

### Performance of Exotic Carambola under Bangladesh Condition

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**Abstract:** A study on the performance of five genotypes of exotic carambola namely, AC0012, AC0013, AC0014, AC0010 and AC0011 was conducted at the Regional Horticulture Research Station, Akbarpur, Moulvibazar for two years (1998 and 1999). The genotype produced significantly higher plant<sup>-1</sup> and ha<sup>-1</sup> yield over all the genotypes tested. Number of fruits plant<sup>-1</sup> was also significantly higher (770.5) in AC0012 than all the genotype except AC0013 (560.5). The genotype AC0012 produced the largest fruit (112.70 g) with maximum size (10.39 × 6.52 cm) while AC0014 produced the smallest fruit (70.75 g) with minimum size (9.16 × 5.28 cm). However, other genotypes produced medium sized fruits ranging from 77.75 to 104.70 g. All the genotypes gave cream fleshed fruits. Texture of flesh of ripe fruit was medium crispy in AC0014, crispy in AC0010 and AC0011 and soft in others. TSS of fruit juice varied from 5.08°B in AC0010 to 7.12° B in AC0012.

**Key words:** Carambola, genotype, propagation, base girth and TSS

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#### Introduction

Carambola (*Averrhoa carambola*) also known as five-corner fruit, is an important fruit of warm, tropical and subtropical areas of the world (Bose and Mitra, 1990). The centre of primary diversity of carambola is the Asia Region, including the sub-tropical belt of China (Ghosh, 1997). It grows well at latitudes from 8° 30 to 16° North where the average annual and monthly temperatures are 25° and 27°C and the minimum temperature is not less than 12°c (Tue, 1997). It is rich in vitamins and minerals. It is also very popular to the children irrespective of sexes and ages for its excellent extraordinary taste. It has a demand not only in our country but also in other countries of the world. In Vietnam it is treated as a major fruit like mango, banana, pineapple, jack fruit, guava, pummelo etc. Carambola has also export potential. In Malaysia it is cultivated on a commercial scale and the country exports this fruit to different countries including Singapore, Hongkong, Europe and the Middle East (Jainal *et al.*, 1997). Underutilized fruits, like carambola and others are very important for small holders in Asia and in Pacific Region. It is also the source of important nutritional supplements which can improve the quality of diets as well as non-food products such as fuel, timber, fodder, medicinal and industrial products (Haq, 1997). These fruit trees also provide positive environmental benefits. Many of those fruits

are now becoming scarce due to the erosion of their natural habitat and lack of commercial exploitation. The major constraints are low yield due to poor planting materials, non-availability of recommended propagation, lack of production packages and losses due to post-harvest and transportation.

In recent years emphasis has been given to crop diversification. Underutilized tropical fruit like carambola could play a role in diversification programme. It can improve the local rural economy, as income from fruit is higher than from field crops (Haq, 1997). To facilitate a common research programme, Underutilized Tropical Fruits for Asia Network (UTFANET) has been established and the International Centre for Underutilized Crops (ICUC) is concerned with the issue of diversification programme. This centre also shows interest in domestication of many indigenous species which have not been considered in the past. In Bangladesh we have no good variety(s) of carambola for commercial cultivation and export. Keeping this view in mind five exotic carambola germplasm collected from Australia were planted at the Regional Horticulture Research Station, Akbarpur, Moulvibazar in the year 1995 and since then their evaluation on different aspects have been going on.

#### **Materials and Methods**

The experiment was conducted at the Regional Horticulture Research Station of Bangladesh Agricultural Research Institute, Akbarpur, Moulvibazar during the period from 10 July 1995 to 30 November 1999. Five genotypes of exotic carambola, namely, AC0012, AC0013, AC0014, AC0010 and AC0011 collected from Australia were included in this study. The genotypes were planted in 10 July 1995 at a spacing of 4 × 5 m under a Randomized Complete Block Design with 3 replications.

#### **Results and Discussion**

##### **Morphological characters**

The height of plant of five exotic genotypes of carambola ranged from 2.86 to 4.04 m (Table 1). The height of AC0010 (4.04 m) was significantly higher than other genotypes except AC0011 (3.80 m) and the lowest (2.86 m) in AC0013. The base girth ranged from 36.38 cm in AC0012 to 48.28 cm in AC0011. Highest spreading (NS and EW) was observed in AC0011 (4.57 × 4.34 m) and the lowest in AC0013 (3.22 × 3.18 m). Number of fruits per plant was found statistically highest in AC0012 (770.50) among the genotypes except AC0013 (560.5) and the lowest (323.3) in AC0014. In case of fruit weight per plant, statistically highest weight was found in AC0012 (73.48 kg) and the lowest in AC0014 (20.84 kg). Similar trend was observed in case of fruit yield per hectare. All the genotypes gave flowers thrice a year i. e. first in late March, second in late May and third in August. Harvesting lasts about 3 to 4 months for all the genotypes.

##### **Fruit characters**

Fruit characters of five genotypes of carambola under study are shown in Table 2. Fruits of the genotypes AC0012, AC0013 and AC0014 were yellowish green in colour while AC0010 and AC0011 were greenish yellow. Fruit surface of all the genotypes were smooth. Flesh colour of all

Table 1: Physio-morphological characters of five exotic genotypes of carambola (Pooled over means of two years)

| Genotypes | Plant height (m) | Base girth of plant (cm) | Plant spreading (m) |        | No. of fruits plant <sup>-1</sup> | Weight of fruits plant <sup>-1</sup> (kg) | Yield of fruit ha <sup>-1</sup> (ton) | Flowering time            | Harvesting time         |
|-----------|------------------|--------------------------|---------------------|--------|-----------------------------------|---|---------------------------------------|---------------------------|-------------------------|
|           |                  |                          | NS                  | EW     |                                   |   |                                       |                           |                         |
| AC0012    | 3.08bc           | 36.38b                   | 4.00ab              | 3.52ab | 770.5a                            | 73.48a                                    | 36.74a                                | Late Mar late May and Aug | June, July, Sep to Nov  |
| AC0013    | 2.86c            | 41.47ab                  | 3.22b               | 3.18b  | 560.5ab                           | 47.08b                                    | 23.55b                                | Late Mar late May and Aug | June, July, Sep to Nov  |
| AC0014    | 2.88c            | 39.75b                   | 4.33a               | 3.95ab | 323.3b                            | 20.84c                                    | 10.42c                                | Late Mar late May and Aug | June, July and Oct, Nov |
| AC0010    | 4.04a            | 42.42ab                  | 3.98ab              | 4.02ab | 359.2b                            | 34.35bc                                   | 17.18bc                               | Late Mar late May and Aug | July, Sep to Nov        |
| AC0011    | 3.80ab           | 48.28a                   | 4.57a               | 4.34a  | 516.7b                            | 39.93bc                                   | 19.96bc                               | Late Mar late May and Aug | June, July, Sep to Nov  |
| F-Test    | **               | **                       | **                  | **     | **                                | **  | **                                    | **                        | **                      |

Table 2: Fruit characteristics of five exotic genotypes of carambola (Pooled over means of two years)

| Genotypes | Fruit wt. (g) | Fruit size (cm) |         |                 | Skin colour     | Surface of fruit | Colour of flesh | Texture of flesh | Taste of flesh           | Fibre/ fibre less | TSS (°B) |
|-----------|---------------|-----------------|---------|-----------------|-----------------|------------------|-----------------|------------------|--------------------------|-------------------|----------|
|           |               | Length          | Breadth | Seeded/seedless |                 |                  |                 |                  |                          |                   |          |
| AC0012    | 112.70a       | 10.39           | 6.52    | Seedless        | Yellowish green | Smooth           | Cream           | Soft             | Sweet with slightly sour | Fibre less        | 7.12a    |
| AC0013    | 101.90ab      | 10.14           | 5.80    | Seeded          | Yellowish green | Smooth           | Cream           | Soft             | Medium sweet             | Fibrous           | 7.02a    |
| AC0014    | 70.75c        | 9.16            | 5.28    | Seeded          | Yellowish green | Smooth           | Cream           | Medium crispy    | Sour                     | Fibrous           | 5.40b    |
| AC0010    | 104.70a       | 10.37           | 5.03    | Seeded          | Greenish yellow | Smooth           | Cream           | Crispy           | Sour                     | Fibrous           | 5.08b    |
| AC0011    | 77.75bc       | 11.36           | 5.19    | Seedless        | Greenish yellow | Smooth           | Cream           | Crispy           | sour                     | Less fibrous      | 7.05a    |
| F-Test    | **            | NS              | NS      |                 |                 |                  |                 |                  |                          |                   | **       |

Table 3: Interaction effects of year and genotypes on quantitative characters of five exotic carambola

| Year   | Genotypes | Plant height (cm) | Base girth (cm) | No. of fruits plant <sup>-1</sup> | Wt. of fruits plant <sup>-1</sup> (kg) | Wt. of fruits ha <sup>-1</sup> (ton) | Fruit wt. (g) | Fruit size (cm) |         |                |
|--------|-----------|-------------------|-----------------|-----------------------------------|--|--------------------------------------|---------------|-----------------|---------|----------------|
|        |           |                   |                 |                                   |  |                                      |               | Length          | Breadth | Fruit TSS (°B) |
| 1998   | AC0012    | 2.72b             | 29.10           | 680.33a                           | 62.37a                                 | 31.18a                               | 110.41a       | 10.28           | 6.47    | 7.00a          |
|        | AC0013    | 2.52b             | 33.60           | 484.33ab                          | 38.50b                                 | 29.25b                               | 95.35ab       | 9.94            | 5.63    | 7.00a          |
|        | AC0014    | 2.58b             | 31.87           | 255.67b                           | 14.17c                                 | 7.09c                                | 64.87c        | 9.67            | 5.43    | 5.33b          |
|        | AC0010    | 3.68a             | 33.57           | 283.33b                           | 25.20bc                                | 12.60bc                              | 101.31a       | 10.03           | 4.90    | 5.00b          |
|        | AC0011    | 3.43a             | 37.10           | 508.67ab                          | 29.90bc                                | 14.95bc                              | 73.74bc       | 11.22           | 5.07    | 7.00a          |
| 1999   | AC0012    | 3.45bc            | 31.81           | 860.67a                           | 84.60a                                 | 42.30a                               | 115.00a       | 10.50           | 6.57    | 7.07a          |
|        | AC0013    | 3.35c             | 47.62           | 636.67ab                          | 55.66b                                 | 27.83b                               | 108.50a       | 10.34           | 5.96    | 7.00a          |
|        | AC0014    | 3.18c             | 48.33           | 391.00b                           | 27.50c                                 | 13.75c                               | 76.62b        | 10.24           | 5.90    | 5.33b          |
|        | AC0010    | 4.42a             | 55.27           | 435.00b                           | 43.50bc                                | 21.75bc                              | 108.17a       | 10.71           | 5.17    | 5.00b          |
|        | AC0011    | 4.17a             | 50.93           | 579.33ab                          | 49.92bc                                | 24.96bc                              | 81.37a        | 11.50           | 5.31    | 7.00           |
| F-Test | **        | NS                | **              | **                                | **                                     | **                                   | **            | NS              | NS      | **             |

Uncommon letter(s) in the same column indicate statistically significant at 1% level

NS = Not significant

the genotypes were cream. Flesh texture of well-matured fruit varied from medium crispy to crispy in AC0014, AC0010 and AC0011 while other genotypes had soft flesh. Fruits of AC0012 were sweet with slightly sour while fruits of other genotypes were sour to medium sweet. Fruits of AC0012 and AC0011 were seedless while others were seeded. Fruits of AC012 had no fibre while AC0013, AC0014 and AC0010 had fibre and AC0011 had less fibre. Mean fruit weight was maximum (112.70 g) in AC0012 followed by AC0010 (104.70 g), AC0013 (101.90 g), AC0011 (77.75 g) and AC0014 (70.75 g). Highest length of fruit (11.36 cm) was recorded in AC0011 closely followed by AC0012 (10.39 cm) and the lowest in AC0014 (9.16 cm). But the maximum breadth (6.52 cm) was recorded in AC0012 while the minimum (5.03 cm) in AC0010. TSS of fruit juice varied from 7.12°B in AC0012 to 5.08°B in AC0010.

The genotypes showed significant differential response over years for plant height, fruits per plant, fruit yield per plant, fruit yield per hectare, individual fruit weight and total soluble sugar (Table 3).

Based on excellent performance on fruit size, flesh texture, less fibre content, high TSS content and high fruit yield potentiality over two years, the genotype AC0012 could be selected and recommended for commercial cultivation.

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