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**Short Communication**

# Field assessment of tinda [*Praecitrullus fistulosus* (Stocks) Pangalo] genotypes under lateritic soils of Eastern India

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Tinda or round melon (*Praecitrullus fistulosus* (Stock) Pangalo, 2n=24) is a minor summer grown cucurbitaceous vegetable. The origin of tinda is probably northwestern India, where wild types may still be found. Previously tinda was considered as a distant relative of watermelon and it was classified as *Citrullus lanatus* subsp. *fistulosus* (Stocks) Duthieet J.B. Fuller (Levi et al. 2005). However, the genetic similarity between *Praecitrullus fistulosus* and *Cucumis* or *Citrullus* group was found less than 3%; and it was found more closely related with *Benincasa hispida* than *Citrullus* spp (Levi et al. 2010). It differs to *Citrullus* in the stratification of pollen grains, haploid chromosome number and to some extent in leaf morphology (Tyagi et al. 2017). The tender fruits of tinda are used as a vegetable, canned, rayata preparation and its seeds are roasted and consumed. Tinda is one of the excellent plants, gifted by the nature for its pharmacological activities and traditional uses (Tyagi et al. 2017). It may have good scope for export because it is cultivated only in north India and fruits are available from April to October and good has good storability (Samadia 2007). In the USA, there is an increased interest in using tinda as a commercial vegetable, and possibly as a rootstock for grafting watermelon, melon or cucumber (Levi et al. 2010). Due to its less area coverage and lesser influence in market economy it has yet not receive full attention by the breeders and production scientists. Only little research was carried out on this crop. Munawar et al. (2015) studied the genetic variability, strength and direction of association, and direct/indirect effects of morphological traits on fresh fruit yield of sixteen genotypes of tinda gourd. Samadia (2007) studied genetic variability and elaborate the scope of improvement in tind under hot arid conditions. Commercial cultivation of tinda is restricted only in parts of north western India. In eastern India, tinda is a totally uncommon crop and even not know by the local growers. Tinda is not commercially cultivated in West Bengal (Mandal 2017). Genotype selection is one of the most important factors in any crop production. Thus, a preliminary study on performance of some tinda genotypes under Red and Laterite Zone of West Bengal was tried during summer months to see its suitability of growing in this region and if this crop could commercially be established in future.

The experiment was conducted in the Horticulture Farm, Institute of Agriculture, Sriniketan. The experimental site was situated in the sub-humid, subtropical laterite belt of West Bengal, India. The crop growing area having three seasons, viz. summer season or pre-*kharif* (March to June), wet or rainy season or *kharif* (July to October) and winter or *rabi* season (November to February). The meteorological data pertaining to the crop growing period of this experiment has been presented in Table 1. It was revealed from the data that tinda received a salubrious weather condition during germination and growth. However, crop faced high temperature and relatively low atmospheric humidity during fruiting period.

The soil of the experimental site was loamy sand in texture with 5.8pH and 0.54% organic carbon. The available nitrogen content was 201.6 kg/ha, available phosphorus content was 12.01 kg/ha and available potassium content was 91.57 kg/ha. Five open pollinated (Ludhiana Special, Tinda Dil Pasand, Tinda Ludhiana Special, Mahy Tinda and Golden Tinda) and two $F_1$ hybrid (Mahy-1 and Chitra) cultivars of tinda were grown during summer 2016 and assessed for various

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**Table 1:** Meteorological data recorded during cropping period at Sriniketan.

| Month | | Temperature ($^0$C) | | Total Rainfall (mm) | Relative Humidity (%) | Sunshine (hr) |
|---|---|---|---|---|---|---|
| | | Maximum (Average) | Minimum (Average) | | | |
| February, 2016 | 1st fortnight | 28.1 | 15.2 | 25.0 | 80.9 | 5.1 |
| | 2nd fortnight | 31.8 | 18.5 | 6.70 | 71.9 | 7.1 |
| March, 2016 | 1st fortnight | 34.0 | 20.4 | 0.7 | 73.0 | 6.5 |
| | 2nd fortnight | 31.3 | 18.5 | 15.6 | 57.6 | 6.8 |
| April, 2016 | 1st fortnight | 39.4 | 24.6 | 0.0 | 54.8 | 7.9 |
| | 2nd fortnight | 41.8 | 26.4 | 0.0 | 66.8 | 8.1 |
| May, 2016 | 1st fortnight | 37.7 | 24.0 | 49.4 | 68.8 | 8.3 |
| | 2nd fortnight | 35.6 | 25.3 | 65.8 | 72.5 | 7.1 |

Source: India Meteorological Department, Meteorological Office Sriniketan, Birbhum.

growth and yield attributes. All the open pollinated and hybrid cultivars were belongs to private seed companies (Table 2).

The experiment was conducted in Randomized Block Design with three replications. Bed and channel system of planting was followed. Bed width was kept 2.5 m and plant to plant spacing was given 0.5 m. Pre-soaked seeds of each genotype were sown on 6th February 2016 in twenty pits per replication. Four seeds per pit were sown and later only one plant was kept in each pit. FYM (10 t/ha) and fertilizer dose of NPK (90:60:60 kg /ha) were applied to grow the crop. Well decomposed farm yard manure, half amount of nitrogen and potash and full dose of phosphorous were mixed at the time of field preparation as basal application. Rest half amount of nitrogen and potassium fertilizers were applied as top dressing 30 days after sowing. Irrigation was given twice in a week in channels. The data was collected for vine length (cm), number of branches per plant, node to first male and female flower appearance, days to first male and female flower opening, fruit length (cm), fruit circumference (cm), fruit numbers per plant, average fruit weight (g), fruit yield per plant (g) and total soluble solid (TSS; $^{\circ}$Brix). Five plants of each replication were tagged for taking observations for growth and flowering traits. Vine length and number of branches per plant were recorded at 90 days after sowing. Ten freshly harvested fruits were randomly collected from the tagged plants to obtain different fruit traits (average fruit weight, fruit length and circumferences) and TSS. Number of fruits per plant and fruit yield per plant was computed by adding the number of fruits and fruit weight harvested each time. The mean values of various traits thus obtained were subjected to statistical analysis. The total variation for different cultivars was tested for significance by F test using analysis of variance technique. Critical differences were calculated for each trait to the test the significance of difference between means of different genotypes. Correlation has been studied to see the inter-relationship among the studied traits. For statistical analyses Windostat version 8.6 from Indostat service Hyderabad was followed.

**Table 2:** Tinda genotypes and source of seed materials

| Cultivar | Seed source |
|---|---|
| Chitra (BSS-695) | Kalash Seeds Pvt. Ltd, Jalna, Maharashtra |
| Mahy-1 | Maharastra Hybrid Seeds Company Private Limited (Mahyco), Jalna, Maharastra |
| Mahy Tinda | Maharastra Hybrid Seeds Company Private Limited (Mahyco), Jalna, Maharastra |
| Golden Tinda | UPL Limited, c/o Bharathi Bhamha Seeds, Telengana |
| Ludhiana Special | Doctors Seeds India, Ludhiana, Punjab |
| Tinda Dil Pasand | Punjab Beej Company, Chowk Baraf Khana, New Delhi |
| Tinda Ludhiana Special | Rizwan Seed Company, Malerkotla, Punjab |

Genotypes recorded significant variation for vine length and number of branches were plant (Table 3). The highest vine length was observed in 'Tinda Dil Pasand'. On the other hand, 'Chitra' and 'Golden Tinda' recorded minimum vine length. Less vine length has considered as desirable trait for dwarf and compact plant type. These types of plants occupy less space and thus, can accommodate more number of plants per unit area. Among the studied genotypes, 'Tinda Dil Pasand' and 'Tinda Ludhiana Special' recorded highest and lowest numbers of branches per plant, respectively. Increased number of branches increases probable fruiting sites and thereby helps to increase yield (Mohanta and Mandal 2016). Variation in growth traits in tinda was reported by Samadia (2007). Length of vine and primary branches per vine showed significant positive association with total fruits per vine (Dahiya et al. 2000).

Monoecious is the major sex form in tinda. In tinda, like others cucurbits, male flowers appears before the appearance of female flowers. The traits such as first female flowering node and days to first female flower opening are related parameters for earliness. Result of this study revealed that flowering traits showed

significant differences among the genotypes for node to first male and female flower appearance and days to first male and female flower opening (Table 3). Among the genotypes, 'Golden Tinda' produced male and female flowers in lowest node. Appearance of flowers (particularly female) at lower nodes and early days often interpreted as early type. Similarly to node numbers, 'Golden Tinda' took minimum number of days to first male and female flower opening. 'Tinda Ludhiana Special' and 'Tinda Dil Pasand' also noted at par with 'Golden Tinda' in days to first male and female flower opening respectively. The appearance of first male and female flower ranged between 22.3 to 31.8 and 35.1 to 43.1 days after sowing respectively. Mohanta and Mandal (2016) reported variation in flowering traits in watermelon.

Among the tinda genotypes significant differences were noted for yield attributing traits, yield and TSS (Table 4). 'Tinda Dil Pasand' produced maximum fruit length, which was noted statistically *at par* with 'Chitra' and 'Mahy Tinda'. 'Tinda Dil Pasand' was also recorded maximum fruit circumference. On the other hand, 'Golden Tinda' was noted minimum fruit length. Fruit diameter of watermelon was studied by Mohanta and Mandal (2016) and Ogwu et al. (2016). Maximum number of fruits per plant was recorded in cultivar 'Golden Tinda'. This cultivar also produce female flower in lower node which was related to early fruit harvest. Munawar et al. (2015) reported that number of fruits per plant had a strong positive association with yield in tinda. Number of fruit per plant is an important character for effective selection of Tinda (Samadia 2007). Fruit weight is an important yield component, which directly contributed to yield per plant and per unit area of land. 'Tinda Dil Pasand' recorded highest average fruit weight in immature stage; whereas 'Tinda Ludhiana Special' showed minimum average fruit weight. Samadia (2007) reported a wide range of variation for fruit weight in tinda (71.4 to 137.5 g). Samadia (2007) reported population mean of 0.89 kg total marketable fruit yield per plant in tinda. 'Tinda Dil Pasand' produced maximum fruit yield per plant which was found superior to other genotypes. The highest Total Soluble Solid (TSS) was recorded in 'Golden Tinda' which was statistically similar to 'Tinda Dil Pasand' and 'MahyTinda'. The genotype Chitra was recorded lowest TSS value. These observed variations may be due to genetic variation among the genotypes. Variation in TSS content in watermelon was reported by Mohanta and Mandal (2016).

Yield is a dependent character and governed by the interaction between genotype and environment. Therefore, for improvement work on any crop, study on its character association with main component is beneficial for formulating the breeding programme. From the correlation study (Table 5) it was noted that

**Table 3:** Growth and flowering traits of tinda cultivars

| Cultivars | Vine Length (cm) | Branch Number | Node to first male flower appeared | Node to first female flower appeared | Days to first male flower opening | Days to first female flower opening |
|---|---|---|---|---|---|---|
| Ludhiana Special | 152.6$^{d}$ | 4.2$^{bcd}$ | 4.3$^{bc}$ | 10.9$^{c}$ | 29.5$^{c}$ | 39.7$^{bc}$ |
| Tinda Dil Pasand | 196.6$^{a}$ | 5.5$^{a}$ | 4.5$^{c}$ | 12.9$^{d}$ | 25.0$^{b}$ | 37.3$^{ab}$ |
| Tinda Ludhiana special | 149.1$^{d}$ | 3.2$^{ef}$ | 3.8$^{bc}$ | 8.8$^{b}$ | 23.5$^{ab}$ | 38.8$^{b}$ |
| Mahy-1 | 167.5$^{c}$ | 4.0$^{cde}$ | 4.4$^{bc}$ | 13.6$^{de}$ | 31.2$^{c}$ | 41.6$^{cd}$ |
| Chitra | 136.5$^{e}$ | 3.4$^{def}$ | 3.9$^{bc}$ | 14.0$^{e}$ | 31.8$^{c}$ | 43.1$^{d}$ |
| Mahy Tinda | 181.7$^{b}$ | 4.4$^{bc}$ | 3.7$^{b}$ | 9.2$^{b}$ | 30.1$^{c}$ | 42.4$^{c}$ |
| Golden Tinda | 136.7$^{e}$ | 5.1$^{ab}$ | 2.6$^{a}$ | 7.3$^{a}$ | 22.3$^{a}$ | 35.1$^{a}$ |
| CV (%) | 3.7 | 12.4 | 10.0 | 5.3 | 3.5 | 3.6 |

Note: Same letters in the columns denote the means that are not statistically different.

**Table 4:** Yield traits, yield and fruit TSS of Tinda cultivars.

| Cultivars | Fruit length (cm) | Fruit circumference (cm) | Fruit numbers /plant | Average fruit weight (g) | Fruit yield /plant (g) | TSS ($^{\circ}$Brix) |
|---|---|---|---|---|---|---|
| Ludhiana Special | 8.8$^{bc}$ | 22.4$^{b}$ | 5.8$^{b}$ | 99.4$^{c}$ | 553.7$^{e}$ | 3.30$^{bcd}$ |
| Tinda Dil Pasand | 11.4$^{a}$ | 24.4$^{a}$ | 5.9$^{b}$ | 213.6$^{a}$ | 1187.8$^{a}$ | 3.80$^{ab}$ |
| Tinda Ludhiana special | 8.5$^{bc}$ | 18.4$^{e}$ | 4.2$^{d}$ | 65.07$^{e}$ | 298.1$^{g}$ | 3.10$^{cd}$ |
| Mahy-1 | 9.2$^{b}$ | 20.8$^{cd}$ | 4.3$^{cd}$ | 100.4$^{c}$ | 429.2$^{f}$ | 2.93$^{d}$ |
| Chitra | 11.0$^{a}$ | 22.7$^{b}$ | 3.6$^{d}$ | 169.7$^{b}$ | 598.7$^{de}$ | 2.37$^{e}$ |
| Mahy Tinda | 10.5$^{a}$ | 21.9$^{bc}$ | 5.2$^{bc}$ | 167.3$^{b}$ | 873.8$^{b}$ | 3.47$^{abc}$ |
| Golden Tinda | 8.0$^{c}$ | 20.0$^{d}$ | 7.7$^{a}$ | 76.8$^{cd}$ | 664.6$^{cd}$ | 4.03$^{a}$ |
| CV (%) | 6.3 | 3.8 | 10.1 | 3.62 | 7.1 | 8.00 |

Note: Same letters in the columns denote the means that are not statistically different.

**Table 5:** Correlation coefficients among various traits of tinda genotypes.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | | | | | | | | | | | |
| 2 | 0.419 | 1.000 | | | | | | | | | | |
| 3 | 0.301 | -0.029 | 1.000 | | | | | | | | | |
| 4 | 0.201 | -0.081 | 0.607 | 1.000 | | | | | | | | |
| 5 | -0.088 | -0.307 | 0.165 | 0.529 | 1.000 | | | | | | | |
| 6 | 0.132 | -0.296 | 0.269 | 0.462 | 0.579 | 1.000 | | | | | | |
| 7 | 0.538 | 0.231 | 0.268 | 0.609 | 0.286 | 0.361 | 1.000 | | | | | |
| 8 | 0.433 | 0.497 | 0.255 | 0.542 | 0.334 | 0.224 | 0.616 | 1.000 | | | | |
| 9 | -0.002 | 0.669* | -0.536 | -0.549 | -0.387 | -0.594 | -0.305 | 0.121 | 1.000 | | | |
| 10 | 0.566 | 0.315 | 0.343 | 0.521 | 0.257 | 0.223 | 0.817* | 0.743* | -0.151 | 1.000 | | |
| 11 | 0.623 | 0.716* | 0.093 | 0.130 | -0.088 | -0.171 | 0.615 | 0.692* | 0.349 | 0.824* | 1.000 | |
| 12 | 0.230 | 0.597 | -0.221 | -0.600 | -0.526 | -0.698* | -0.235 | -0.061 | 0.741* | 0.005 | 0.495 | 1.000 |

Note: (1) Vine length, (2) Branch number, (3) Node to first male flower appearance, (4) Node to first female flower appearance, (5) Days to first male flower opening, (6) Days to first male flower opening, (7) Fruit length, (8) Fruit circumference, (9) Fruit number/plant, (10) Average fruit weight, (11) Fruit yield/plant, (12) TSS (°Brix); * means significant at 5% level of significance.

the branch number of tinda was positive and significantly correlated with number of fruits per plant and fruit yield per plant. Munawar et al. (2015) reported that number of vines per plant was positively associated with number of fruits per plant. Fruit length and circumference was positive and significantly correlated with average fruit weight. Average fruit weight and fruit circumference was also positive and significantly associated with fruit yield per plant. Munawar et al. (2015) noted a strong positive association among fruit length, fruit diameter, fruit weight, number of fruits per plant with yield in tinda. Samadia (2007) noted a very strong positive and significant correlation between fruit yield per plant with number of fruits per plant. Dahiya et al. (2000) suggested that selection based on total and number of marketable fruits per vine would be more effective for the improvement of yield in tinda. Days to first female flower opening were negative and significantly correlated with TSS. However, fruit number per plant was positive and significantly correlated with TSS. This study revealed that tinda can be successfully grown under Red and Laterite Zone of West Bengal. 'Golden Tinda' and 'Tinda Dial Pasand' can be tried in this region for commercial cultivation. More numbers of accession /genotypes of tinda should be assessed in future for establishing this crop in this region.

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