha) and longer active fruiting duration (43.70 days). It also showed resistant reaction to bacterial wilt, recording only 12.44 per cent wilt incidence as compared to other varieties where it was in the range of 34.44 to 62.2 per cent at 55 days after transplanting. Although, Ketan and Vijay Kiron recorded moderately higher per plant fruit yield of 1.52 and 1.47 kg/plant, respectively but their total marketable fruit production reduced substantially due to high incidence of bacterial wilt

(62.22 and 57.78%, respectively). The local cultivars, JC-1 and Longai exhibited moderately resistant reaction to bacterial wilt which registered 40.00 and 34.44 per cent respectively.

2.3 Economic importance of wilt disease

In brinjal, the disease can bring about total destruction of the crop during rainy season in all brinjal growing areas of Karnataka. In India, the loss in yield due to the bacterial wilt disease in brinjal as high as 80 per cent (Rao, 1976). Kishun (1987) recorded loss in yield ranging from 10 to 90 per cent, and plant mortality ranging from 10 to 100 per cent in tomato. Shekhawat *et al.* (1992) reported that, the disease was wide spread, endemic throughout India. However, the disease is more severe in the parts of Kerala, Gujarat, Karnataka, Western Maharastra, Madhya Pradesh, Eastern plains of Assam and Nicobar islands. In Karnataka, the disease is locally known as Parrya and Bangadiroga. The disease occurs in both *kharif* and *rabi* seasons and incidence varies from 0 to 98 per cent (Gadewar *et al.,* 1991).

2.4 Morphology of *Ralstonia solanacearum (Smith)*

Smith (1896) was the first to describe the shape and size of the bacterium. He reported rod shaped bacterium measuring 0.5 x 1.5 µm when 48 hours old culture was stained with methyl violet. The variations among the isolates infecting tomato, potato, brinjal and chilli were studied by measuring the size of the cell and they were found to be motile with lophotrichous flagellum, non-spore forming, gram negative and cell size ranged from 1.3 to 1.02 × 1.02 to 1.78 µm (Khan, 1974).

2.5 Pathogen and pathogenecity of bacterial wilt

Bacterial wilt is a soil borne disease, which is caused by *Ralstonia solanacearum* (Smith) strains. It is classified into five races based on their host range and into five biovars on the basis of differential ability to produce acid from a panel of carbohydrates. Biovar is a variant prokaryotic strain that differs physiologically and biochemically from other strains in a particular species. It was first described in 1896 by E. F. Smith. It has wide range of host like tomato, potato, brinjal, chilli, capsicum, tobacco, ornamentals and weeds. The solanaceous crops are mainly affected by race -1 and -3.

Bacterial wilt spread by infected soil and debris serve as primary source of inoculum and infected soil, irrigation water and implements serves as secondary source of inoculum. It is a non spore-forming, gram (-) negative bacterium do not retain the crystal violet stain and spread worldwide, in virtually all environments that support life. They are composed of a thin peptidoglycon cell wall sandwiched between an inner cytoplasmic cell membrane and a bacterial outer membrane having single cell with a rod shaped structure and an average size of 0.5 to 0.7 ×1.5 to 2.5 µm.

2.6 Performance of brinjal for bacterial wilt disease resistance

Sadashiva *et al*. (1994) evaluated seven eggplant lines resistant to bacterial wilt for their yield performance along with three susceptible checks in wilt sick soil followed by artificial inoculation. Among seven lines, four lines *viz.,* IIHR 124-2, WCGR, Rampur Local and Mattugulla showed 100 per cent survival, whereas, all the susceptible checks succumbed to bacterial wilt. Rampur Local (1.65kg per plant) was the highest yielder followed by West Coast Green Round (1.37 kg per plant).

Chaudhary and Sharma (2000) evaluated nine genotypes of brinjal *(Solanum melongena* L.) *viz.,* Arka Kesav, Arka Neelkanth, Hisar Shyamal, Pusa Purple Cluster, Pusa Purple Long, SM 6-6, SM 6-7, Arka Nidhi and Punjab Barsati. The genotypes Arka Kesav, Arka Neelkanth, Arka Nidhi and SM 6·6 were observed to be resistant to bacterial wilt.The highest survival per centage was recorded in cv. Arka Keshav (91.60%) followed by BB-60-C (90.0%), 95-4 Round (88.46%), and CHES-309 (87.50%). Minimum survival was recorded in cv. BB-44 (0.00%) after 150 days of transplanting. The highest fruit yield was recorded by cv. BB-46 followed by BB-60-C, BB-13-1, and Arka Nidhi. The cultivars BB-46 and BB-60-C were the most suitable varieties for crop production in Andaman and Nicobar Islands (Swaroop *et al.,* 2000).

Solanum torvum is a wild species of eggplant, it was identified as a potential source for bacterial wilt disease resistance for cultivated susceptible solanaceae species. It has been found that, *S. torvum* can be considered as resistant to race-1, biovar-1 strain, and tolerant to the race-1 biovar-3 and race-3, biovar-2 strains of *R. Solanacearum* (Clain *et al*., 2004).

Hussain *et al.* (2005) screened fifteen brinjal accessions in the sick bed pre inoculated with *Ralstonia solanacearum*. The population of *R. solanacearum* in sick soil was 2.1×10^7 cfu/g soil. The accession EG203 was resistant against the bacterium with lowest wilt incidence. The accession EG193 was moderately susceptible.

Rahman *et al.* (2011) screen out the resistant cultivars of eggplant against wilt disease. At 55 days after transplanting (DAT), the cultivar Luffa exhibit the highest bacterial wilt incidence (80%) and the lowest wilt incidence was recorded in the cultivar Kata Begun (30%). The highest shoot height was recorded in the cultivar Kata Begun and the lowest shoot height was recorded in the cultivar Singhnath. The highest yield per hectare (29.84 t/ha) was recorded in the cultivar Nayantara and the lowest yield (10.50 t/ha) was recorded in the cultivar Dhundhul. Among the cultivars Kata Begun graded as resistant for both Bacterial wilt.

Eight local brinjal (*Solanum melongena* L.) germplasm were screened against bacterial wilt caused by the pathogen *Ralstonia solanacearum* (Smith) by Mondal *et al.* (2013). Based on the results of screening, the local brinjal germplasm Midnapore Local (collected from the district of Midnapore) and Bhangar (collected from district of South 24 Parganas) were found tolerant to bacterial wilt and also possess marketable qualitative fruit characters which can be exploited by the breeder to develop resistant lines.

Gopalakrishnan *et al.* (2014) evaluated forty-one eggplant accessions in a sick plot for bacterial wilt resistance. Nine accessions *viz.,* IIHR-322, AVT-IIRES-1, AVT-IIRES-2, AVT-IIRES-4, AVT-IIRES-5, IIHR500-A, BPLH-1, IIHR-3 and IIHR-5 showed highly resistant reaction, with no wilting of plants; five accessions viz., RES-2, RES-5, RES-6, 37-36-4-4 and 36-37-13 showed resistance reaction with wilt incidence 3.33 -10.0 per cent. Two accessions *viz.,* 36-37-3 and 37-4-20 are showed moderately resistant reaction with 11.0 and 12.0 per cent wilt incidence, respectively. While, 22 accessions were moderately susceptible to highly susceptible, with wilt incidence ranging from 25.45 to 100.0 per cent.

Kumar *et al.* (2014) evaluated 9 brinjal accessions. Among the accessions, Arka Nidhi was found most resistant. But, two entries BEBWRES-05, Arka Nidhi were highly resistant with maximum wilt per cent of 7 and 19 respectively at 120 days interval, whereas BEBWRES-2, BEBWRES- 4 and SM 6-6 (C) with less than 40 per cent wilt at 120 days interval were found moderately resistant to bacterial wilt.

Evaluated forty brinjal genotypes by artificial inoculation using *Ralstonia solanacearum* L. Santhosha *et al.* (2015) inoculum at a concentration of 1.0×10^8 cfu/ml. Genotypes Arka Nidhi, Haritha, Swetha, Surya, IIHR-3, IIHR-555, WCGR, R-2588, WL-2230, L-3261, L-3270, L-3272 and Arka Anand were found to be resistant to bacterial wilt, whereas, IIHR-7, L-3263, L-3268 and

L-3269 were moderately resistant. Genotypes R-2584, R- 2586, R- 2592, L-3260, L-3262, L-3264, L-3266 and L-3267 were moderately susceptible, and genotypes R-2580, R-2582, R-2587, R-2591, R- 2593 and R- 2595 were found to be susceptible. Lastly, genotypes R-2581, R- 2594, R-2589, R-2590, WL-2232, Pusa hybrid-6, Arka Shirish, R-2585 and R-2583 were found to be highly susceptible to bacterial wilt.

Bhavana and Singh (2016) evaluated eight lines found to be wilt resistant under natural field conditions were screened in rainy season. Out of these only two lines were found resistant at 90 days after transplanting namely IC-261786 (12.06 t/ha; fruit weight 118.0 g; fruit length 17.3 cm) and IC-261793 (6.31 t/ha; fruit weight 252.0 g; fruit length 7.7 cm) with 84 % plant survival against bacterial wilt. Thus the identified germplasm can further be utilized for pre-breeding aimed at developing wilt resistant high yielding varieties.

Devmore *et al.* (2016) twenty nine brinjal genotypes for bacterial wilt resistance. Among them, five genotypes namely RCM-BL-3, CHES-309, Majal Local, Navashi Local and Bholanath were exhibited immune reaction , whereas seven genotypes namely N-1009 (2.22 %), BB-64 (2.22 %), Vengurla Local (2.22 %), Lanja Local (4.44 %), Asond Local (4.44 %), Vetore Local, (6.67 %) and BGTP-1 (8.89) were found as resistant. Seven genotypes, Sadave Local (11.11 %), Singnath (11.11 %), N-1007 (15.56 %), BB-46-13 (15.56 %), N-1008 (17.78 %), BGTP-2 (17.78 %), Bandthiware (20.00 %) and DPL-B-5 (20.00 %) were found moderately resistant however, the genotypes such as DPL-B-4 (26.67 %), IIHR-3 (28.89 %), NB-746 (31.11 %), VNR-218 (31.11 %), D-79-19 (42.22 %) and Utkal (46.67 %) showed moderately susceptible reaction and rest of the genotypes reacted as highly susceptible against bacterial wilt disease as their disease incidence ranged from 68.89 to 100.00 per cent.

Biswas and Ghosh (2018) screened twenty brinjal cultivars, among twenty, ten were found resistant (R), four moderately susceptible (MS) and six cultivars were found susceptible (S). Variety Blue Star was found to be most appropriate in terms minimum wilt incidence 4.53 and 5.53 per cent whereas, variety VNR-B5, Suvarna and VNR-218 were found suitable in terms yield 46.41, 46.02 and 45.17 t/ha respectively.

2.7 Quality: Phenol content

The study on quantitative and qualitative analyses of phenolic acid fractions (free and liberated after acidic and basic hydrolysis) in three aubergine cultivars (Black Beauty, Solara F1, Epic F1) was conducted by Kowalski and Kowalska (2005). Results revealed that the fruits of the Black Beauty cultivar contained the highest level of phenolic acid (35.14 µg/g fresh matter) with protocatechuic acid (22.36 µg/g fresh matter) predominating compared to other cultivars.

Okmen *et al.* (2009) studied the phenolic content of 26 eggplant (*Solanum melongena* L.) cultivars. Cultivars showed significant variation for total phenolic contents ranging from 615 to1376 mg/kg of fruit sample, 2.2-fold difference has been found. The total water soluble antioxidant activity and total phenolic content were significantly correlated and results of this study suggested that breeders can use the information to develop eggplant cultivars with high antioxidant activity.

Shaheen *et al.* (2013) reported the total phenol content (TPC) of different varieties of *Solanum melongena* L. It varied from 3.16 ± 0.04 to 7.86 ± 0.33 mg GAE/g of fresh weight (FW). It also revealed that all varieties of *Solanum tuberosum* L. with peel contained higher TPC than without peel. BARI Begun-8, high yielding varieties of *Solanum melongena* and *Solanum tuberosum* with peel are good sources of polyphenols.

Methanolic (80%) extracts of various parts (green crown, peel and flesh) of selected varieties of round and long aubergine were explored for total phenolic content (TPC). The results

showed that TPC methanolic extracts, of different parts of selected varieties of aubergine, ranged from 16.72-25.00 mg GAE/100g DW. The highest amounts of TPC (22.05-25.00 mg GAE/100g DW) were obtained in round aubergine extracts and lower in long aubergine extracts (16.72-20.43 mg GAE/100g DW) (Sultana *et al.,* 2013).

Somawathi *et al.* (2014) conducted study to determine the total phenol content (TPC) of *Solanum melongena* L. Total phenolic content (TPC) and FRAP values of brinjal extracts varied from 48.67±0.27 to 61.11±0.26 mg GAE/100 g fresh weight of fruit and 4.19±0.11 to 7.46±0.26 mmol of $FeS0_4$/g fresh weight, respectively. Brinjal with dark purple lines (S_3) showed the highest antioxidant activity as quantified by FRAP and TPC while brinjal with light purple lines (S_2) showed the least. Kumari *et al.* (2014) fifty genotypes of brinjal having fruits of different colours were evaluated for total phenols. Highest total phenol content was found in genotype G-415 (Green).

Kandoliya *et al.* (2015) studied the antioxidant activity of eggplant (*Solanum melongena* L.). The findings showed 25.17-40.35 per cent radical scavenging activity (DPPH), comparable amount of flavanoids (7.42-13.25 mg $100g^{-1}$) and anthocyanine content along with total phenol (32.89-39.12 mg $100g^{-1}$), ascorbic acid (9.43-16.75 mg $100g^{-1}$), protein (0.92-1.39 %) and titrable acidity (0.20-0.32 %) in a pulp of brinjal fruits.

Nayanathara *et al.* (2016) examined five eggplant genotypes (Violet Nadan, Long Green, Small Round Green, Violet Suphol and Violet with white stripes) for total phenolic activity. The maximum phenol content was obtained in violet suphol that was 856.76 mg/g. The minimum was obtained in long green 386.75 mg/g. The phenol content of Violet Nadan was 640.415 mg/g, whereas the phenol content of small round green was 435.33mg/g. and violet with white stripes was 397.80mg/g. Violet Suphol which contained high total phenolic and flavonoid content had better anthocyanin value as compared (129.29 mg/g) to other varieties.

III. MATERIAL AND METHODS

The present study conducted to know the 'Performance of advanced breeding lines of brinjal (*Solanum melongena* L.) for bacterial wilt disease resistance, yield and quality attributes'. This experiment was conducted at vegetable science research block, Department of Vegetable Science, College of Horticulture, Bengaluru, in association with Department of Plant Pathology, College of Horticulture, Bengaluru, and department of Genetics and Plant Breeding, college of horticulture, Bengaluru during 2017-18. Experiment details, material used and methods followed in the study are presented in this chapter.

3.1 Geographical location and Climate

The field experiment was carried out at Vegetable Science Research Block, College of Horticulture, UHS Campus, GKVK (Post), Bengaluru, Karnataka. The research farm is situated between 13.05º latitude and 77º East longitudes at an altitude of 924 meter above mean sea level.

3.2 Experimental details

3.2.1 Experimental material

Fourteen advanced breeding lines of green long brinjal were evaluated in two replications along with parents and two checks. Ten advanced breeding lines of green round brinjal along with parents were evaluated in three replications.

3.2.1.1 Green long segment

The pedigree lines 12-36-46-3-32, 12-36-46-3-35, 12-36-46-6-4, 12-36-46-6-37, 12-36-46-6-10, 170-11-1, 170-11-11, 170-11-14, 170-9-11, 170-9-30, 170-9-15, 170-9-19, 170-19-26, 170-19-19 were obtained from the cross Green Long × IIHR 3, Arka Anand was used as resistant check and Arka Kusumakar was used as susceptible check.

3.2.1.2 Green round segment

The pedigree lines are 12-23-30-2-7, 12-23-30-2-12, 12-23-30-1-7, 12-23-30-1-41, 12-23-30-1-42, 12-23-30-1-32, 12-23-30-1-18, 12-23-249-10-29, 12-23-249-10-54, 12-23-249-10-55 were obtained from the cross Raidurga Green Round × WCGR. The parental lines namely Raidurga Green Round and WCGR are used as check for the comparision of performance of advanced lines as there is no available released varieties.

3.3 Background of research

Arun Kumar (2013) had initiated research work to know the inheritance of bacterial wilt disease resistance in brinjal by crossing eight bacterial wilt susceptible and five resistant lines in Line × Tester design. Further, 40 F_1s were evaluated for bacterial wilt disease resistance along with horticultural properties and found that, Green Long × IIHR-3 and Raidurga Green Round × WCGR were good in respect of bacterial wilt disease resistance along with good horticultural properties. Further, six generation mean analysis revealed that, the resistance is governed by

single dominant gene in the said material. This work was continued by Manoj (2015) by evaluating 250 F_2 plants in both the crosses. The selection was done based on earliness, fruit characters and bacterial wilt resistance in both the population. Further F_2:F_3 population were evaluated by Ishwaree (2016) in Green Long x IIHR-3 and Raidurga Green Round x WCGR for variability and character association studies to select superior plants in terms of earliness, yield attributes and bacterial wilt disease resistance.

Neelambika (2017) evaluated $F_{3:4}$ population in green long segments of brinjal namely, 12-36-46-3, 12-36-46-6, 12-36-164-1, 12-36-164-7, 12-36-164-10, 12-36-164-11, 12-36-164-14, 12-36-170-9, 12-36-170-11 and 12-36-170-19 for yield and bacterial wilt disease resistance along with two parents (Green Long and IIHR-3) and two checks (Arka Anand and Arka Kusumakar). Simultaneously, Aswathi (2017) evaluated green round $F_{3:4}$ population of brinjal (12-23-30-1, 12-23-30-2, 12-23-30-12, 12-23-30-14, 12-23-249-2, 12-23-249-10, 12-23-249-12) for yield and bacterial wilt disease resistance along with two parents (RGR and WCGR). Further 13 plants (12-36-46-3-32, 12-36-46-3-35, 12-36-46-6-4, 12-36-46-6-37, 12-36-46-6-10, 12-36-170-11-1, 12-36-170-11-11, 12-36-170-11-14, 12-36-170-9-30, 12-36-170-9-15, 12-36-170-9-19, 12-36-170-19-19 and 12-36-170-19-26) were selected in green long segment and 10 plants in green round segment *viz.,* 12-23-30-1-41, 12-23-30-1-42, 12-23-30-1-32, 12-23-30-1-18, 12-23-30-1-7, 12-23-30-2-7, 12-23-30-2-12, 12-23-249-10-54, 12-23-249-10-55 and 12-23-249-10 29 were selected based on fruit shape, fruit colour, yield and per cent bacterial wilt disease incidence.

Plate 1: General view of the experimental plot

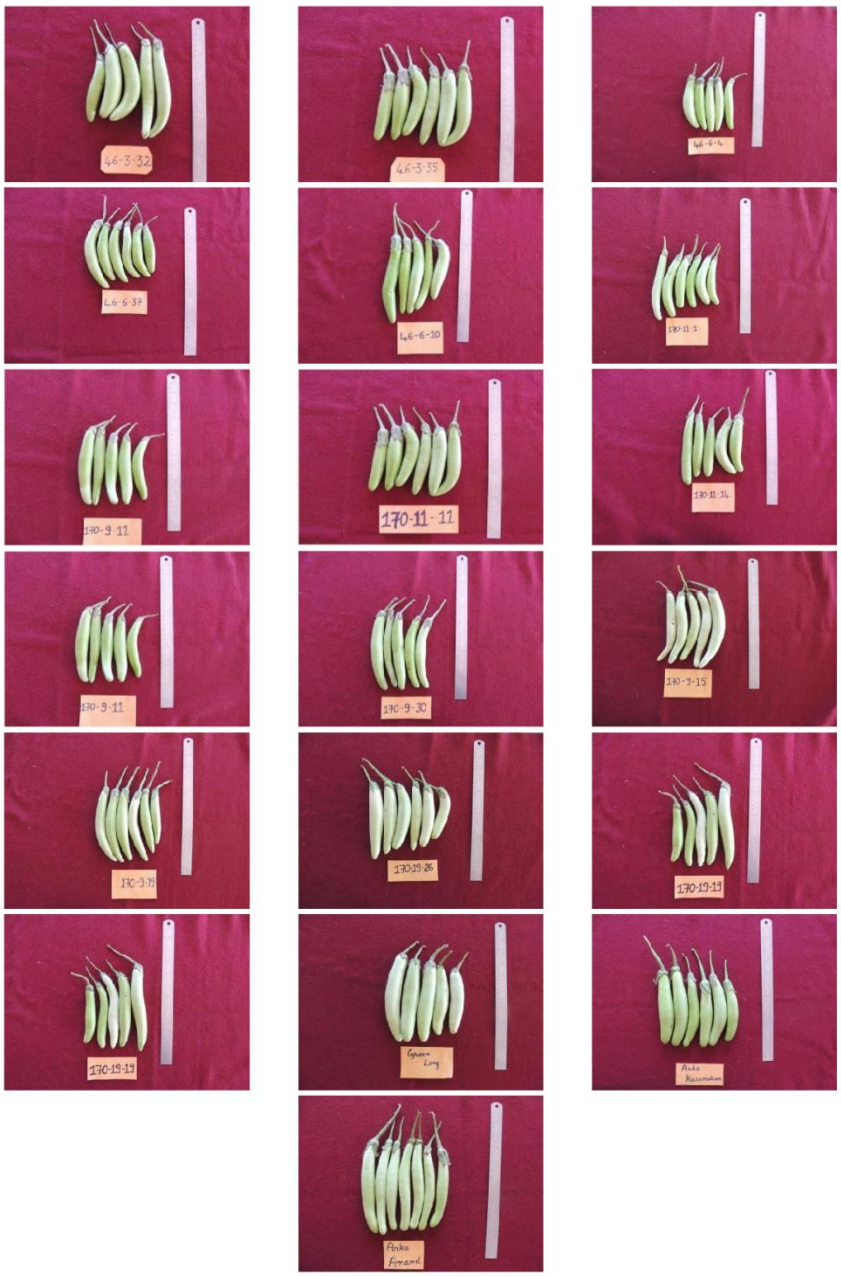

Plate 2: Advanced breeding lines of green long fruited genotypes of brinjal

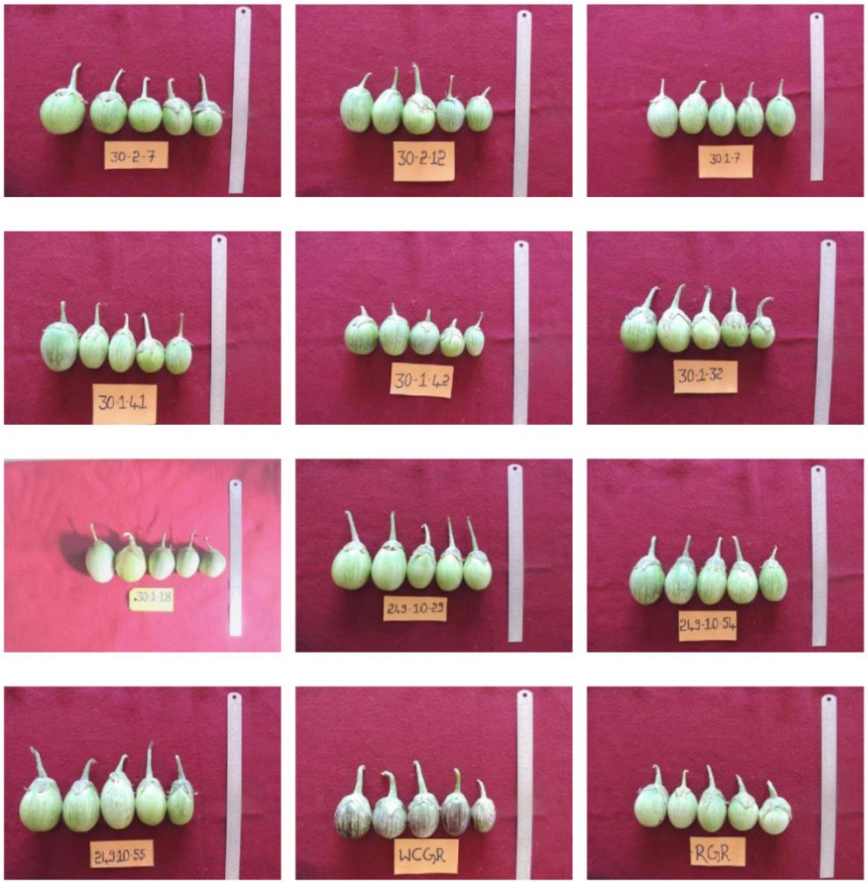

Plate 3: Advanced breeding lines of green round fruited genotypes of brinjal

3.3.1 Design and experimental layout

The experiment consists of both green long and green round segments of brinjal. For green long segments, randomized complete block design (RCBD) with two replications was maintained and each replications consists of 18 treatments including parents and checks. For green round segments, randomized complete block design (RCBD) with three replications was maintained separately. Each replications consists of 12 treatments.

3.3.2 Nursery

Seedlings were raised in 98 celled portrays filled with cocopeat @ 1.2kg/tray. Seeds were sown at a depth of 1 cm and covered with cocopeat. After slight irrigation, portrays were kept one above the other and covered with a polythene sheet for uniform seed germination. After 3 days, portrays were spread on the raised bed inside the polyhouse. Seedlings were irrigated twice daily and also drenched with nutrient 19:19:19 @ 0.5 per cent on 15^{th} day after sowing for proper growth of the seedlings.

3.4 Cultural operations

The cultural operations constitute the following sequence of work.

3.4.1 Field preparation and transplanting

The field was prepared by ploughing with disc harrow to obtain fine tilth. Farm yard manure was applied at the time of last ploughing at 25 tonnes per hectare. Four weeks old seedlings were transplanted in the main field at a spacing of 60 cm × 60 cm. Drip laterals were provided for irrigation at regular intervals. The experimental populations were maintained by following package of practices (Anon., 2014b) recommended by University of Horticultural Sciences, Bagalkot.

3.4.2 Fertilizer application

The recommended dose of nitrogen, phosphorus and potassium (125 kg: 100 kg: 50 kg) were applied in the form of urea, di-ammonium phosphate (DAP) and murite of potash (MOP) respectively at the time of sowing. As per the recommendations, full dose of P and K and half dose of nitrogen were applied at the time of transplanting, the crop was top dressed with remaining 50 per cent of N in the form of urea and earthing up was done.

3.4.3 Weeding

The experimental plot was kept weed free by 2-3 hand weeding and earthing up was done at 45 days after transplanting.

3.4.4 Irrigation

Irrigation was given at an interval of 3-5 days during experimentation, depending on the soil moisture status and climatic conditions.

3.4.5 Plant protection

The incidence of pests like leaf hopper, whitefly, hadda beetle, ash weevil, and shoot and foot borer were noticed during cropping season. For effective management chloropyriphos 2 ml/l), acephate (1.5 g/l), dimethoate (1.5 ml/l), dichlorovos (1 ml/l) and corragen (2 ml/l) were sprayed at different stages of growth.

3.4.6 Harvesting

Brinjal fruits are harvested when they have developed a good colour and marketable size, are still immature and tender.

3.5 Observations recorded

The following observations were recorded from each plant of the experiment

3.5.1 Plant height (cm)

The height of the plants was recorded from all the plants of each genotype and the mean is taken for analysis. The plant height was measured with the help of meter scale and average was computed and expressed in centimeters.

3.5.2 Number of branches per plant

Total number of branches are counted at the time of last harvest and the average number was worked out.

3.5.3 Days to first flowering

The first flower appears was recorded by counting number of days after transplanting and the average was calculated and expressed as days to first flowering.

3.5.4 Days to 50 per cent flowering

Number of days from transplanting to first flower appearance in fifty per cent of the population in each entry was taken and expressed in days.

3.5.5 Fruit length (cm)

The length of five fruits per plant from each plant of a line was measured during third harvest in centimeter with the measuring scale and the average fruit length was calculated.

3.5.6 Fruit breadth (cm)

The width of five fruits from each plant during third harvest was measured in verniercalipers and the average fruit breadth was calculated.

3.5.7 Average fruit weight (g)

The average fruit weight was computed by taking five fresh fruits per plant per picking was recorded in grams using weighing balance.

3.5.8 Number of fruits per plant

Total number of fruits harvested from each picking was pooled in every plant and the average number of fruits was calculated.

3.5.9 Yield per plant (g/ plant)

The total weight of all the fruits harvested from each pickings and from each plant was pooled and expressed in kilogram per plant.

3.6 Per cent wilt incidence

The number of plants infected in each replication was recorded and computed using following formula.

$$\text{Per cent disease incidence (PDI)} = \frac{\text{Number of plants infected with bacterial wilt}}{\text{Total number of plants observed}} \times 100$$

The number of wilted plants in each accession were recorded and classified into five different groups according to Hussain *et al.* (2005).

Disease reaction	Per cent wilt incidence
Highly resistant (HR)	Plants do not show any wilt symptom
Resistant (R)	1-20% plants wilt
Moderately resistant (MR)	21-40% plants wilt
Moderately susceptible (MS)	41-60% plants wilt
Susceptible (S)	61-80% plants wilted
Highly susceptible (HS)	More than 80% plants wilted

3.7 Phenol estimation

The procedure followed to estimate the phenol content of brinjal genotypes are presented below

1. Extract the fresh fruit sample (3g) using 20 ml of ethanol (80 %) using homogenizer or pestle and mortar repeatedly 3 times.
2. 1 ml of freshly prepared sample was taken in 25 ml volumetric flask.
3. 1 ml of Folin and Ciocalteau phenol reagent was taken in the volumetric flasks.
4. Then, 2 ml of 20 per cent Na_2CO_3 solution was added to the volumetric flasks.
5. Volume made up to 25 ml using distilled water.
6. All the flasks were mixed well.
7. Then the flasks were kept in incubation at room temperature for 30 minute.
8. The colour so developed was read using spectrophotometer at 700nm.

Comparison of obtained with standard curve values of phenols using Gallic acid (GA) as standard.

Calculation: Total phenol content (mg GA equivalents/g)

The total phenol content was calculated by using the following formula given by Singleton and Rossi (1965).

$$\text{Total phenols (mg/g)} = \frac{\text{OD at 700 nm} \times \text{Volume made up} \times \text{Standard curve value}}{0.5 \times \text{Weight of sample (g)}} \times 100$$

3.8 Statistical analysis

The data of the experiment was subjected to statistical analysis of RCBD as described by Panse and Sukhatme (1985). The level of significance used in 'F' test was P = 0.05 critical difference was calculated whenever the 'F' test was found significant.

3.8.1 Analysis of Variance (ANOVA)

The mean values of the genotypes were used for analysis of variance. Replication wise mean values were subjected to RCBD analysis. The significance of difference among all genotypes was tested using 'F' test. The model of analysis of variance was given below.

Sources of variation	Degree of freedom (df)	Sum of squares (SS)	Mean sum of squares (MSS)	'F' cal
Replication	r-1	RSS	RMSS	RMSS/EMSS
Treatment	t-1	TrSS	TrMSS	TrMSS/EMSS
Error	(r-1) (t-1)	ESS	EMSS	
Total	rt-1	TSS		

Where,

t = Number of treatments (genotypes)
r = Number of replications
SS = Sum of squares
MSS = Mean sum of squares
df = Degrees of freedom

Standard error of mean (S.Em±) and critical difference (CD) were worked out using appropriate formulae for comparing the means of the treatments.

3.8.2 Standard error of mean (S.Em±)

It is the measure of the mean difference between sample estimate of mean x and the population parameter (μ) i.e. it is the measure of controlled variation present in a sample and is denoted by S.Em**±**.

$$S.Em \pm = \sqrt{EMSS/r}$$

3.8.3 Critical difference (C.D.)

Critical difference is used to compare the observed differences among different treatments. If the difference is greater than critical difference, it is considered as significant and vice versa and is denoted by CD.

$$CD = \sqrt{2} \times S.Em \times t$$

Where,

S.E**±**m = Standard error of mean
t = table value at error degrees of freedom

IV. EXPERIMENTAL RESULTS

The results obtained from the field experiment conducted on “Performance of advanced breeding lines of brinjal (*Solanum melongena* L.) for bacterial wilt disease resistance, yield and quality attributes” during 2017 are presented in this chapter.

4.1 Analysis of variance

4.2 Growth and yield parameters

4.3 Disease incidence

4.4 Quality parameter

4.1 Analysis of variance

Analysis of variance was carried out for quantitative and qualitative characters including yield attributing and quality characters of green long and green round advanced breeding lines of brinjal were evaluated in separate experiment.

All the genotypes showed significant (P=0.05) differences for yield and quality characters in green long brinjal genotype. The results of analysis of variance for all the characters of the study are summarized and presented in Table 1.

Significant (P=0.05) differences for yield and quality characters in green round genotypes of brinjal were studied in a separate experiment. The results of analysis of variance for all the characters are summarized and presented in Table 2.

4.2 Growth and yield parameters

4.2.1 Plant height

The data pertaining to plant height showing significant difference among the green long genotypes are presented in Table 3.

Plant height varied significantly among the genotypes. Genotype 170-11-11 (75.21 cm) recorded maximum plant height followed by Arka Anand (72.57 cm) and 46-3-35 (70.94 cm) whereas, the minimum plant height was recorded in 170-19-19 (59.16 cm). Plant height was observed in the range of 59.16 cm to 75.21 cm.

Table 1: Analysis of variance (Mean sum of squares) for performance of advanced breeding lines of green long brinjal

Sl. No.	Characters	RMSS	TMSS	EMSS	S.Em±	CD at 5%
1.	Degrees of freedom	1.00	17.00	17.00	-	-
2.	Plant height (cm)	13.86	39.85*	9.34	2.16	6.45
3.	Number of branches	1.60	2.27*	0.75	0.61	1.83
4.	Days to first flowering	4.43*	6.29*	0.67	0.58	1.73
5.	Days to 50 per cent flowering	4.11	7.09*	1.46	0.85	2.55
6.	Fruit length (cm)	2.60	2.51*	0.57	0.53	1.59
7.	Fruit width (cm)	0.01	0.03*	0.01	0.06	0.18
8.	Number of fruits per plant	1.10	20.54*	3.33	1.29	3.85
9.	Average fruit weight (g)	1.77	28.48*	4.90	1.56	4.67
10.	Yield per plant (g)	6312.94	7052.38*	2142.60	32.73	97.66
11.	Bacterial wilt incidence (%)	2.28	173.79*	50.46	5.02	14.99
12.	Phenol content (GAE mg/g)	0.79	0.88*	0.33	0.41	1.22

*significant at 5 %

Table 2: Analysis of variance (Mean sum of squares) for performance of advanced breeding lines of green round brinjal

Sl. No.	Characters	RMSS	TMSS	EMSS	S.Em±	CD at 5%
1.	Degrees of freedom	2.00	12.00	12.00	-	-
2.	Plant height (cm)	0.68	100.81*	3.64	1.35	4.20
3.	Number of branches	0.70	1.46*	0.29	0.38	1.19
4.	Days to first flowering	5.46	15.73*	1.47	0.86	2.67
5.	Days to 50 per cent flowering	1.58	12.94*	1.30	0.81	2.51
6.	Fruit length (cm)	0.07	0.08*	0.03	0.12	0.36
7.	Fruit width (cm)	0.04	0.13*	0.04	0.15	0.45
8.	Number of fruits per plant	1.26	9.67*	0.67	0.58	1.80
9.	Average fruit weight (g)	0.81	16.49*	3.70	1.36	4.23
10.	Yield per plant (g)	144.19	8532.70*	422.09	14.53	45.22
11.	Bacterial wilt incidence (%)	47.51	220.69*	51.13	5.06	15.74
12.	Phenol content (GAE mg/g)	0.33	0.48*	0.12	0.24	0.75

*significant at 5%

Table 3: Performance of advanced breeding lines of green long brinjal for plant height, number of branches and days to first flowering

Sl. No.	Genotypes	Plant height (cm)	Number of branches	Days to first flowering
1.	46-3-32	69.79	6.53	38.82
2.	46-3-35	70.94	6.14	39.61
3.	46-6-4	62.90	4.63	36.70
4.	46-6-37	62.22	3.96	39.17
5.	46-6-10	62.32	4.84	38.71
6.	170-11-1	70.29	3.83	38.58
7.	170-11-11	75.21	3.54	38.42
8.	170-11-14	69.75	4.42	39.06
9.	170-9-11	67.30	3.85	39.97
10.	170-9-30	67.44	3.50	42.30
11.	170-9-15	65.13	3.37	41.61
12.	170-9-19	62.67	4.71	40.50
13.	170-19-26	61.37	6.56	40.47
14.	170-19-19	59.16	5.99	40.98
15.	IIHR-3	67.30	5.80	37.17
16.	Green Long	61.70	5.02	36.74
17.	Arka Kusumakar	66.63	4.65	38.97
18.	Arka Anand	72.57	5.29	43.00
	S.Em±	**2.16**	**0.61**	**0.58**
	CD at 5%	**6.45**	**1.83**	**1.73**

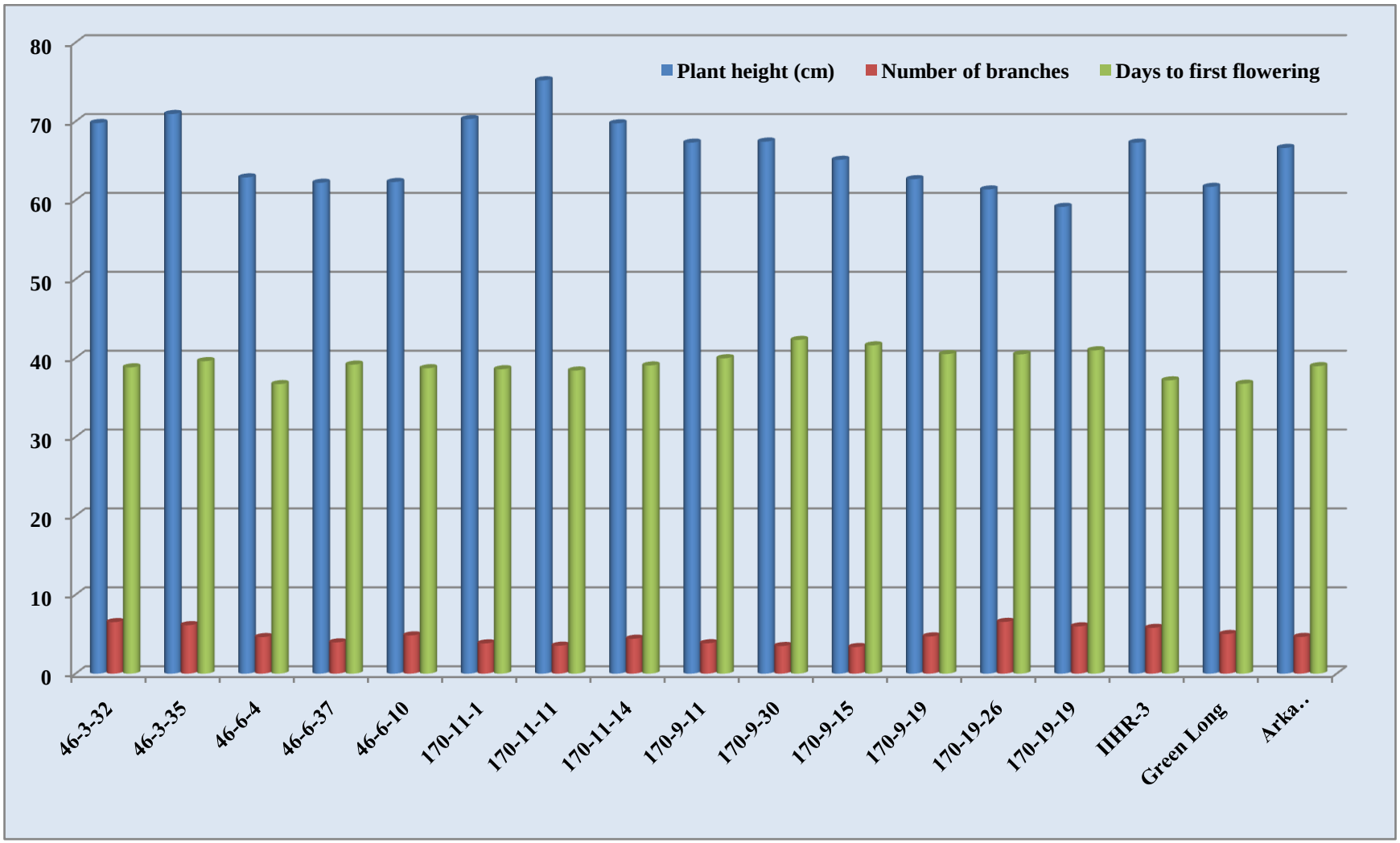

Fig. 1: Performance of green round advanced breeding lines of brinjal for plant height, number of branches and days to first flowering

The data pertaining to plant height showing significant difference among the different green round genotypes are presented in Table 6. Plant height varied significantly among the genotypes. Plant height was observed in the range of 43.88 cm to 64.32 cm. Genotype 30-2-7 (64.32 cm) recorded maximum plant height followed by 30-2-12 (63.75 cm) and 249-10-29 (62.74 cm) whereas, the minimum plant height was recorded in 30-1-32 (43.88 cm).

4.2.2 Number of branches per plant

Data pertaining to number of branches per plant differed significantly among green long genotypes are recorded in the Table 3. Maximum number of branches per plant was recorded in genotype 170-19-26 (6.56) which was on par with 46-3-32 (6.53), 46-3-35 (6.14) and 170-19-19 (5.99). While, minimum number of branches per plant was recorded in 170-9-15 (3.37).

Data pertaining to number of branches per plant differed significantly in different green round genotypes are recorded in Table 6. The maximum number of branches per plant was recorded in genotype 249-10-29 (6.82) which was on par with 249-10-54 (6.70), 249-10-55 (6.14) and 30-1-41 (5.53). While, the minimum number of branches per plant was recorded in 30-2-12 (4.25).

4.2.3 Days to first flowering

Data pertaining to days to first flowering was differed significantly for different genotypes of brinjal (Table 3). Among the different genotypes of brinjal studied, genotype 46-6-4 (36.70 days) has recorded less number of days to first flowering which was on par with IIHR-3 (37.17days), Green Long (36.74) and 170-11-11 (38.42 days) lines. The genotype 170-9-30 (42.30 days) has recorded more number of days to first flowering.

Data pertaining to days to first flowering and differed significantly for different green round genotypes of brinjal (Table 6).

Among the different genotypes of green round brinjal studied, genotype 30-1-42 (37.53 days) recorded less number of days to first flowering which was on par with 30-1-7 (39.59 days) and 30-1-41 (40.34 days) genotypes. The genotype 249-10-55 (46.36 days) has recorded more number of days to first flowering.

4.2.4 Days to 50 per cent flowering

Among green long genotype, Green Long (42.38 days) recorded minimum number of days to 50 per cent of flowering followed by 46-6-4 (42.90 days) and 170-11-1 (43.13 days). The genotype 170-9-30 (49.35 days) has recorded maximum number of days to 50 per cent flowering. (Table 4).

The genotype 30-1-42 (44.30days) recorded minimum number of days to 50 per cent of flowering followed by one of the parent RGR (45.63 days) and 30-1-41 (45.90 days). The genotype 249-10-55 (52.18 days) has recorded maximum number of days to 50 per cent flowering among green round advanced breeding lines (Table 7).

4.2.5 Fruit length (cm)

The significant difference was recorded among different green long genotypes for fruit length (Table 4). The genotype 46-3-32 recorded maximum fruit length (15.80 cm) however, it was on par with 46-6-10 (15. 62 cm) and lowest fruit length was recorded in 46-6-4 (13. 37 cm).

The variation in fruit length among different green round genotypes is presented in Table 7. The fruit length varied from 5.80 cm (30-1-41) to 5.16 cm (31-1-32). The maximum fruit length was recorded in the genotype 30-1-41 (5.80 cm) however, it was on par with 30-1-42 (5.72 cm) and lowest fruit length was recorded in 30-1-32 (5.16 cm).

Table 4: Performance of advanced breeding lines of green round brinjal for plant height, number of branches and days to first flowering.

Sl. No.	Genotypes	Plant height (cm)	Number of branches	Days to first flowering
1.	30-2-7	64.32	4.81	42.61
2.	30-2-12	63.75	4.25	40.44
3.	30-1-7	61.32	5.50	39.59
4.	30-1-41	50.90	5.53	40.34
5.	30-1-42	47.63	4.68	37.53
6.	30-1-32	43.88	4.82	43.34
7.	30-1-18	50.64	5.36	45.36
8.	249-10-29	62.74	6.82	44.01
9.	249-10-54	61.80	6.70	46.15
10.	249-10-55	61.11	6.14	46.36
11.	WCGR	61.50	4.30	44.30
12.	RGR	59.87	5.50	41.13
	S.Em±	**1.35**	**0.38**	**0.86**
	CD at 5%	**4.20**	**1.19**	**2.67**

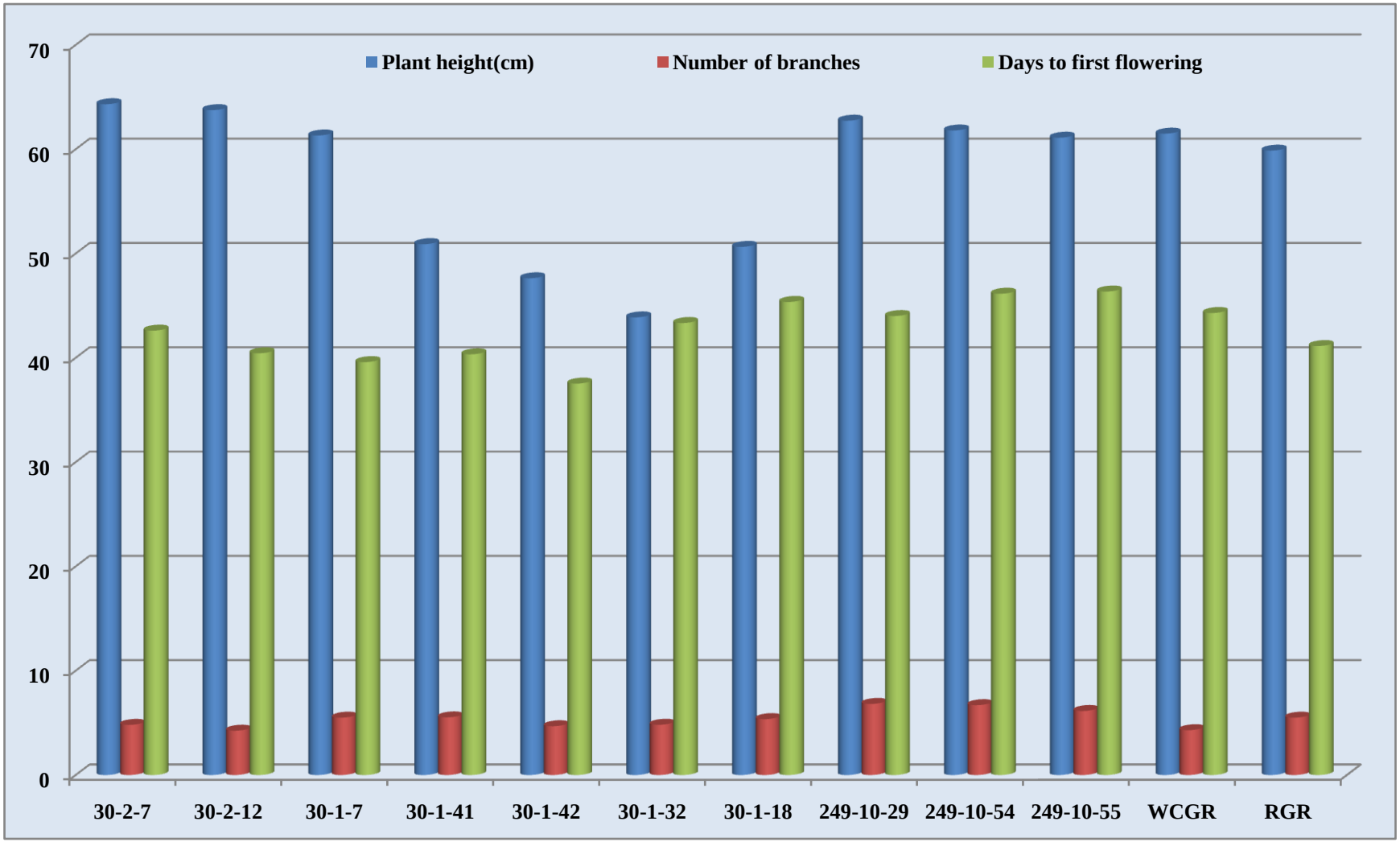

Fig. 2: Performance of green round advanced breeding lines of brinjal for plant height, number of branches and days to first flowering

Table 5: Performance of advanced breeding lines of green long brinjal for days to 50 per cent flowering, fruit length and fruit width

Sl. No.	Genotypes	Days to 50 per cent flowering	Fruit length (cm)	Fruit width (cm)
1.	46-3-32	44.87	15.80	2.94
2.	46-3-35	45.98	14.10	2.77
3.	46-6-4	42.90	13.37	3.11
4.	46-6-37	44.49	14.28	2.98
5.	46-6-10	44.23	15.62	2.86
6.	170-11-1	43.13	13.73	2.88
7.	170-11-11	43.75	14.18	2.96
8.	170-11-14	46.21	14.24	3.01
9.	170-9-11	46.00	15.02	3.10
10.	170-9-30	49.35	15.29	2.92
11.	170-9-15	46.81	14.63	3.04
12.	170-9-19	45.83	14.02	2.96
13.	170-19-26	45.30	14.25	2.89
14.	170-19-19	46.52	14.03	2.99
15.	IIHR-3	43.37	15.17	2.72
16.	Green Long	42.38	15.01	2.98
17.	Arka Kusumakar	44.75	14.31	2.94
18.	Arka Anand	48.57	18.38	2.63
	S.Em±	**0.85**	**0.53**	**0.06**
	CD at 5%	**2.55**	**1.59**	**0.18**

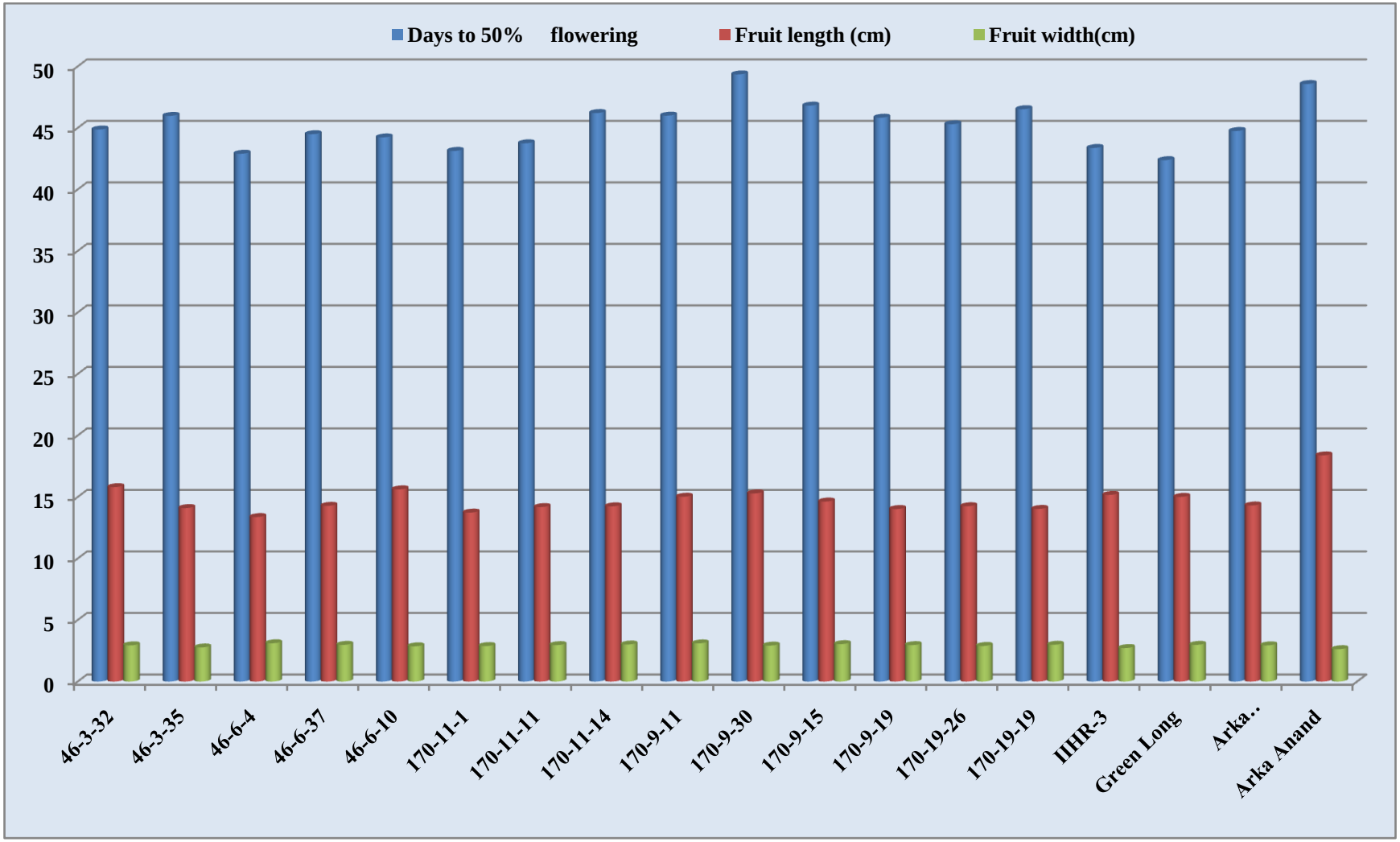

Fig. 3: Performance of green round advanced breeding lines of brinjal for days to 50 per cent flowering, fruit length and fruit width

Table 6: Performance of advanced breeding lines of green round brinjal for days to 50 per cent flowering, fruit length and fruit width.

Sl. No.	Genotypes	Days to 50 per cent flowering	Fruit length (cm)	Fruit width (cm)
1.	30-2-7	45.89	5.51	4.94
2.	30-2-12	45.94	5.42	4.86
3.	30-1-7	47.59	5.36	4.98
4.	30-1-41	45.90	5.80	4.96
5.	30-1-42	44.30	5.72	4.54
6.	30-1-32	47.33	5.16	4.77
7.	30-1-18	50.07	5.29	4.27
8.	249-10-29	50.24	5.24	4.97
9.	249-10-54	51.28	5.63	5.01
10.	249-10-55	52.18	5.56	4.94
11.	WCGR	48.80	5.59	5.07
12.	RGR	45.63	5.64	5.23
	S.Em±	**0.81**	**0.12**	**0.15**
	CD at 5%	**2.51**	**0.36**	**0.45**

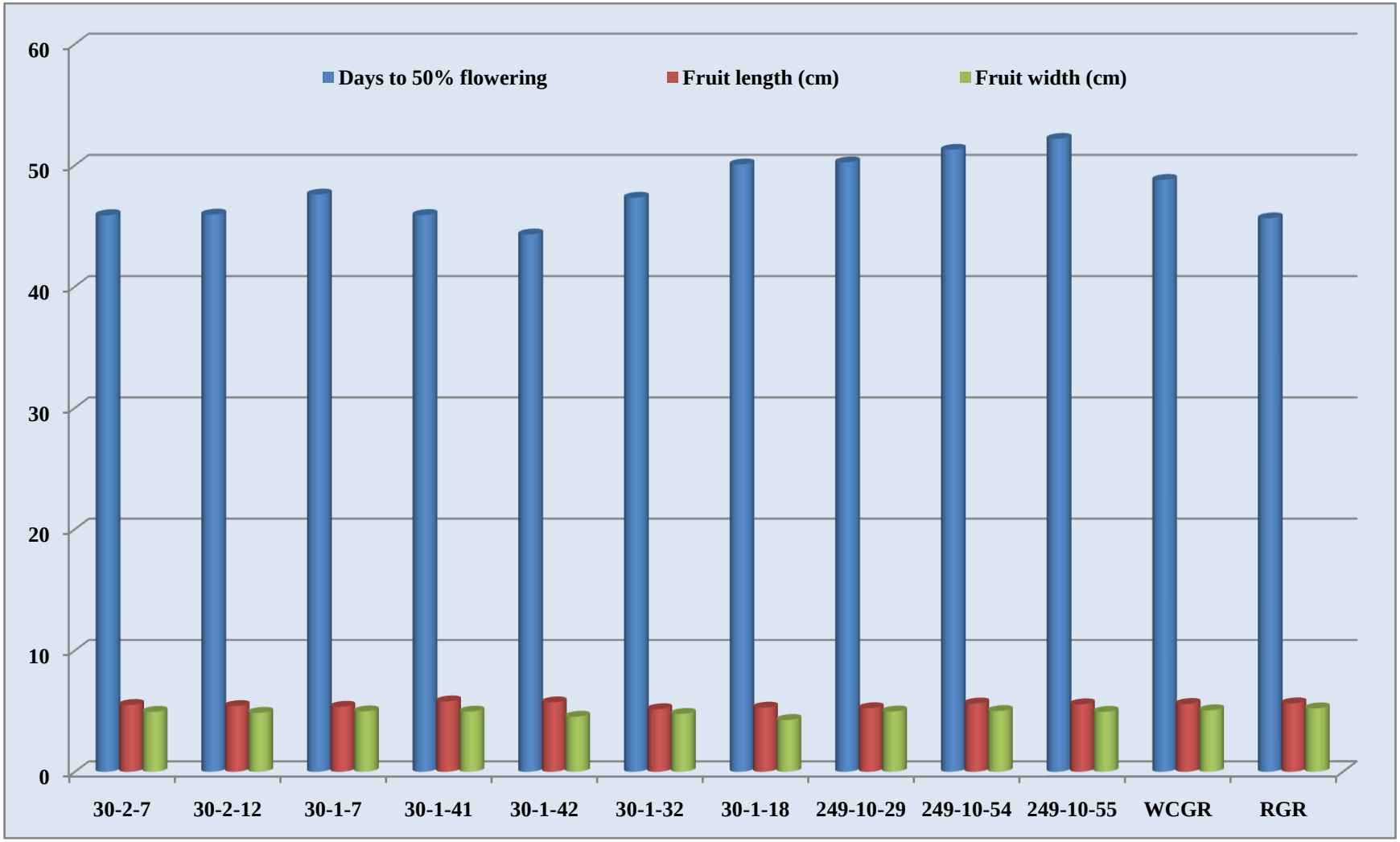

Fig. 4: Performance of green round advanced breeding lines of brinjal for days to 50 per cent flowering, fruit length and fruit width

4.2.6 Fruit width (cm)

Among green long genotypes, fruit width ranged from 2.63 cm to 3.11 cm. Genotype 46-6-4 (3.11cm) recorded the maximum fruit width which was on par with 170-9-11 (3.10 cm), 170-11-14 (3.01cm), 170-11-11 (2.96 cm) and 170-9-19 (2.96 cm) While, genotype Arka Anand recorded minimum fruit width of 2.63 cm (Table 4).

Among the different green round genotypes, fruit width ranged from 4.27cm (30-1-18) to 5.23 cm. (RGR). Among genotypes, 249-10-54 (5.01 cm) recorded maximum fruit width which was on par with 30-1-7 (4.98 cm), 249-10-29 (4.97cm). While, genotype 30-1-18 recorded minimum fruit width of 4.27 cm (Table 7).

4.2.7 Number of fruits per plant

Among the different genotypes of brinjal the maximum number of fruits per plant was noticed in 170-19-26 (26.31) which was on par with 170-9-19 (22.50) and 170-19-19 (22.49). The minimum number of fruits per plant was recorded in 170-9-30 (16.23) which are presented in Table 5.

The variation in number of fruits per plant among the green round genotypes is presented in Table 8. Among the different genotypes of brinjal, the maximum number of fruits per plant was noticed in 30-2-12 (20.44) which was on par with 30-2-7 (19.48). The minimum number of fruits per plant was recorded in 30-1-18 (13.00).

4.2.8 Average fruit weight (g)

The estimates of evaluation for average fruit weight among green long genotypes was analysed and results revealed that it ranges from 27.36 g (170-9-19, 170-19-19) to 40.60g (Green Long) (Table 5). Among the advanced lines, maximum fruit weight was recorded in genotype 170-9-30 (38.58 g), and it was on par with 46-3-35 (37.93 g) and 46-6-37 (36.31 g).

Average fruit weight among different green round genotypes revealed that it ranges from 36.15 g (30-1-42) to 46.13 g (30-1-18). The parents recorded 43.61g and 37.31g in RGR and WCGR respectively (Table 8).

Table 7: Performance of advanced breeding lines of green long brinjal for number of fruits per plant, average fruit weight and yield per plant

Sl. No.	Genotypes	Number of fruits per plant	Average fruit weight (g)	Yield per plant (g)
1.	46-3-32	18.95	35.44	667.96
2.	46-3-35	18.16	37.93	657.00
3.	46-6-4	17.90	36.25	660.60
4.	46-6-37	16.78	36.31	623.63
5.	46-6-10	17.11	36.27	632.84
6.	170-11-1	19.50	34.29	663.12
7.	170-11-11	19.54	32.31	662.73
8.	170-11-14	18.36	34.35	641.06
9.	170-9-11	18.86	35.16	654.00
10.	170-9-30	16.23	38.58	646.68
11.	170-9-15	20.78	33.60	718.68
12.	170-9-19	22.50	27.36	706.23
13.	170-19-26	26.31	27.74	836.11
14.	170-19-19	22.49	27.36	668.64
15.	IIHR-3	17.12	37.19	623.15
16.	Green Long	16.80	40.60	665.78
17.	Arka Kusumakar	19.58	34.42	687.31
18.	Arka Anand	27.64	32.09	731.05
	S.Em±	**1.29**	**1.56**	**32.73**
	CD at 5%	**3.85**	**4.67**	**97.66**

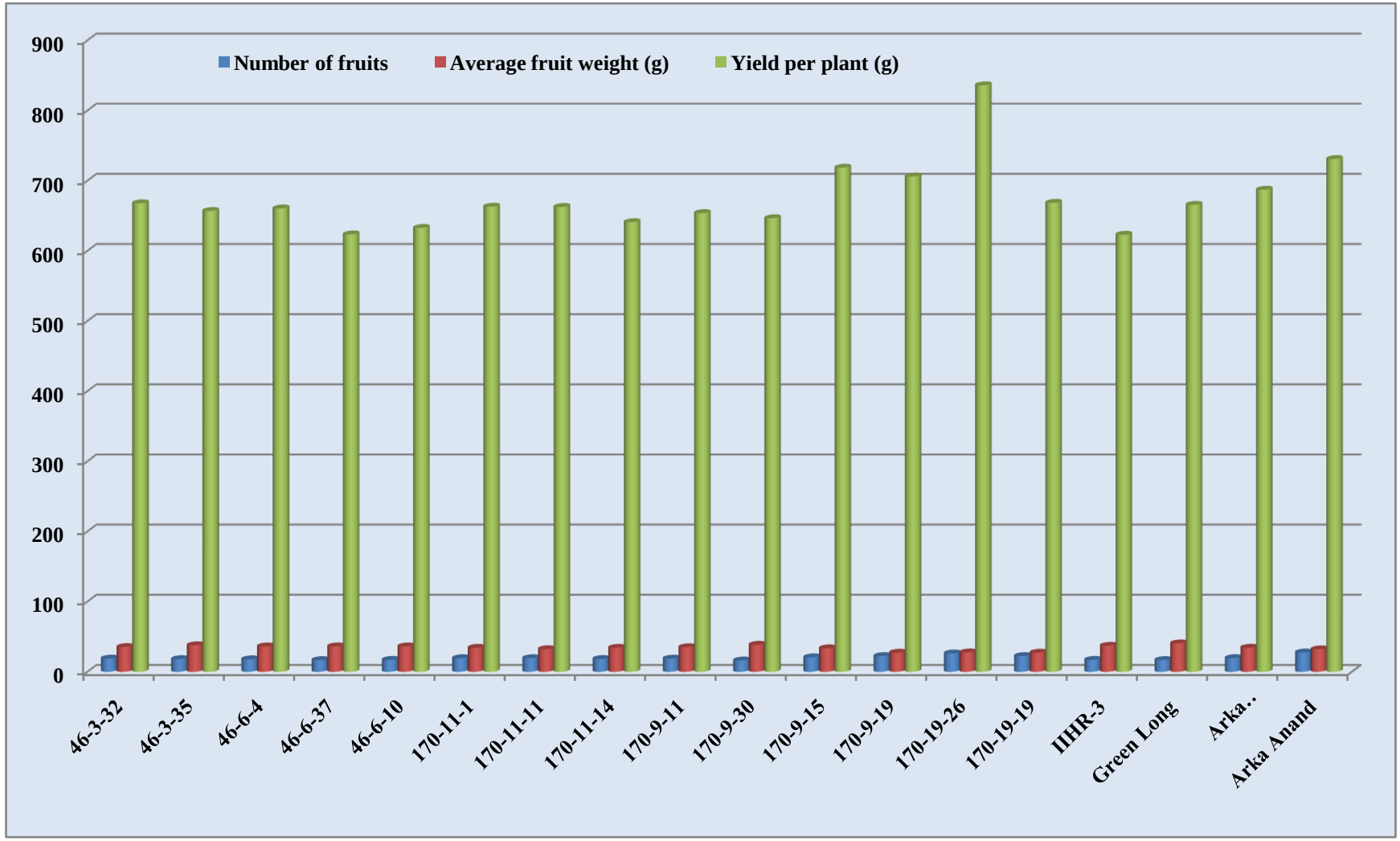

Fig. 5: Performance of green long advanced breeding lines of brinjal for number of fruits, average fruit weight and yield per plant

Table 8: Performance of advanced breeding lines of green round brinjal for number of fruits per plant, average fruit weight and yield per plant

Sl. No.	Genotypes	Number of fruits per plant	Average fruit weight(g)	Yield per plant (g)
1.	30-2-7	19.48	41.16	754.64
2.	30-2-12	20.44	36.55	743.64
3.	30-1-7	18.50	40.90	753.95
4.	30-1-41	18.03	38.72	691.86
5.	30-1-42	17.33	36.15	622.33
6.	30-1-32	15.02	41.16	614.85
7.	30-1-18	13.00	46.13	578.38
8.	249-10-29	15.57	40.41	622.11
9.	249-10-54	14.98	39.12	597.66
10.	249-10-55	15.46	39.68	604.98
11.	WCGR	16.30	37.31	639.71
12.	RGR	14.75	43.61	605.85
	S.Em±	**0.58**	**1.36**	**14.53**
	CD at 5%	**1.80**	**4.23**	**45.22**

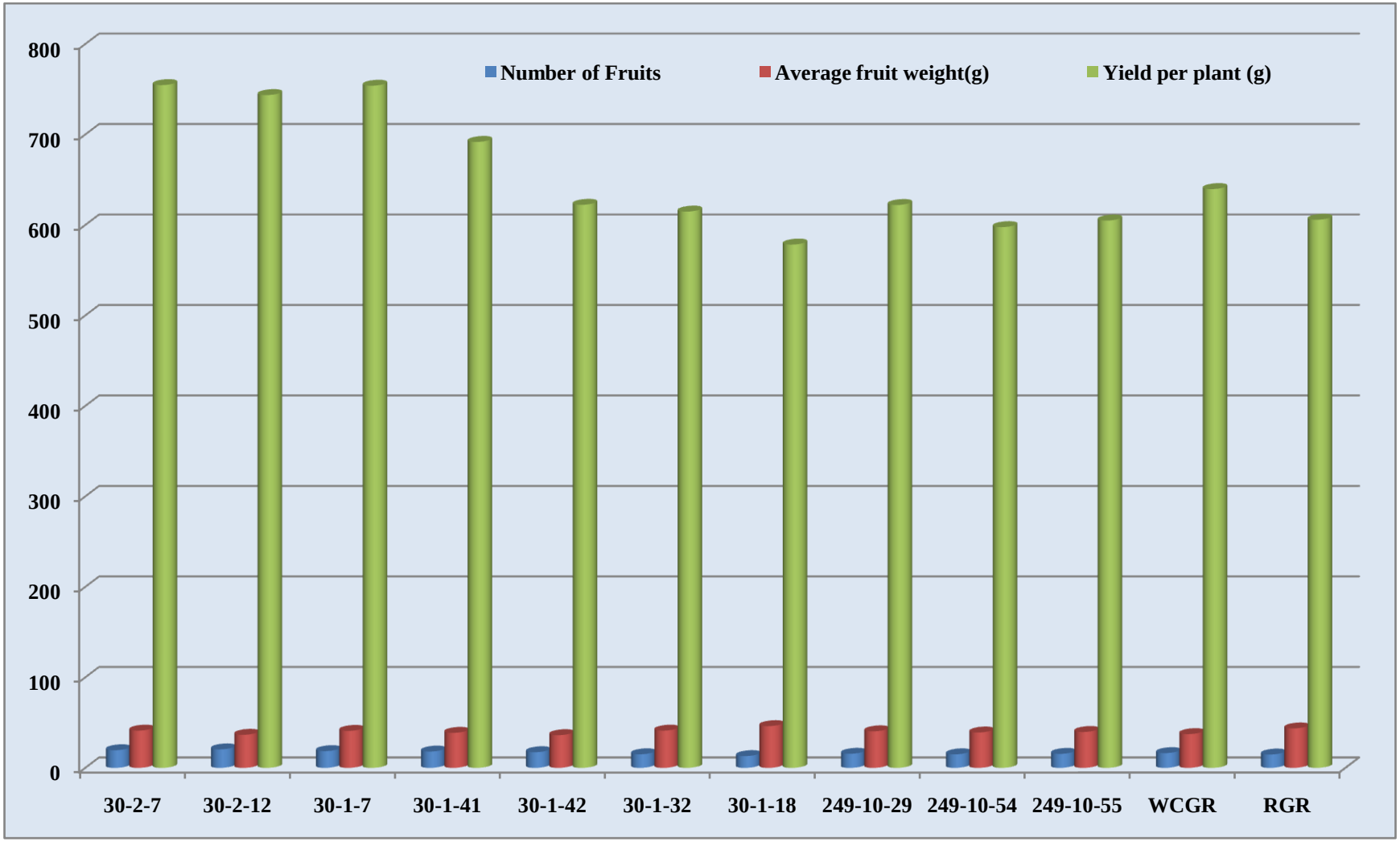

Fig. 6: Performance of green round advanced breeding lines of brinjal for number of fruits, average fruit weight and yield per plant

4.2.9 Fruit yield per plant (g)

The data pertaining to fruit yield per plant showed significant difference among the genotypes (Table 5). The variation in fruit yield per plant was significantly differed among the genotypes and it ranged from 623.63 g to 836.11 g. The significantly highest fruit yield per plant was recorded in genotype 170-19-26 (836.11g) followed by Arka Anand (731.05 g) and 170-9-15 (718.68 g) compared to parents. The lowest fruit yield per plant recorded in 46-6-37 (623.63 g).

The data pertaining to fruit yield per plant showed significant difference among the green round genotypes (Table 8). The fruit yield per plant ranged from 578.38g to 754.64g. The maximum fruit yield per plant recorded in genotype 30-2-7 (754.64 g) and it was on par with 30-1-7 (753.95 g) and 30-2-12 (743.64 g). The lowest fruit yield per plant was recorded in 30-1-18 (578.38 g).

4.3 Evaluation of per cent bacterial wilt disease incidence

The obtained data on disease reaction of $F_{4:5}$ green long genotypes showed resistance in 46-3-32 (17.85 %), 46-3-35 (10.71%), 170-11-1 (17.86%), 170-11-11 (8.93%), 170-9-11 (17.85%), 170-9-30 (10.71%), 170-9-15 (14.28%), 170-9-19 (14.26%), 170-19-26 (10.71%) and IIHR-3 (10.71%) progenies while, 46-6-37 (32.14%), 46-6-10 (21.42%), 170-11-14 (21.43%) and 170-19-19 (28.54%) were moderately resistant and 46-6-4 (57.14%) progenies showed moderately susceptible reaction are presented in Table 9.

Green round brinjal genotypes differed significantly with respect to bacterial wilt disease incidence. Values ranged from 10.71% to 48.57%. Least and same bacterial wilt disease incidence was observed in 30-2-7 (10.71%), 30-2-12 (14.28%), 30-1-7 (10.71%), 249-10-29 (14.28%), 249-10-54 (10.69%) and WCGR (11.07%) which are resistant to bacterial wilt incidence followed by 30-1-41 (28.56%), 30-1-42 (33.21%) and 249-10-55 (24.99%) which are moderately resistant. Highest infestation was found in 30-1-32 (48.57%) and 30-1-18 (47.50%) which are moderately susceptible to bacterial wilt.

Table 9: Performance of advanced breeding lines of green long brinjal for per cent disease incidence of bacterial wilt

Sl. No.	Genotypes	PDI
1.	46-3-32	17.85 (24.90)
2.	46-3-35	10.71 (18.86)
3.	46-6-4	57.14 (49.17)
4.	46-6-37	32.14 (34.52)
5.	46-6-10	21.42 (27.58)
6.	170-11-1	17.86 (23.92)
7.	170-11-11	8.93 (17.30)
8.	170-11-14	21.43 (26.11)
9.	170-9-11	17.85 (24.90)
10.	170-9-30	10.71 (18.86)
11.	170-9-15	14.28 (21.54)
12.	170-9-19	14.26 (22.20)
13.	170-19-26	10.71 (18.86)
14.	170-19-19	28.54 (31.54)
15.	IIHR-3	10.71 (18.82)
16.	Green Long	42.86 (40.87)
17.	Arka Kusumakar	44.46 (41.82)
18.	Arka Anand	10.71 (18.86)
	S.Em±	**5.02**
	CD at 5%	**14.99**

(The values are arc sine transformed)

Table 10: Performance of advanced breeding lines of green round brinjal for per cent disease incidence of bacterial wilt

Sl. No.	Genotypes	PDI
1.	30-2-7	10.71 (18.86)
2.	30-2-12	14.28 (21.54)
3.	30-1-7	10.71 (18.86)
4.	30-1-41	28.56 (32.14)
5.	30-1-42	33.21 (34.86)
6.	30-1-32	48.57 (44.19)
7.	30-1-18	47.50 (43.58)
8.	249-10-29	14.28 (21.54)
9.	249-10-54	10.69 (18.84)
10.	249-10-55	24.99 (29.46)
11.	WCGR	11.07 (19.15)
12.	RGR	47.21 (43.46)
	S.Em±	**5.06**
	CD at 5%	**15.74**

(The values are arc sine transformed)

4.4 Phenols (GAE mg/g)

The phenol content in green long genotypes ranged from 1.13 to 4.06 GAE mg/g (Table 11). Maximum phenol content was recorded in Arka Anand (4.06) which is on par with the genotypes 170-19-19 (3.56), Green Long (3.39), 170-11-11 (3.28) while, minimum phenol content was recorded in the genotype Arka Kusumakar (1.13).

In green round segment, brinjal lines ranged from 1.55 to 3.15 GAE mg/g in green round genotypes (Table 12). Maximum phenol content was recorded in 30-1-18 (3.15) which is on par with the genotypes 249-10-55 (2.66) and RGR (2.48). while, minimum phenol content was recorded in the genotype 30-1-41 and 249-10-54 (1.55).

Table. 11: Performance of advanced breeding lines of green long brinjal for phenol content

Sl. No.	Genotypes	Phenol content (GAE mg/g)
1.	46-3-32	2.63
2.	46-3-35	3.04
3.	46-6-4	2.24
4.	46-6-37	2.27
5.	46-6-10	2.80
6.	170-11-1	3.27
7.	170-11-11	3.28
8.	170-11-14	2.97
9.	170-9-11	2.79
10.	170-9-30	2.80
11.	170-9-15	2.92
12.	170-9-19	2.02
13.	170-19-26	2.75
14.	170-19-19	3.56
15.	IIHR-3	2.14
16.	Green Long	3.39
17.	Arka Kusumakar	1.13
18.	Arka Anand	4.06
	S.Em±	**0.41**
	CD at 5%	**1.22**

Table 12: Performance of advanced breeding lines of green round brinjal for phenol content

Sl. No.	Genotypes	Phenol content (GAE mg/g)
1.	30-2-7	2.41
2.	30-2-12	2.38
3.	30-1-7	2.07
4.	30-1-41	1.55
5.	30-1-42	2.02
6.	30-1-32	1.91
7.	30-1-18	3.15
8.	249-10-29	1.56
9.	249-10-54	1.55
10.	249-10-55	2.66
11.	WCGR	2.06
12.	RGR	2.48
	S.Em±	**0.24**
	CD at 5%	**0.75**

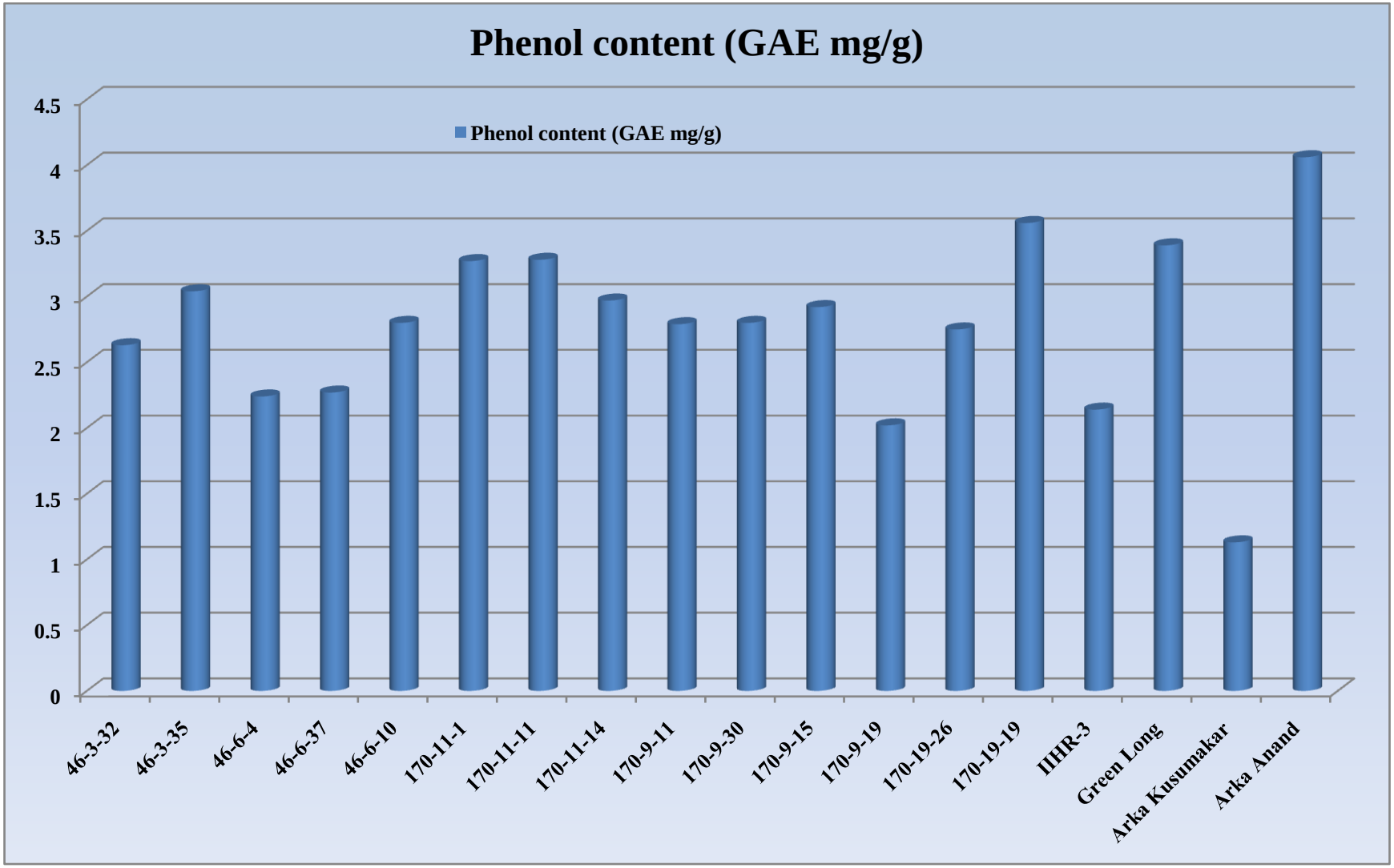

Fig. 7: Performance of green long advanced breeding lines of brinjal for phenol content

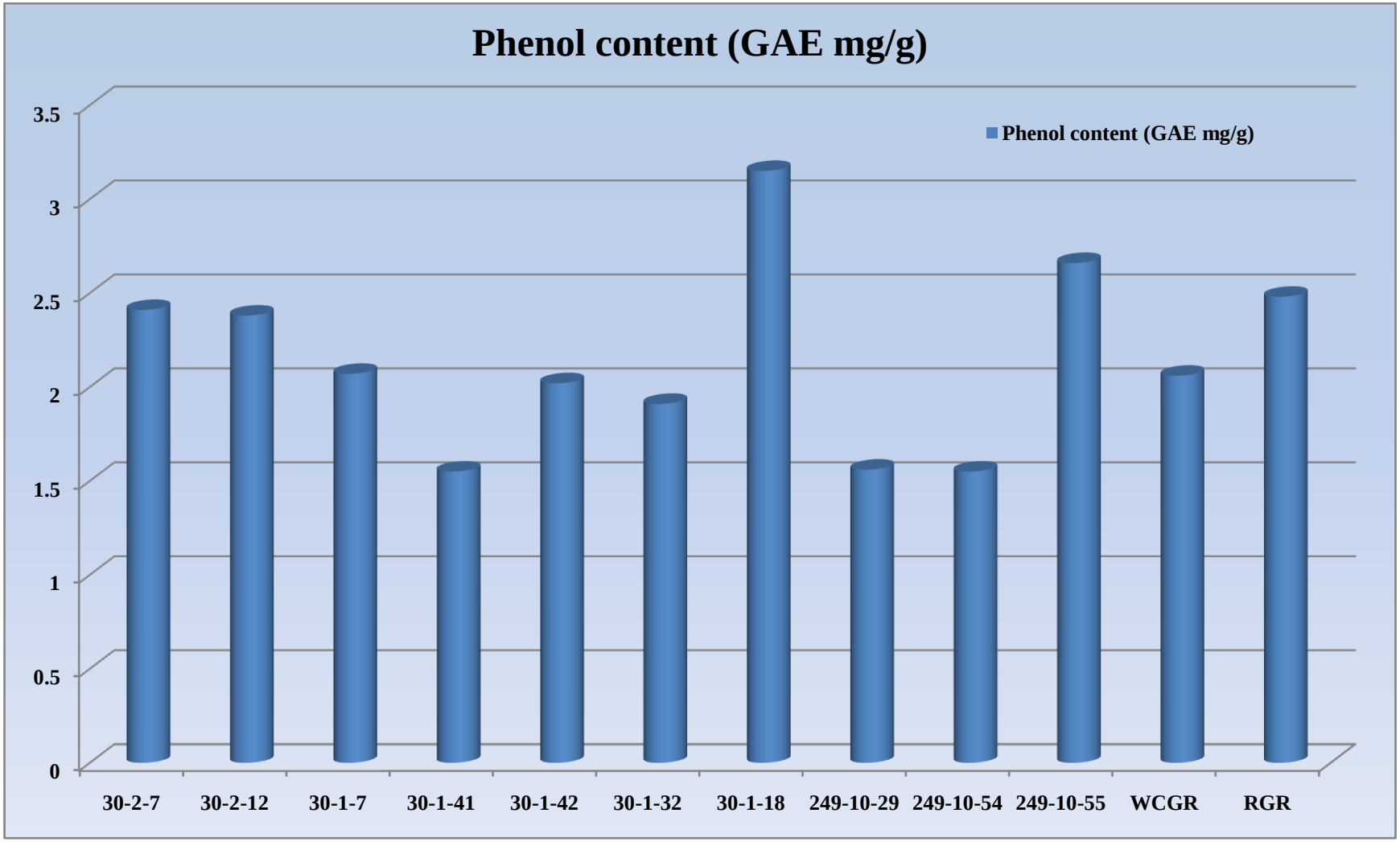

Fig. 8: Performance of green round advanced breeding lines of brinjal for phenol content

V. DISCUSSION

Brinjal is one of the most important vegetable in the family solanaceae which is grown world wide and it is an important source of dietary fibre. Several biotic and abiotic constraints in cultivation of brinjal hinders its production and reduces the productivity. There are many biotic and abiotic stresses which causes yield loss. Among diseases, bacterial wilt is one of the most devastating soil borne disease caused by *Ralstonia solanacearum* (Smith). Due to its destructive nature, wide host range and geographical distribution wilt is an important disease in the world. In India it affects wide range of economically important crops like tomato, chilli, potato, eggplant and non-solanaceous crops like banana and groundnut. This disease causes yield loss ranging from 4.24 to 86.14 per cent (Sabita *et al.,* 2000).

In the absence of effective control methods (chemical, cultural and biological) to overcome this serious problem, the most effective method of management is breeding for disease resistance. Development and cultivation of disease resistant hybrids offers most technically feasible, environmentally sound and economic means of disease control. The success of any breeding programme depends upon evaluation of the trait *i.e.,* yield and yield contributing traits and also identification of the stable bacterial wilt disease resistance genotype for that particular region is important in increasing the productivity of eggplant.

In this context, Arun Kumar (2013) had initiated research work to know the inheritance of bacterial wilt disease resistance in brinjal by crossing 8 bacterial wilt susceptible and 5 resistant lines in Line × Tester design. Further, 40 F_1s were evaluated for both bacterial wilt disease resistance and horticultural properties. Results revealed that Green Long × IIHR 3 and Raidurga Green Round × WCGR were good in respect of bacterial wilt disease resistance along with good horticultural properties. Further, six generation mean analysis revealed that the resistance is governed by single dominant gene in the said material. This work was continued by Manoj (2015) by evaluating 250 F_2 plants in both the crosses. The selection was done based on earliness, fruit characters and bacterial wilt resistance in both the population. Further F_2 : F_3 population were evaluated by Ishwaree (2016) in Green Long x IIHR-3 and Raidurga Green Round x WCGR for variability studies, character association to select superior plants in terms of earliness, yield attributes and bacterial wilt disease resistance.

Neelambika (2017) evaluated $F_{3:4}$ population in green long segments of brinjal namely, 12-36-46-3, 12-36-46-6, 12-36-164-1, 12-36-164-7, 12-36-164-10, 12-36-164-11, 12-36-164-14, 12-36-170-9, 12-36-170-11 and 12-36-170-19 for yield and bacterial wilt disease resistance along with two parents (Green Long and IIHR-3) and two checks (Arka Anand and Arka Kusumakar). Simultaneously, Aswathi (2017) evaluated green round $F_{3:4}$ population of brinjal (12-23-30-1, 12-23-30-2, 12-23-30-12, 12-23-30-14, 12-23-249-2, 12-23-249-10, 12-23-249-12) for yield and bacterial wilt disease resistance along with two parents (RGR and WCGR). Further 13 plants (12-36-46-3-32, 12-36-46-3-35, 12-36-46-6-4, 12-36-46-6-37, 12-36-46-6-10, 12-36-170-11-1, 12-36-170-11-11, 12-36-170-11-14, 12-36-170-9-30, 12-36-170-9-15, 12-36-170-9-19, 12-36-170-19-19 and 12-36-170-19-26) were selected in green long segment and 10 plants in green round segment *viz.,* 12-23-30-1-41, 12-23-30-1-42, 12-23-30-1-32, 12-23-30-1-18, 12-23-30-1-7, 12-23-30-2-7, 12-23-30-2-12, 12-23-249-10-54, 12-23-249-10-55 and 12-23-249-10 29 were selected based on fruit shape, fruit colour, yield and per cent bacterial wilt disease incidence.

The objective of evaluation of genotypes is to select the high yielding cultivars with better crop growth, yield and quality traits. Selection of genotypes for a particular region is more important to investigate considerable variability in various characters when grown under a particular environment.

In order to know the performance of the genotypes, a preliminary evaluation is necessary. Therefore, the results obtained in the present investigation of evaluation of different brinjal genotypes are discussed here under the following headings with supporting data and available literature.

5.1 Analysis of variance

Significant difference was observed for all the characters both in green long and green round segments of brinjal. This indicates the presence of considerable amount of genetic variation among genotypes studied. The significant differences was also noticed between replications for days to first flowering in green long genotypes. This might be due to heterogeneity in soil factors and genotypes.

5.2 Growth parameters

Significant difference was found among the genotypes studied for the growth attributed traits namely plant height and number of branches per plant (Table 3 and 6). The plant height significantly varied among the different genotypes of brinjal. In general, the growth of all the cultivars increased gradually as the days advanced. In green long segment, genotypes 170-11-11 (75.21 cm), 46-3-35 (70.94 cm) and 46-3-32 (69.79 cm) were vigorous. The genotype 170-11-11 (75.21 cm) recorded maximum plant height at final harvest. In green round types, 30-2-7 (64.32 cm) and 30-2-12 (63.75 cm) genotypes. With respect to number of branches per plant, in green long segment, genotype 170-19-26 (6.56) has recorded the maximum number of branches per plant. In green round segments 249-10-29 (6.82) has recorded the maximum number of branches per plant. Plant height and number of branches were good index of plant vigour which may contribute towards greater productivity. Different responses to plant height and number of branches might be due to genetic characteristic of genotypes and adaptability to a prevailing environment. Similar variation in plant height among the genotypes was also observed previously by Sharma and Swaroop (2000), Asati (2001), Paikra (2001), Praneetha *et al.* (2011), Nirmala *et al.* (2013), Hanchinmani and Imamsaheb (2015), Malshe *et al.* (2016), Chaturvedi *et al.* (2016), Nirmala and Vethamoni (2016), Chaturvedi *et al.* (2016), Tripathy *et al.* (2017) in brinjal.

5.3 Flowering parameters

Flowering parameters including days taken to first flowering and days taken to 50 per cent flowering. It varied significantly among the genotypes. The time taken for first flowering and for 50 per cent flowering was less in green long genotype, 46-6-4 (36.70 days, 42. 90 days). In green round types, genotype 30-1-42 (37.53 and 44.30 days) Hence, these cultivars were said to be early type. Early flowering in certain genotypes indicated adaptability of these genotypes in a particular environment, better and efficient utilization of nutrients in a relatively hostile environment which might have resulted in early termination of vegetative phase and initiation of reproductive phase as compared to late flowering genotypes. Similar results have also been reported by earlier worker in brinjal by Paikra (2001), Meena *et al.* (2009), Chattopadhyay *et al.* (2011), Kumar and Arumugam (2013), Panwar *et al.* (2013), Nirmala *et al.* (2013), Nirmala and Vethamoni (2016) and Tripathy *et al.* (2017).

5.4 Yield parameters

Significant difference was found among the genotypes with respect to fruit length. Highest fruit length was recorded in the genotype 46-3-32 (15.80 cm) and 30-1-41 (5.80 cm) in green long and green round types respectively (Table 4 and 7). The variation in fruit length in different brinjal genotypes reported to be inter varietal association with the genetic makeup of the cultivar and governed by the cell size and intercellular spaces of the flesh. These results are in lines with the findings of Sharma and Swaroop (2000), Chaurasia *et al.* (2005), Chattopadhyay *et al.* (2011), Panwar *et al.* (2013), Sanas *et al.* (2014), Malshe *et al.* (2016), Sharma and Banyal (2016), Bhavana and Singh (2016) and Das *et al.* (2017).

Fruit width differed significantly among both green long and green round segments. In green long 46-6-4 (3.11 cm) and in green round 249-10-54 (5.01 cm) has recorded the maximum fruit width. This

may be due to sufficient diversity among brinjal genotypes and also due to climatic and genetic factors. Similar variations have been reported previously by Paikra (2001), Chaurasia *et al.* (2005), Chattopadhyay *et al.* (2011), Praneetha *et al.* (2011), Karak *et al.* (2012), Sanas *et al.* (2014), Malshe *et al.* (2016) in brinjal.

Significant difference was found among the genotypes with respect to average fruit weight. In green long 170-9-30 (38.58g) and in green round genotype 30-1-18 (46.13g) has recorded the maximum average fruit weight. This may be due to the variation among the genotypes. Similar variations have been reported previously by Asati (2001), Paikra (2001), Chaurasia *et al.* (2005), Meena *et al.* (2009), Chattopadhyay *et al.* (2011), Praneetha *et al.* (2011), Karak *et al.* (2012), Sanas *et al.* (2014), Malshe *et al.* (2016), Sharma and Banyal (2016), Bhavana and Singh (2016).

Significant difference was observed for number of fruits per plant among different genotypes of brinjal (Table 5 and 8). The maximum number of fruits was noticed in 170-19-26 (26.31) green long genotype and in 30-2-12 (20.44) green round genotype. This might be due to higher number of flower cluster per plant and higher fruit set. It could also due to higher number of leaves, number of branches and maximum plant spread in genotypes. These results are in confirmation with the findings of Chaudhary and Pathania (1998), Sharma and Swaroop (2000), Paikra (2001), Baswana *et al.* (2002), Illangakoon *et al.* (2004), Maharana *et al.* (2006), Meena *et al.* (2009), Praneetha *et al.* (2011), Karak *et al.* (2012), Nirmala and Vethamoni (2016), Chaturvedi *et al.* (2016), Tripathy *et al.* (2017) in brinjal.

Genotypes showed significant differences with respect to fruit yield per plant. In green long segments, the maximum fruit yield per plant was recorded in 170-9-26 (836.11g) and in green round 30-2-7 (754.64g) was recorded. This may be due to that, more number of fruits per plant might be due to higher number of flower clusters per plant and higher fruit set. It could also be due to higher number of leaves, number of branches and maximum plant spread in genotypes. Similar results were reported by Chaudhary and Pathania (1998), Asati (2001), Paikra (2001), Baswana *et al.* (2002), Katoch and Pathania (2002), Illangakoon *et al.* (2004), Maharana *et al.* (2006), Meena *et al.* (2009), Ansari *et al.* (2011), Chattopadhyay *et al.* (2011), Suresh *et al.* (2012) in brinjal.

5.5 Bacterial wilt disease incidence

The genotypes differed significantly with respect to bacterial wilt incidence (Table. 9). The least incidence was recorded in the genotype 170-9-30 (10.71%) among green long and in 249-10-54 (10.69%) among green round where as the maximum disease incidence was recorded in the long green genotype 46-6-4 (57.14%) and 30-1-32 (48.57%) in green round genotypes. This may be due to the resistant accessions had longer incubation period compared to the susceptible ones. Similar observation was also made by Chaudhary and Sharma (2000), (Clain *et al*., 2004), Hussain *et al.* (2005), Rahman *et al.* (2011), Mondal *et al.* (2013), Gopalakrishnan *et al.* (2014), Kumar *et al.* (2014), Santhosh *et al.* (2015), Devmore *et al.* (2016), Biswas and Ghosh (2018).

5.6 Quality parameter

Phenol content in brinjal differed significantly among the genotypes (Table 11 and 12). The highest phenol content in Arka Anand (4.06 mg/g) among green long genotypes and among green round genotypes 30-1-18 (3.15 mg/g) was recorded. The variation in phenol content depending on genotypes, environment and growing conditions. It could also depends on harvesting stage of the crop. The results are in agreement with Okmen *et al.* (2009), Shaheen *et al.* (2013), (Sultana *et al.,* 2013), Somawathi *et al.* (2014), Kandoliya *et al.* (2015) and Nayanathara *et al.* (2016).

VI. SUMMARY

The present study entitled as 'Performance of advanced breeding lines of brinjal (*Solanum melongena* L.) for bacterial wilt disease resistance, yield and quality attributes' This experiment was conducted at Department of Vegetable Science, College of Horticulture, Bengaluru during 2017-18 with the objectives to study the performance of advanced breeding lines of brinjal for growth, yield, quality attributes and bacterial wilt disease resistance. The experiment was conducted separately for green long and green round genotypes. Fourteen green long genotypes were evaluated in two replications in randomized complete block design along with parents (Green Long and IIHR-3) and checks (Arka Kusumakar and Arka Anand). In green round segment, ten genotypes along with parents (RGR and WCGR) were evaluated in three replications in randomized complete block design. The salient findings of the investigation are summarized in this chapter.

Analysis of variance showed significant difference for all the parameters *viz.,* plant height (cm), number of branches, days to first flowering, days to 50 per cent flowering, fruit length (cm), fruit width (cm), number of fruits per plant, average fruit weight (g), yield per plant (g), bacterial wilt incidence (%) and phenol content (GAE mg/g) in green long and green round segments of brinjal. Plant height, number of branches, days to first flowering, days to 50% flowering, number of fruits per plant, average fruit weight, yield per plant in green round segments.

Genotype 170-11-11 (75.21 cm) and 30-2-7 (64.32 cm) were the tallest among green long and green round segments respectively.

Genotypes 170-19-26 (6.56) and 249-10-29 (6.82) recorded the maximum number of branches per plant among green long and green round types respectively.

Among all the evaluated green long and green round brinjal genotypes, 46-6-4 (36.70 days) and 30-1-42 (37.53 days) were the earliest to show the first flowering respectively and the same genotypes continued its early flowering behavior and reached to fifty per cent flowering in 42.90 and 44.30 days after transplanting respectively compared to other genotypes.

The fruit length varied among the genotypes due to their genetic makeup. Fruit length was highest in the green long genotype 46-3-32 (15.80 cm) and green round genotype 30-1-41 (5.80 cm). The fruits of green long genotypes 46-6-4 (3.11 cm) and 249-10-54 (5.01 cm) among green round has recorded highest fruit width among green round respectively.

Number of fruits per plant varied significantly among the genotypes. The maximum number of fruits per plant was recorded in 170-19-26 (26.31) and 30-2-12 (20.44) among green long and green round brinjal genotypes respectively.

The genotypes 170-9-30 (38.58 g) and 30-1-18 (46.13 g) was recorded the highest average fruit weight among green long and green round genotypes respectively. The genotypes 170-19-26 (836.11g) and 30-2-7 (754.64g) recorded highest fruit yield among green long and green round genotypes respectively.

Among green long genotypes, nine (46-3-32, 46-3-35, 170-11-1, 170-11-11, 170-9-11, 170-9-30, 170-9-15, 170-9-19,170-19-26) advanced breeding lines were resistant, four (46-6-37, 46-6-10, 170-11-14, 170-19-19) genotypes were moderately resistant and one genotype (46-6-4) was found to be moderately susceptible to bacterial wilt disease.

Five genotypes (30-2-7, 30-2-12, 30-1-7, 249-10-29, 249-10-54) found resistant to bacterial wilt disease, three genotypes (30-1-41, 30-1-42, 249-10-55) were moderately resistant and two genotypes

(30-1-32 and 30-1-18) were moderately susceptible to bacterial wilt disease in green round segment of brinjal.

With respect to quality parameter, phenol content in fruit was highest in the genotype 170-19-19 (3.56) among green long segment and 30-1-18 (3.15) among green round segment.

In the present investigation, an attempt was made to identify the best genotypes for yield and quality. Genotypes 46-6-4 (36.70 days) and 30-1-42 (37.53 days) can be used as early types among different green long and green round genotypes. Genotypes, 170-9-26 (836.11 g) and 30-2-7 (754.64g) were found promising in terms of fruit yield.

Conclusion

- For growth parameters the genotypes, 170-11-11 and 30-2-7 were recorded highest plant height.
- For earliness, 46-6-4 and 30-1-42 genotypes shows minimum number of days to first and 50 per cent flowering.
- 170-9-26 and 30-2-7 genotypes were recorded maximum fruit yield, in green long and green round segments in brinjal.
- 170-9-30, 46-3-35 and 170-19-26 in green long segment and 249-10-54, 30-2-7 and 30-1-7 in green round segment shows resistant to bacterial wilt disease.

Future line of work

Based on the current study, the following work may be suggested for future investigations.

- Performance of the identified superior genotypes could be confirmed by large scale evaluation trial at different locations for yield stability and the best genotypes could be adopted for commercial cultivation.
- Investigations on evaluation of genotypes under different seasons of the year may be taken up as the present study was restricted to a single season only.

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APPENDIX - I

Meterological data recorded during the period of experimentation*(2017-18)

Month	Rainfall (mm)	Temperature (^{0}C)		Relative humidity (%)		Sun shine (Hours)
		Maximum	Minimum	Maximum	Minimum	
July	80.8	28.3	19.7	93	54	4.2
August	117.4	28.2	19.5	93	56	3.8
September	128.6	28.5	19.4	91	54	4.5
October	428.4	28.1	18.8	94	56	4.4
November	29.4	26.2	17.5	90	54	6.8
December	1.0	26.6	16.2	90	48	6.3
January	10.0	27.4	15.2	91	45	8.2
February	0.0	29.9	15.3	86	42	12.6
March	21.2	32.2	18.9	85	37	8.7
April	142.1	32.1	21.0	84	41	7.9

*UHS Campus (RHREC and COH), Bengaluru 2018

APPENDIX - II

Quantitative characters of parents and checks

Parent/ check	Plant height (cm)	Number of branches	Days to first flowering	Fruit length (cm)	Fruit breadth (cm)	Number of fruits	Average fruit weight (g)	Yield/ plant (g)
Green Long	61.70	5.02	36.74	15.01	2.98	16.80	40.60	665.78
IIHR-3	67.30	5.80	37.17	15.17	2.72	17.12	37.19	623.15
WCGR	61.50	4.30	44.30	5.59	5.07	16.30	37.31	639.71
RGR	59.87	5.50	41.13	5.64	5.23	14.75	43.61	605.85
Arka Anand	72.57	5.29	43.00	18.38	2.63	27.64	32.09	731.05
Arka Kusumakar	66.63	4.65	38.97	14.31	2.94	19.58	34.42	687.31

APPENDIX - III

Quantitative characters of each plant of F_5 generation of the cross Green Long × IIHR-3

Quantitative characters of each plant of green long pre breeding line 46-3-32

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	60.00	4.00	35.00	40.00	15.60	2.95	21.00	35.62	748.00
P2	67.00	4.00	38.00	43.00	11.50	2.38	17.00	37.20	632.40
P3	72.00	3.00	37.00	42.00	10.20	3.20	17.00	31.14	529.40
P4	67.00	2.00	38.00	42.00	12.60	3.05	22.00	33.74	742.20
P5	68.00	3.00	38.00	46.00	12.50	2.96	20.00	33.33	666.50
P6	69.00	2.00	38.00	44.00	14.40	3.22	23.00	28.15	647.50
P7	75.00	3.00	38.00	42.00	21.30	2.83	31.00	34.92	1082.60
P8	65.00	2.00	38.00	46.00	13.50	3.26	16.00	34.11	545.80
P9	46.00	1.00	38.00	46.00	18.50	3.21	14.00	38.88	544.30
P10	63.00	4.00	37.00	44.00	17.50	3.12	21.00	33.34	700.20
P11	67.00	2.00	37.00	42.00	11.30	3.26	19.00	37.02	703.40
P12	73.00	2.00	38.00	43.00	14.00	3.46	16.00	33.41	534.60
P13	62.00	2.00	38.00	41.00	21.00	2.90	14.00	33.69	471.60
P14	67.00	2.00	39.00	43.00	21.00	2.67	15.00	30.69	460.30
P15	76.00	9.00	38.00	45.00	12.50	3.50	15.00	36.68	550.20
P16	77.00	6.00	39.00	43.00	23.60	2.66	18.00	38.23	688.20
P19	71.00	8.00	40.00	55.00	11.60	3.31	13.00	39.98	519.70
P20	70.00	7.00	40.00	46.00	13.00	3.29	17.00	35.76	608.00
P21	73.00	8.00	41.00	46.00	24.30	2.91	19.00	35.25	669.70
P23	73.00	9.00	41.00	46.00	21.00	2.18	25.00	34.44	861.10
P24	73.00	7.00	40.00	47.00	23.80	2.53	23.00	34.79	800.10
P25	74.00	6.00	41.00	47.00	22.60	2.25	21.00	36.40	764.50
P26	76.00	7.00	40.00	46.00	23.50	2.43	21.00	35.29	741.10
P27	75.00	6.00	40.00	45.00	12.50	3.42	17.00	42.46	721.80

Quantitative characters of each plant of green long pre breeding line 46-3-35

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	72.00	6.00	38.00	42.00	12.50	2.73	18.00	35.04	665.80
P2	72.00	2.00	38.00	40.00	11.63	3.54	15.00	31.68	506.80
P3	64.00	3.00	39.00	42.00	9.62	2.78	15.00	36.69	513.70
P4	69.00	3.00	39.00	41.00	11.90	2.49	16.00	39.03	585.40
P5	68.00	2.00	38.00	40.00	15.90	2.37	22.00	49.29	739.40
P6	54.00	3.00	39.00	42.00	11.26	2.36	20.00	41.09	739.60
P7	72.00	3.00	39.00	45.00	16.40	2.11	20.00	35.97	683.50
P8	60.00	3.00	39.00	43.00	9.70	2.30	15.00	33.60	539.40
P9	68.00	4.00	40.00	45.00	9.50	2.30	18.00	32.50	638.20
P10	69.00	2.00	40.00	42.00	13.50	2.74	17.00	37.58	651.00
P11	67.00	4.00	40.00	54.00	9.40	3.54	13.00	30.67	445.40
P12	77.00	3.00	41.00	56.00	12.50	3.36	18.00	44.44	666.60
P13	68.00	2.00	40.00	52.00	11.98	2.39	17.00	42.89	643.40
P14	73.00	4.00	39.00	51.00	15.40	2.56	20.00	42.73	683.60
P15	76.00	9.00	38.00	45.00	12.50	3.50	15.00	36.68	550.20
P16	77.00	6.00	39.00	43.00	23.60	2.66	18.00	38.23	688.20
P19	71.00	8.00	40.00	55.00	11.60	3.31	13.00	39.98	519.70
P20	70.00	7.00	40.00	46.00	13.00	3.29	17.00	35.76	608.00
P21	73.00	8.00	41.00	46.00	24.30	2.91	19.00	35.25	669.70
P23	73.00	9.00	41.00	46.00	21.00	2.18	25.00	34.44	861.10
P24	73.00	7.00	40.00	47.00	23.80	2.53	23.00	34.79	800.10
P25	74.00	6.00	41.00	47.00	22.60	2.25	21.00	36.40	764.50
P26	76.00	7.00	40.00	46.00	23.50	2.43	21.00	35.29	741.10
P27	75.00	6.00	40.00	45.00	12.50	3.42	17.00	42.46	721.80

Quantitative characters of each plant of green long pre breeding line 46-6-4

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	62.00	1.00	38.00	42.00	13.50	2.45	17.00	38.33	659.90
P3	65.00	3.00	36.00	42.00	12.68	3.30	19.00	28.58	600.10
P4	66.00	2.00	37.00	43.00	12.69	3.54	20.00	36.92	753.80
P5	60.00	2.00	36.00	43.00	12.40	2.98	16.00	43.85	682.30
P9	67.00	2.00	38.00	44.00	13.55	3.85	15.00	45.46	654.60
P17	65.00	3.00	37.00	43.00	12.80	2.66	17.00	34.03	506.30
P18	60.00	4.00	36.00	44.00	13.50	2.45	14.00	31.11	573.30
P19	62.00	4.00	36.00	42.00	11.56	2.18	17.00	39.11	669.30
P22	50.00	5.00	36.00	42.00	17.02	2.98	23.00	31.91	774.40
P23	72.00	6.00	37.00	44.00	13.98	2.97	21.00	33.25	732.00

Quantitative characters of each plant of green long pre breeding line 46-6-37

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P3	60.00	2.00	38.00	38.00	13.50	2.87	17.00	32.90	594.80
P4	70.00	2.00	39.00	39.00	11.98	3.26	17.00	32.18	586.20
P5	71.00	2.00	40.00	40.00	15.69	3.02	17.00	30.24	562.90
P6	56.00	2.00	41.00	41.00	12.80	2.36	16.00	44.81	692.90
P7	59.00	2.00	40.00	40.00	12.80	2.55	18.00	31.59	610.70
P9	69.00	3.00	38.00	38.00	13.40	2.67	14.00	45.27	607.40
P11	66.00	3.00	39.00	39.00	15.20	3.21	19.00	34.13	677.80
P12	50.00	2.00	38.00	38.00	14.28	2.97	16.00	40.28	643.10
P13	68.00	5.00	39.00	39.00	16.20	2.98	17.00	37.98	655.70
P14	72.00	4.00	38.00	38.00	13.40	3.04	18.00	35.13	656.70
P15	60.00	6.00	38.00	38.00	12.60	2.54	13.00	36.15	470.00
P17	63.00	7.00	40.00	40.00	13.80	2.88	17.00	38.22	658.60
P18	60.00	5.00	40.00	40.00	15.29	2.67	16.00	42.43	666.70
P20	61.00	4.00	38.00	38.00	13.56	2.64	16.00	38.76	626.40
P21	68.00	5.00	40.00	40.00	14.82	3.19	18.00	37.82	691.60
P22	61.00	6.00	41.00	41.00	15.00	3.24	17.00	35.69	628.30
P24	39.00	3.00	40.00	40.00	14.56	2.97	19.00	32.91	660.80
P26	66.00	4.00	38.00	38.00	15.90	2.94	17.00	35.94	631.30
P27	65.00	7.00	39.00	39.00	16.21	2.85	17.00	27.68	532.20

Quantitative characters of each plant of green long pre breeding line 46-6-10

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	58.00	3.00	42.00	49.00	17.00	2.53	17.00	36.21	634.50
P3	70.00	4.00	41.00	48.00	16.20	2.62	17.00	47.06	764.70
P4	59.00	2.00	38.00	44.00	12.60	2.31	16.00	42.96	672.60
P5	65.00	2.00	40.00	46.00	14.56	2.68	17.00	38.75	665.00
P6	58.00	3.00	40.00	45.00	13.01	3.21	18.00	37.28	684.70
P7	81.00	4.00	38.00	42.00	15.26	2.68	22.00	25.72	637.20
P8	55.00	2.00	40.00	45.00	15.60	3.31	17.00	31.55	578.60
P10	58.00	2.00	38.00	42.00	13.45	2.97	18.00	30.02	590.30
P12	64.00	2.00	38.00	45.00	15.00	3.14	18.00	27.09	552.20
P13	71.00	3.00	40.00	48.00	16.40	2.56	17.00	34.33	612.00
P14	72.00	2.00	40.00	47.00	16.20	3.14	18.00	31.63	611.20
P15	62.00	4.00	39.00	42.00	14.26	3.20	16.00	37.64	614.00
P16	65.00	5.00	38.00	43.00	15.60	2.92	15.00	42.29	622.90
P18	58.00	5.00	38.00	45.00	18.21	2.83	17.00	35.63	627.60
P22	56.00	4.00	38.00	43.00	16.10	3.21	19.00	31.42	639.90
P23	52.00	3.00	38.00	42.00	17.40	2.53	17.00	37.03	644.30
P24	60.00	4.00	37.00	43.00	16.23	2.69	15.00	43.16	631.60
P25	65.00	5.00	38.00	45.00	14.62	3.02	15.00	40.76	607.60
P26	62.00	5.00	37.00	43.00	17.23	2.65	18.00	34.18	644.40

Quantitative characters of each plant of green long pre breeding line 170-11-1

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	68.00	2.00	36.00	42.00	12.25	2.89	15.00	37.68	565.23
P2	71.00	4.00	38.00	41.00	13.69	3.04	24.00	35.47	851.23
P3	69.00	2.00	36.00	42.00	14.89	2.97	19.00	37.49	712.30
P4	77.00	3.00	40.00	43.00	13.65	2.65	23.00	30.43	700.00
P5	66.00	4.00	39.00	41.00	14.25	2.64	27.00	33.78	912.00
P6	72.00	4.00	40.00	45.00	13.69	2.98	25.00	30.98	774.60
P7	71.00	3.00	39.00	42.00	12.55	3.12	34.00	33.68	1145.00
P8	76.00	3.00	40.00	45.00	13.22	3.28	18.00	36.11	650.00
P9	67.00	4.00	39.00	42.00	12.54	2.95	19.00	27.63	525.00
P11	79.00	5.00	38.00	43.00	15.26	2.31	18.00	32.83	591.00
P13	74.00	4.00	38.00	42.00	15.80	2.96	21.00	30.95	650.00
P14	75.00	5.00	37.00	43.00	13.66	2.85	20.00	25.78	623.00
P15	69.00	4.00	40.00	45.00	12.88	2.54	19.00	31.37	596.12
P16	77.00	3.00	38.00	42.00	15.70	2.73	15.00	40.90	613.50
P18	65.00	5.00	38.00	42.00	14.21	3.24	17.00	35.88	610.00
P19	69.00	4.00	38.00	43.00	13.51	2.11	15.00	40.06	600.90
P20	70.00	4.00	38.00	44.00	12.68	2.65	16.00	34.38	550.00
P21	71.00	5.00	40.00	45.00	12.90	2.89	18.00	33.92	610.50
P23	65.00	6.00	38.00	42.00	13.66	2.97	17.00	35.90	610.30
P24	70.00	4.00	40.00	46.00	12.56	3.21	16.00	35.01	560.12
P25	71.00	4.00	40.00	45.00	15.86	2.91	16.00	38.27	612.32
P26	72.00	2.00	38.00	42.00	13.56	3.40	19.00	33.31	632.80
P27	62.00	4.00	38.00	43.00	12.90	2.98	19.00	35.22	669.21
P28	61.00	4.00	40.00	45.00	13.54	2.81	18.00	30.54	549.70

Quantitative characters of each plant of green long pre breeding line 170-11-11

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	70.00	2.00	36.00	42.00	13.95	3.01	17.00	26.43	517.20
P2	78.00	3.00	38.00	43.00	15.29	2.96	29.00	28.32	879.60
P3	72.00	2.00	36.00	43.00	15.87	3.05	19.00	29.61	614.60
P4	80.00	3.00	38.00	44.00	12.98	2.65	25.00	24.46	689.20
P5	74.00	4.00	39.00	45.00	11.45	2.64	31.00	33.56	1072.60
P6	85.00	4.00	38.00	43.00	14.56	2.98	25.00	28.73	774.60
P7	77.00	3.00	39.00	45.00	14.39	3.12	36.00	32.85	1218.20
P8	84.00	3.00	39.00	44.00	11.98	3.28	15.00	33.44	534.40
P9	72.00	4.00	39.00	44.00	11.26	3.36	16.00	27.43	501.70
P11	86.00	3.00	38.00	43.00	15.26	2.31	18.00	34.85	653.10
P13	84.00	3.00	38.00	43.00	15.80	2.64	21.00	27.24	635.80
P14	75.00	4.00	38.00	43.00	14.95	2.85	22.00	34.32	783.50
P15	62.00	4.00	40.00	48.00	14.98	2.54	16.00	36.62	602.80
P16	78.00	3.00	38.00	43.00	15.70	2.73	15.00	41.35	613.50
P18	65.00	5.00	39.00	44.00	15.96	3.24	15.00	33.41	534.10
P19	66.00	4.00	38.00	43.00	12.50	2.98	17.00	32.75	593.00
P20	75.00	4.00	38.00	42.00	13.70	3.21	14.00	36.43	527.90
P21	78.00	5.00	40.00	47.00	12.90	2.89	18.00	31.58	610.50
P23	72.00	3.00	38.00	44.00	14.23	2.68	17.00	33.17	598.00
P24	80.00	4.00	40.00	44.00	14.91	3.21	16.00	31.02	541.20
P25	85.00	4.00	39.00	41.00	15.86	2.91	16.00	34.86	583.50
P26	77.00	2.00	38.00	43.00	13.56	3.40	19.00	30.91	632.80
P27	62.00	4.00	38.00	42.00	12.90	3.56	16.00	40.36	644.00
P28	68.00	5.00	40.00	47.00	15.30	2.81	16.00	31.79	549.70

Quantitative characters of each plant of green long pre breeding line 170-11-14

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	67.00	5.00	38.00	58.00	13.21	3.07	23.00	30.73	753.10
P4	66.00	6.00	40.00	43.00	15.40	2.89	18.00	34.27	645.50
P6	72.00	3.00	40.00	45.00	13.90	3.20	17.00	34.05	608.60
P8	75.00	4.00	40.00	50.00	17.30	2.89	16.00	36.86	605.50
P12	84.00	6.00	38.00	42.00	18.20	2.14	17.00	31.90	582.80
P13	73.00	5.00	38.00	43.00	11.65	3.64	21.00	34.68	754.90
P14	80.00	2.00	39.00	43.00	12.90	2.67	19.00	31.53	641.40
P16	71.00	5.00	39.00	44.00	12.99	2.69	20.00	32.51	650.12
P17	62.00	4.00	41.00	46.00	13.61	3.12	19.00	31.50	598.45
P18	61.00	5.00	37.00	42.00	14.36	3.26	21.00	30.96	650.26
P19	70.00	5.00	39.00	44.00	13.69	2.98	20.00	29.86	597.25
P20	66.00	3.00	40.00	48.00	14.36	3.26	16.00	38.77	620.36
P21	75.00	6.00	40.00	47.00	12.96	2.98	15.00	42.41	636.12
P23	66.00	4.00	38.00	43.00	14.36	3.26	16.00	39.09	625.36
P24	77.00	4.00	39.00	44.00	14.23	3.12	17.00	37.13	631.20

Quantitative characters of each plant of green long pre breeding line 170-9-11

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	77.00	5.00	38.00	43.00	12.90	3.49	27.00	31.75	898.40
P2	73.00	3.00	38.00	44.00	14.96	3.02	19.00	28.46	598.40
P3	71.00	4.00	38.00	42.00	13.56	2.98	14.00	44.78	603.00
P5	72.00	5.00	38.00	43.00	16.40	2.85	15.00	40.91	609.10
P6	51.00	3.00	38.00	43.00	15.26	3.05	26.00	30.41	838.60
P7	69.00	5.00	40.00	46.00	16.23	2.65	15.00	41.78	617.80
P8	70.00	4.00	41.00	48.00	14.26	3.21	13.00	40.74	525.90
P9	65.00	2.00	40.00	48.00	12.00	2.56	15.00	39.17	591.70
P11	76.00	3.00	42.00	47.00	11.89	3.21	21.00	40.61	849.80
P12	70.00	2.00	38.00	44.00	13.54	2.97	17.00	30.40	564.80
P13	66.00	2.00	40.00	47.00	12.98	3.56	13.00	49.21	593.70
P15	51.00	3.00	38.00	42.00	15.26	3.05	21.00	29.42	617.80
P16	66.00	5.00	40.00	49.00	16.23	2.65	19.00	32.94	625.90
P17	70.00	4.00	41.00	48.00	16.26	3.21	20.00	34.59	691.70
P18	75.00	5.00	44.00	49.00	16.44	3.65	20.00	32.26	645.22

Quantitative characters of each plant of green long pre breeding line 170-9-30

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	80.00	3.00	45.00	49.00	17.60	2.60	14.00	36.39	527.50
P2	66.00	2.00	36.00	44.00	13.45	3.21	13.00	42.09	536.70
P3	54.00	3.00	45.00	51.00	12.69	3.70	16.00	32.80	659.20
P4	70.00	2.00	36.00	49.00	16.25	2.98	17.00	33.27	699.00
P5	72.00	2.00	45.00	51.00	13.54	3.14	15.00	38.25	582.50
P6	64.00	2.00	45.00	52.00	17.22	2.86	16.00	38.75	626.20
P7	51.00	2.00	40.00	48.00	19.80	2.36	16.00	42.45	667.00
P8	57.00	2.00	45.00	51.00	16.21	3.12	14.00	44.77	602.90
P9	75.00	3.00	42.00	49.00	11.65	2.68	23.00	36.85	1084.50
P10	64.00	3.00	43.00	49.00	13.58	2.58	16.00	40.35	643.80
P11	76.00	3.00	42.00	49.00	15.94	3.01	20.00	40.89	895.20
P13	79.00	3.00	43.00	48.00	17.26	2.78	24.00	35.45	873.60
P14	71.00	3.00	41.00	49.00	16.87	2.56	16.00	41.70	658.70
P16	60.00	3.00	45.00	51.00	16.28	2.97	15.00	37.42	574.20
P17	70.00	4.00	43.00	50.00	13.56	3.26	16.00	36.60	602.60
P18	72.00	4.00	42.00	49.00	15.80	3.05	14.00	39.13	552.20
P19	76.00	5.00	43.00	49.00	14.60	2.97	15.00	34.79	547.90
P20	35.00	2.00	42.00	51.00	16.90	2.85	12.00	49.06	543.40
P21	55.00	3.00	43.00	50.00	12.50	2.65	17.00	34.93	619.20
P22	67.00	6.00	43.00	50.00	14.26	2.89	16.00	41.16	652.80
P23	78.00	6.00	42.00	49.00	17.25	2.76	15.00	41.54	615.40
P24	80.00	5.00	40.00	47.00	16.50	3.01	20.00	31.73	676.00
P25	79.00	6.00	42.00	50.00	13.60	3.10	17.00	32.26	587.10
P27	68.00	5.00	42.00	49.00	14.26	2.85	14.00	43.64	592.80

Quantitative characters of each plant of green long pre breeding line 170-9-15

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	50.00	2.00	37.00	42.00	13.25	3.24	17.00	34.87	618.40
P2	56.00	2.00	40.00	45.00	12.56	3.67	17.00	26.78	521.40
P3	63.00	3.00	38.00	43.00	16.58	2.69	32.00	30.45	1022.20
P4	66.00	2.00	45.00	50.00	14.09	3.15	32.00	30.75	1030.20
P6	62.00	2.00	38.00	42.00	13.38	2.56	19.00	30.76	630.60
P7	67.00	3.00	38.00	43.00	15.29	2.95	34.00	30.90	1096.20
P8	57.00	4.00	45.00	50.00	12.50	3.74	25.00	30.84	816.80
P10	73.00	3.00	43.00	49.00	13.65	3.15	14.00	33.20	498.80
P11	58.00	2.00	40.00	48.00	14.65	3.24	20.00	31.81	677.20
P12	70.00	2.00	38.00	44.00	12.66	3.56	19.00	33.16	664.20
P13	66.00	2.00	36.00	41.00	15.65	2.56	21.00	37.61	801.80
P14	73.00	4.00	39.00	43.00	21.80	2.54	16.00	42.65	669.20
P15	75.00	5.00	42.00	49.00	13.65	2.42	31.00	37.46	1174.00
P16	59.00	4.00	43.00	49.00	15.34	2.85	20.00	30.75	661.20
P17	62.00	4.00	45.00	50.00	13.85	3.26	16.00	40.47	645.20
P18	78.00	5.00	42.00	48.00	14.65	3.21	16.00	38.60	624.60
P20	77.00	5.00	48.00	51.00	13.65	3.15	16.00	36.52	601.70
P21	58.00	3.00	45.00	50.00	14.35	3.24	14.00	35.79	522.10
P22	76.00	5.00	43.00	49.00	14.56	2.98	16.00	33.68	570.50
P23	65.00	5.00	42.00	49.00	13.24	3.21	17.00	35.16	621.90
P24	67.00	4.00	45.00	49.00	14.56	2.85	20.00	32.28	684.20
P25	66.00	4.00	43.00	47.00	13.98	3.15	32.00	24.99	874.60
P26	58.00	3.00	43.00	48.00	15.21	2.97	18.00	36.01	668.10
P27	63.00	3.00	42.00	48.00	16.80	3.16	16.00	35.56	591.20
P28	65.00	4.00	42.00	45.00	15.91	2.56	20.00	29.69	645.40

Quantitative characters of each plant of green long pre breeding line 170-9-19

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	61.00	6.00	38.00	42.00	12.56	3.25	15.00	35.83	558.30
P2	58.00	7.00	42.00	49.00	14.26	2.98	22.00	26.28	646.80
P4	52.00	8.00	38.00	42.00	11.65	3.25	19.00	30.26	623.60
P5	54.00	6.00	36.00	44.00	12.87	3.28	17.00	35.03	620.40
P6	60.00	4.00	38.00	43.00	13.65	2.97	18.00	28.08	565.10
P7	75.00	8.00	39.00	44.00	15.60	3.01	17.00	32.63	591.60
P8	69.00	5.00	40.00	44.00	16.80	2.58	23.00	25.06	651.10
P9	56.00	4.00	41.00	44.00	13.80	3.24	21.00	30.91	694.50
P10	41.00	5.00	40.00	45.00	15.60	2.55	22.00	27.18	662.00
P11	44.00	4.00	42.00	49.00	12.50	2.54	26.00	25.19	729.00
P12	56.00	7.00	43.00	49.00	14.65	2.81	24.00	24.20	659.80
P13	76.00	7.00	42.00	48.00	17.00	2.57	23.00	28.84	719.10
P14	63.00	7.00	40.00	45.00	13.25	3.30	25.00	27.11	742.10
P16	70.00	4.00	40.00	46.00	12.87	3.56	25.00	24.93	698.60
P18	58.00	3.00	40.00	46.00	13.20	3.21	19.00	24.62	544.70
P19	56.00	3.00	41.00	49.00	12.00	2.45	23.00	27.11	687.90
P20	67.00	4.00	40.00	46.00	15.60	2.34	21.00	28.74	659.80
P21	67.00	3.00	42.00	49.00	19.00	2.65	22.00	17.21	492.60
P22	60.00	4.00	43.00	47.00	12.50	3.24	19.00	31.54	641.50
P23	37.00	3.00	45.00	50.00	12.65	2.34	23.00	27.14	688.50
P24	51.00	3.00	38.00	42.00	16.00	3.12	20.00	34.57	718.60
P25	72.00	5.00	39.00	43.00	15.40	2.96	26.00	25.12	727.60
P26	40.00	2.00	42.00	49.00	12.50	3.21	28.00	23.04	730.00
P27	57.00	3.00	40.00	46.00	11.25	3.67	27.00	25.01	750.20
P28	75.00	4.00	43.00	47.00	13.56	2.98	36.00	19.94	818.10

Quantitative characters of each plant of green long pre breeding line 170-19-26

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	62.00	7.00	36.00	40.00	14.56	2.37	28.00	27.12	823.80
P2	64.00	7.00	38.00	42.00	12.68	3.25	34.00	40.03	1360.80
P4	71.00	9.00	40.00	45.00	13.55	2.69	21.00	31.23	699.60
P5	68.00	8.00	45.00	50.00	13.87	3.01	35.00	21.38	841.30
P6	71.00	9.00	40.00	44.00	12.98	2.97	23.00	34.24	816.40
P7	72.00	9.00	38.00	42.00	16.80	2.14	18.00	36.05	668.60
P8	54.00	8.00	38.00	42.00	13.28	2.97	36.00	30.93	1158.80
P9	58.00	7.00	40.00	45.00	12.87	2.78	22.00	27.35	665.00
P10	50.00	6.00	42.00	47.00	12.80	2.85	17.00	27.58	531.00
P11	59.00	7.00	39.00	41.00	11.64	2.65	21.00	25.20	603.20
P12	59.00	7.00	38.00	42.00	14.00	2.97	30.00	20.40	709.90
P13	56.00	7.00	40.00	45.00	13.20	2.45	29.00	27.47	859.20
P14	64.00	8.00	42.00	45.00	14.56	3.12	32.00	37.70	1217.80
P15	71.00	6.00	38.00	44.00	11.20	2.60	28.00	22.73	722.70
P16	69.00	5.00	43.00	46.00	12.54	3.40	30.00	22.80	770.00
P17	44.00	5.00	42.00	48.00	20.50	3.70	16.00	44.24	686.60
P18	71.00	5.00	43.00	48.00	13.68	2.99	26.00	22.92	681.30
P19	56.00	7.00	38.00	43.00	14.25	2.35	28.00	20.25	665.80
P20	54.00	9.00	39.00	46.00	15.90	3.21	14.00	37.58	538.20
P21	72.00	2.00	42.00	47.00	16.50	2.58	28.00	24.91	773.00
P22	60.00	6.00	43.00	48.00	13.65	2.69	24.00	29.14	753.60
P23	47.00	5.00	42.00	48.00	14.32	3.12	34.00	18.68	741.70
P24	72.00	5.00	43.00	49.00	14.36	3.56	28.00	24.77	769.70
P26	64.00	6.00	40.00	46.00	16.32	2.59	27.00	19.85	636.80
P27	47.00	5.00	42.00	48.00	15.69	3.15	29.00	20.94	702.60

Quantitative characters of each plant of green long pre breeding line 170-19-19

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	62.00	6.00	45.00	45.00	12.56	3.25	15.00	35.83	558.30
P2	58.00	7.00	42.00	49.00	14.26	2.98	22.00	26.28	646.80
P4	52.00	8.00	38.00	43.00	11.65	3.25	19.00	30.26	623.60
P5	54.00	6.00	36.00	42.00	12.87	3.28	17.00	35.03	620.40
P6	60.00	4.00	38.00	46.00	13.65	2.97	18.00	28.08	565.10
P7	75.00	8.00	39.00	43.00	15.60	3.01	17.00	32.63	591.60
P9	56.00	4.00	41.00	48.00	13.80	3.24	21.00	30.91	694.50
P10	41.00	5.00	40.00	47.00	15.60	2.55	22.00	27.18	662.00
P11	44.00	4.00	42.00	49.00	12.50	2.54	26.00	25.19	729.00
P12	56.00	7.00	43.00	49.00	14.65	2.81	24.00	24.20	659.80
P13	76.00	7.00	42.00	49.00	17.00	2.57	23.00	28.84	719.10
P14	63.00	7.00	40.00	48.00	13.25	3.30	25.00	27.11	742.10
P15	70.00	4.00	40.00	48.00	12.87	3.56	25.00	24.93	698.60
P17	58.00	3.00	40.00	49.00	13.20	3.21	19.00	24.62	544.70
P18	56.00	3.00	41.00	48.00	12.00	2.45	23.00	27.11	687.90
P19	67.00	4.00	40.00	46.00	15.60	2.34	21.00	28.74	659.80
P20	67.00	3.00	42.00	47.00	19.00	2.65	22.00	17.21	492.60
P21	60.00	4.00	43.00	46.00	12.50	3.24	19.00	31.54	641.50
P22	37.00	3.00	45.00	50.00	12.65	2.34	23.00	27.14	688.50
P23	51.00	3.00	38.00	43.00	16.00	3.12	20.00	34.57	718.60
P24	72.00	5.00	39.00	44.00	15.40	2.96	26.00	25.12	727.60
P25	40.00	2.00	42.00	49.00	12.50	3.21	28.00	23.04	730.00
P26	57.00	3.00	40.00	45.00	11.25	3.67	27.00	25.01	750.20
P27	75.00	4.00	43.00	48.00	13.56	2.98	36.00	19.94	818.10

APPENDIX - IV

Quantitative characters of F_5 RGR×WCGR

Quantitative characters of each plant of green round pre breeding line 30-2-7

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	51.00	4.00	40.00	43.00	6.50	4.46	17.00	32.18	547.00
P2	60.00	5.00	42.00	45.00	6.40	5.10	19.00	46.00	874.00
P7	58.00	4.00	43.00	46.00	5.60	3.86	21.00	40.52	851.00
P8	57.00	4.00	40.00	42.00	5.56	4.20	17.00	43.18	734.00
P10	56.00	5.00	45.00	45.00	5.09	5.37	17.00	39.65	674.10
P11	39.00	5.00	42.00	48.00	5.55	5.15	23.00	35.96	827.10
P12	44.00	3.00	43.00	50.00	4.93	4.43	17.00	39.12	665.10
P16	68.00	5.00	45.00	48.00	4.82	5.92	18.00	33.83	609.00
P17	73.00	6.00	43.00	46.00	4.53	5.63	19.00	32.26	580.65
P18	74.00	5.00	43.00	47.00	4.52	5.21	20.00	37.04	666.80
P19	75.00	4.00	42.00	46.00	5.45	5.25	23.00	48.91	880.40
P20	50.00	4.00	42.00	45.00	4.63	5.24	22.00	49.28	887.10
P21	68.00	6.00	42.00	46.00	5.30	4.88	23.00	45.18	813.20
P22	70.00	5.00	43.00	48.00	5.65	5.90	18.00	45.90	826.20
P23	74.00	3.00	43.00	46.00	5.90	4.98	24.00	49.25	886.50
P24	75.00	8.00	43.00	47.00	5.50	4.26	20.00	39.12	704.10
P25	78.00	4.00	45.00	46.00	4.95	5.82	18.00	38.20	687.60
P26	75.00	7.00	43.00	46.50	5.32	4.75	18.00	36.86	663.40
P28	65.00	7.00	43.00	46.00	5.50	5.00	20.00	57.76	1039.60

Quantitative characters of each plant of green round pre breeding line 30-2-12

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P4	42.00	4.00	39.00	45.00	5.87	4.39	22.00	32.71	719.70
P6	43.00	3.00	39.00	42.00	4.26	4.13	21.00	35.17	738.50
P7	40.00	5.00	39.00	46.00	5.50	5.80	18.00	36.90	664.20
P8	54.00	4.00	38.00	43.00	5.50	4.20	20.00	38.66	773.10
P9	42.00	4.00	38.00	46.00	4.90	5.30	24.00	33.77	810.40
P10	52.00	5.00	38.00	45.00	5.20	4.95	20.00	39.49	789.70
P12	54.00	4.00	39.00	42.00	5.60	4.70	23.00	34.59	795.50
P13	46.00	5.00	39.00	43.00	6.10	5.20	21.00	36.25	761.20
P17	62.00	5.00	42.00	50.00	6.90	5.20	20.00	34.12	682.40
P19	29.00	2.00	42.00	49.00	5.90	4.40	21.00	29.03	609.60
P20	59.00	5.00	42.00	48.00	5.85	5.50	21.00	34.26	719.50
P23	54.00	5.00	43.00	48.00	4.40	4.90	18.00	42.24	760.40
P24	62.00	4.00	42.00	46.00	5.00	4.40	19.00	39.86	757.30
P26	45.00	3.00	43.00	46.00	4.50	5.40	20.00	39.51	790.20
P27	54.00	5.00	42.00	47.00	5.53	4.45	21.00	39.53	830.20
P28	61.00	5.00	42.00	49.00	5.64	4.80	18.00	38.68	696.30

Quantitative characters of each plant of green round pre breeding line 30-1-7

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	40.00	4.00	36.00	45.00	5.69	4.82	21.00	34.96	734.10
P2	59.00	9.00	38.00	44.00	5.00	3.70	19.00	42.64	810.20
P3	55.00	3.00	36.00	47.00	5.53	4.20	19.00	36.61	695.60
P4	50.00	6.00	38.00	49.00	6.21	5.60	17.00	38.55	655.30
P5	51.00	6.00	39.00	60.00	5.00	4.98	21.00	45.35	952.30
P6	52.00	4.00	38.00	48.00	5.00	3.50	13.00	43.57	566.40
P7	47.00	4.00	39.00	43.00	5.20	5.60	18.00	41.02	738.40
P8	58.00	5.00	38.00	44.00	5.09	5.38	18.00	52.90	952.20
P10	49.00	5.00	38.00	46.00	4.93	4.45	16.00	38.91	622.50
P11	61.00	5.00	39.00	45.00	5.55	5.15	17.00	38.11	647.80
P14	60.00	4.00	39.00	43.00	6.30	5.80	25.00	34.64	866.00
P15	43.00	4.00	39.00	44.00	5.30	4.66	20.00	34.93	698.50
P16	54.00	6.00	39.00	45.00	5.55	5.15	19.00	33.42	635.00
P17	60.00	7.00	42.00	56.00	5.93	4.90	18.00	43.53	783.50
P18	55.00	4.00	42.00	54.00	4.97	5.60	19.00	35.71	678.50
P19	59.00	6.00	43.00	58.00	4.37	5.33	19.00	35.11	667.10
P20	86.00	5.00	42.00	46.00	5.05	4.58	18.00	46.68	840.20
P21	62.00	7.00	42.00	43.00	6.21	4.98	20.00	35.29	705.70
P22	52.00	5.00	42.00	49.00	5.90	5.30	19.00	35.08	666.60
P23	55.00	6.00	40.00	47.00	4.85	5.65	16.00	42.59	681.50
P24	65.00	8.00	42.00	48.00	4.29	5.26	20.00	67.50	1350.00
P25	68.00	8.00	40.00	43.00	5.90	4.98	15.00	42.63	639.40

Quantitative characters of each plant of green round pre breeding line 30-1-41

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	55.00	5.00	39.00	43.00	5.60	4.89	15.00	39.71	595.60
P2	55.00	6.00	39.00	45.00	6.82	5.26	14.00	46.41	649.80
P5	45.00	5.00	40.00	49.00	5.87	6.25	15.00	42.27	634.10
P6	46.00	5.00	40.00	47.00	6.02	4.89	20.00	43.40	867.90
P8	43.00	5.00	39.00	43.00	5.98	4.56	19.00	37.31	708.90
P11	45.00	4.00	39.00	48.00	5.26	4.85	18.00	32.84	591.20
P12	55.00	7.00	39.00	43.00	5.49	6.20	19.00	36.44	692.40
P13	58.00	7.00	40.00	46.00	6.31	5.21	21.00	30.98	650.50
P14	63.00	5.00	41.00	47.00	5.30	4.30	16.00	37.50	600.00
P15	54.00	5.00	40.00	46.00	5.68	5.12	17.00	46.62	792.60
P17	32.00	4.00	40.00	48.00	5.36	4.56	16.00	41.21	659.40
P18	42.00	5.00	40.00	46.00	5.65	4.86	18.00	38.09	685.70
P19	62.00	6.00	41.00	47.00	6.13	5.24	18.00	36.87	663.70
P20	65.00	7.00	40.00	42.00	5.98	4.26	20.00	34.71	694.10
P22	55.00	9.00	42.00	42.00	5.46	4.25	20.00	39.45	788.90
P24	43.00	4.00	41.00	48.00	5.58	4.82	24.00	33.94	814.60
P25	48.00	5.00	45.00	50.00	6.10	4.98	16.00	40.37	645.90
P28	62.00	11.00	41.00	48.00	4.57	3.65	22.00	37.01	750.90

Quantitative characters of each plant of green round pre breeding line 30-1-42

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	48.00	5.00	37.00	45.00	6.17	5.26	20.00	33.78	675.50
P2	39.00	3.00	38.00	46.00	5.75	4.89	17.00	41.25	701.30
P3	32.00	3.00	39.00	45.00	6.23	3.97	16.00	37.01	592.10
P9	52.00	6.00	39.00	46.00	4.25	3.65	16.00	37.54	600.60
P14	49.00	6.00	41.00	46.00	5.26	4.28	13.00	39.71	516.20
P18	43.00	4.00	36.00	41.00	6.37	5.66	19.00	34.50	655.50
P19	36.00	5.00	34.00	46.00	5.55	4.89	18.00	42.29	761.30
P20	34.00	4.00	35.00	42.00	6.53	3.97	19.00	28.53	542.10
P28	44.00	6.00	40.00	43.00	5.16	4.19	17.00	32.42	551.20

Quantitative characters of each plant of green round pre breeding line 30-1-32

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P2	51.00	4.00	39.00	42.00	3.28	5.60	17.00	38.75	658.80
P3	46.00	3.00	41.00	45.00	5.20	3.99	14.00	52.09	729.30
P4	34.00	3.00	40.00	46.00	3.74	4.55	13.00	45.22	587.90
P5	48.00	4.00	41.00	46.00	5.61	4.68	16.00	42.44	679.10
P6	38.00	3.00	40.00	43.00	4.95	5.21	17.00	41.51	705.60
P7	41.00	4.00	43.00	48.00	5.62	4.67	15.00	38.56	578.40
P9	50.00	5.00	45.00	48.00	4.56	5.21	22.00	38.51	847.20
P10	28.00	1.00	43.00	49.00	4.88	5.34	15.00	38.02	570.30
P11	52.00	6.00	45.00	49.00	4.68	5.26	17.00	39.58	672.80
P12	38.00	3.00	43.00	51.00	6.40	5.00	9.00	40.43	363.90
P14	47.00	4.00	45.00	50.00	4.96	3.14	16.00	30.89	494.20
P15	45.00	6.00	42.00	49.00	4.32	5.26	14.00	46.74	654.30
P16	55.00	7.00	43.00	49.00	4.50	3.90	16.00	42.45	679.20
P18	45.00	6.00	45.00	50.00	4.85	5.62	14.00	38.81	543.40
P19	43.00	8.00	48.00	51.00	5.00	4.40	17.00	40.14	682.40
P20	44.00	5.00	43.00	49.00	4.35	5.35	13.00	49.03	637.40
P21	46.00	7.00	45.00	52.00	5.31	4.97	15.00	40.79	611.80
P22	44.00	5.00	43.00	49.00	5.18	4.23	16.00	36.49	583.80
P23	42.00	4.00	45.00	50.00	4.98	3.58	14.00	41.08	575.10
P25	44.00	8.00	43.00	50.00	5.62	4.96	14.00	40.08	561.10
P26	42.00	5.00	45.00	51.00	5.36	5.21	13.00	42.88	557.50
P27	43.00	7.00	48.00	53.00	5.96	4.98	15.00	39.82	597.30
P28	44.00	4.00	43.00	19.00	5.32	4.68	13.00	43.04	559.50

Quantitative characters of each plant of green round pre breeding line 30-1-18

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	52.00	5.00	45.00	49.00	5.86	3.89	13.00	45.29	588.80
P2	56.00	6.00	48.00	51.00	5.46	4.28	14.00	48.04	672.60
P4	43.00	6.00	45.00	50.00	4.98	4.35	12.00	49.33	592.00
P8	50.00	5.00	45.00	50.00	5.29	4.58	14.00	45.86	642.10
P9	53.00	6.00	43.00	49.00	6.21	5.46	13.00	45.08	586.10
P10	45.00	4.00	45.00	51.00	5.48	4.68	14.00	41.16	576.30
P12	51.00	6.00	48.00	52.00	4.97	3.58	14.00	41.36	579.00
P15	53.00	6.00	44.00	49.00	5.16	3.29	12.00	45.73	548.80
P16	54.00	5.00	45.00	50.00	5.36	4.08	13.00	50.20	652.60
P18	45.00	5.00	44.00	49.00	4.48	4.15	11.00	51.09	562.00
P22	56.00	6.00	43.00	49.00	5.19	4.18	13.00	48.62	632.10
P23	51.00	5.00	45.00	50.00	6.01	5.16	12.00	48.66	583.90
P24	48.00	5.00	46.00	51.00	5.28	4.38	13.00	44.22	574.90
P26	52.00	5.00	49.00	51.00	4.27	3.68	14.00	41.14	576.00

Quantitative characters of each plant of green round pre breeding line 249-10-29

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	69.00	8.00	48.00	53.00	4.90	5.43	15.00	40.68	610.20
P2	68.00	6.00	45.00	49.00	5.26	4.98	15.00	49.21	738.20
P3	73.00	6.00	45.00	51.00	6.20	5.10	14.00	41.21	577.00
P4	77.00	7.00	43.00	49.00	6.10	5.40	22.00	37.97	835.30
P5	52.00	7.00	48.00	54.00	5.63	4.68	14.00	42.36	593.10
P6	60.00	4.00	45.00	49.00	4.52	3.65	13.00	40.65	528.50
P7	70.00	7.00	43.00	52.00	5.48	4.98	14.00	48.04	672.60
P9	63.00	9.00	42.00	53.00	6.40	4.80	15.00	44.23	663.50
P10	64.00	6.00	42.00	53.00	5.98	5.78	15.00	45.85	687.80
P11	69.00	8.00	43.00	49.00	4.68	4.23	15.00	43.59	653.90
P12	54.00	6.00	45.00	51.00	5.26	4.87	11.00	45.23	497.50
P13	60.00	8.00	42.00	49.00	6.24	5.28	17.00	34.89	593.20
P14	63.00	7.00	43.00	48.00	4.85	5.26	14.00	43.28	605.90
P15	63.00	8.00	45.00	50.00	5.48	4.26	16.00	38.96	623.40
P16	31.00	2.00	42.00	48.00	6.10	5.42	13.00	38.82	504.70
P17	58.00	6.00	43.00	49.00	6.21	5.67	14.00	36.53	511.40
P18	62.00	7.00	45.00	50.00	5.24	5.78	17.00	35.80	608.60
P19	60.00	8.00	43.00	49.00	4.98	4.98	19.00	35.96	683.20
P20	59.00	8.00	42.00	48.00	5.26	5.01	17.00	38.49	654.30
P21	64.00	9.00	45.00	51.00	5.36	4.92	17.00	40.85	694.50
P22	67.00	7.00	43.00	47.00	4.97	3.68	18.00	38.84	699.20
P23	56.00	6.00	45.00	52.00	5.68	4.86	16.00	36.24	579.90
P24	65.00	6.00	42.00	49.00	5.92	4.68	10.00	49.69	496.90
P25	60.00	7.00	43.00	48.00	4.98	5.26	18.00	35.65	641.70
P26	62.00	6.00	45.00	52.00	5.94	4.28	16.00	34.02	544.30
P27	69.00	7.00	48.00	51.00	5.34	4.91	17.00	35.83	609.10
P28	74.00	8.00	43.00	52.00	6.10	5.97	19.00	35.58	676.10

Quantitative characters of each plant of green round pre breeding line 249-10-54

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	65.00	8.00	45.00	49.00	4.98	5.09	13.00	40.58	527.50
P2	66.00	7.00	43.00	48.00	5.62	4.67	13.00	42.65	554.50
P3	70.00	7.00	43.00	49.00	6.59	5.34	14.00	45.46	636.40
P4	62.00	6.00	45.00	46.00	6.08	4.76	12.00	46.76	561.10
P5	60.00	5.00	48.00	52.00	5.98	4.89	14.00	40.30	564.20
P6	67.00	8.00	48.00	55.00	4.98	5.48	16.00	40.90	654.40
P7	62.00	7.00	43.00	49.00	5.38	4.98	18.00	36.31	653.60
P8	60.00	5.00	45.00	52.00	5.50	4.97	13.00	43.02	559.30
P9	58.00	6.00	48.00	51.00	6.35	5.46	13.00	39.55	514.10
P10	63.00	7.00	45.00	51.00	5.26	4.98	13.00	42.98	558.80
P11	65.00	9.00	48.00	53.00	5.97	4.87	15.00	41.23	618.50
P12	59.00	8.00	45.00	50.00	5.46	5.27	17.00	40.13	682.20
P13	60.00	5.00	43.00	49.00	4.97	4.58	12.00	43.48	521.70
P15	59.00	7.00	43.00	49.00	5.36	4.97	20.00	29.17	583.30
P16	62.00	7.00	45.00	46.00	5.64	4.57	11.00	40.84	449.20
P17	65.00	8.00	43.00	48.00	4.97	5.26	14.00	34.81	487.30
P18	68.00	9.00	48.00	52.00	5.27	4.97	14.00	38.49	538.80
P22	48.00	5.00	45.00	49.00	4.65	5.24	14.00	40.37	565.20
P23	59.00	6.00	52.00	60.00	5.68	4.89	17.00	34.25	582.30
P24	67.00	6.00	48.00	54.00	5.27	5.17	21.00	37.99	797.70
P25	58.00	5.00	52.00	60.00	4.98	4.87	16.00	35.59	569.40

Quantitative characters of each plant of green round pre breeding line 249-10-55

Plant number	Plant height (cm)	No. of branches	Days to first flowering	Days 50 per cent flowering	Fruit length (cm)	Fruit width (cm)	Total No. of fruits	Average fruit weight (g)	Yield/ plant (g)
P1	60.00	5.00	45.00	58.00	5.87	4.38	11.00	44.35	487.80
P2	64.00	6.00	43.00	49.00	5.31	5.07	14.00	40.09	561.20
P3	57.00	4.00	45.00	51.00	5.18	6.30	18.00	34.05	612.90
P4	65.00	5.00	48.00	54.00	6.21	5.97	18.00	47.82	860.80
P5	62.00	6.00	45.00	52.00	3.89	4.20	9.00	40.72	366.50
P6	75.00	7.00	43.00	49.00	5.89	3.89	18.00	29.42	529.60
P7	62.00	6.00	48.00	52.00	5.29	4.25	12.00	43.49	521.90
P8	67.00	9.00	43.00	49.00	4.97	4.56	16.00	37.72	603.50
P9	48.00	5.00	42.00	49.00	5.21	4.98	13.00	40.95	532.40
P10	65.00	8.00	48.00	52.00	5.14	4.25	18.00	33.98	611.70
P11	62.00	7.00	50.00	56.00	5.28	4.96	20.00	36.03	720.50
P12	64.00	6.00	50.00	54.00	5.88	4.28	16.00	40.45	647.20
P13	63.00	8.00	43.00	49.00	4.67	3.99	13.00	35.78	465.10
P14	60.00	6.00	45.00	50.00	3.48	4.28	12.00	45.23	542.80
P15	57.00	6.00	52.00	59.00	5.26	5.64	16.00	38.94	623.00
P16	55.00	5.00	43.00	49.00	4.86	5.12	14.00	40.51	567.20
P17	52.00	7.00	48.00	52.00	4.98	5.26	11.00	46.16	507.80
P18	65.00	9.00	50.00	56.00	5.18	4.86	20.00	37.08	741.60
P19	62.00	6.00	50.00	57.00	6.18	5.77	20.00	34.24	684.70
P20	55.00	5.00	48.00	52.00	5.64	5.87	14.00	44.97	629.60
P21	69.00	7.00	45.00	49.00	4.99	5.11	13.00	49.22	639.90
P22	52.00	5.00	52.00	58.00	5.37	4.99	17.00	43.54	740.10
P23	45.00	3.00	48.00	53.00	6.24	5.67	13.00	39.52	513.80
P24	65.00	6.00	43.00	47.00	5.97	4.87	21.00	35.14	737.90
P25	61.00	7.00	40.00	48.00	4.99	5.26	18.00	37.02	666.30
P26	55.00	7.00	50.00	56.00	5.51	4.97	15.00	42.91	643.70
P27	51.00	5.00	48.00	52.00	5.64	4.89	18.00	34.08	613.40
P28	62.00	6.00	43.00	49.00	5.88	4.67	15.00	37.77	566.50

APPENDIX - V

LIST OF SYMBOLS AND ABBREVIATIONS

Symbols	Abbreviations
%	Per cent
CD	Critical difference
⁰ C	Degree centigrade
cm	Centimetre
et al.	And co-worker/and others
Fig.	Figure
g	Gram
viz.	Namely
Kg	Kilogram
m	Meter
mg	Milligram
MSS	Mean sum of square
TMSS	Treatment mean sum of square
RMSS	Replication mean sum of square
No.	Number
RCBD	Randomized complete block design
S.Em	Standard error of mean
WCGR	West Coast Green Round
RGR	Raidurga Green Round