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Promising lines of Eggplant (*Solanum melongena*) Developed through Population improvement of locally popular cultivar –Plastic

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Abstract: Recurrent selection is an important breeding method employed to improve the populations of crop plants particularly those of cross-pollinated species. Brinjal (*Solanum melongenum* L.) is one major cross-pollinated crop which most important vegetables of the world and a huge prospect in Sri Lanka. Several brinjal landraces are being cultivated in Sri Lanka even though few brinjal varieties have been released by Department of Agriculture. A local brinjal cultivar, so-called 'Plastic', is also one of the popular cultivars being cultivated by farmers in the northern region, especially in Vanni area of Sri Lanka. This cultivar does not have a pure population in the farmer's field and the farmers received the seed materials from unreliable sources. Regional Agriculture Research and Development Centre (RARDC), Kilinochchi has initiated a purification program of the plastic cultivar since the year of 2016. Randomized complete block design (RCBD) was used with five replicates. Recurrent selection and restricted open-pollination methods have been continued for five consecutive seasons with five lines to get a purified high-yielding brinjal cultivar. Originally developed five lines were advanced for three seasons and one line (number 5) was dropped out from the third season owing to its low yielding performance. While improving the population, yield evaluation was also made. Yield evaluation conducted in the fourth and the fifth seasons with the selected lines that indicated significant difference in their yield performances among these lines. Finally, two high performing uniform lines (Line number 02 and 03) with the yield more than 22 t/ha were generated. These two lines could be promoted as promising variety/s after conducting multi-locations trials.

***Keywords*:** Landraces, Population improvement, Recurrent selection

Introduction

Eggplant (*Solanum melongena*) is a widely grown species among the *Solanaceous* crops in both greenhouses and at the open fields, consumed throughout the year, in Asia, Africa, and the subtropics, including the southern USA and the Mediterranean region (Daunay, 2008). They show a wide variation according to their

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morphological structure (Cericola *et al*., 2013). It has large diversity of fruit color, shape and size and a large number of cultivars have been cultivated throughout the world according to market needs and consumer demands (Sidhu *et al*., 2005). Genetic improvement of any crop mainly depends on the amount of genetic variability present in the population and the germplasm serves as a valuable source of base population and provide scope for wide variability (Gavade and Ghadage, 2015). An improvement in yield and quality of brinjal is normally achieved by selecting the genotypes with desirable character combination existing in nature or from recombinant population developed through by hybridization.

Varieties of eggplants varying in size, shape, and color are put in the market for sale. Healthy looking, shiny, bright-colored fruits that feel heavy and firm with stout and green stalks are considered as fresh. Several brinjal landraces are being cultivated in Sri Lanka even though few brinjal varieties have been released by Department of Agriculture for general cultivation (Arasakesary *et al*., 2013). A local brinjal cultivar so-called "Plastic" also one of the popular cultivar is being cultivated by farmers in the northern region, especially in Vanni area of Sri Lanka. The average yield of this local cultivar is varying from 15-20 t/ha. However, this cultivar does not have a pure-population in the farmer's field and the farmers received their seed materials from unreliable sources. The growers are often not producing their own seeds. So, availability of the pure plastic cultivar is important for brinjal production. To meet required seed supply, self-seed production is promoted by various agencies. RARDC, Kilinochchi has initiated a purification program of the plastic cultivar with the support of Food and Agriculture (FAO), Kilinochchi since the year of 2016. This paper stems out from the series of the experiments conducted on purification of plastic brinjal cultivar.

Methodology

The seeds used in this experiment were received from the Deputy Director (Extension), Department of Agriculture, Vavuniya. The seeds were graded as Very good (14.9 g), Good (4.6 g) and Bad (1.1 g) respectively to get good vigorous seedlings for selection process. Good seeds were sown in the nursery beds on 11th of January 2016. Base population was established with 550 plants in 2015/16 *Maha* season. Twenty-five day old seedlings were planted with a spacing of 90 x 60 cm as a single plant per hill in 3.6 x 3 m plots. Primarily selection was based on the characters; plant height, number of branches per plant and number of leaves per plant. At fruits maturity, a second and more vigorous selection was practiced and compared with the primarily selected plants based on the fruit's characteristics; number of fruits per plant, fruits weight, fruit length and the diameter. Selected plants were then covered by insect proofing net to assure open fruit setting by open-pollination within the flowers of the same plants. Thus 60 plants were selected from the whole population based on the plants

and fruit characters. The second generation was raised from the selected superior individuals; the same selection procedure was continued for another three seasons thereby four superior lines were identified and established at fourth and fifth seasons. Each line was selected with 80 plants. In the later season the populations were near homozygocity. Thus the off types were only removed and the seeds of selected lines were bulk to have uniform population. Agronomic traits were characterized using the descriptors of Plant Generic Resource Center, Gannoruwa. Fifteen traits were used to separate the line generated at fourth season. At flowering stage; the following traits were measured from five plants from each line; plant height (cm), Leaf blade length (cm), and Leaf blade Maximum Width (cm). Other morphological characterization also was done to identify the variation among these selected lines. Samples of five randomly selected fruits, at the maturity stage of each plant were used to determine the fruit traits; length (cm), diameter (cm) and weight (g). While, number of fruits per plant and total fruit yield per plant (g) were also estimated on the basis of average value of five plants. Superior lines were identified from overall performance of line generated at final season.

Results and discussion

Morphological characters observed in the segregating population of the plastic cultivar observed are given in table 1.

Growth habit comprising fifteen characters were not considerably different among these lines except notable difference of the plant high which ranged from 71.2 to 81 cm. The prominent difference in the plant height and the fruit length were observed although seeds were generated for the fourth season.

Average values of the yield attributing traits observed in the fourth season

Table 1: Details of morphological characters observed in plastic cultivar

Character	Line 01	Line 02	Line 03	Line 04
Growth habit	Intermediate	Intermediate	Intermediate	Intermediate
Petiole color	Green	Green	Green	Green
Leaf blade color	Violet	Violet	Violet	Violet
Leaf blade length(cm)	33.3	34	35	34.4
Leaf blade maximum width (cm)	15.7	15.5	17.3	15.8
Leaf blade lobbing	Weak	Weak	Weak	Weak
Leaf blade tip angle	Intermediate	Intermediate	Intermediate	Intermediate
No of leaf prickles on upper surface of the leaf	None	None	None	None
Plant height at flowering stage (cm)	75.1	81	75.9	71.2
Days to flowering	36	36	36	36
Corolla color	Light Violet	Light Violet	Light Violet	Light Violet
Fruit curvature	Slightly Curved	Slightly Curved	Slightly Curved	Slightly Curved
Fruit apex shape	Rounded	Rounded	Rounded	Rounded
Primary fruit color at table use maturity	Purple	Purple	Purple	Purple
Fruits color at physiological ripeness	Deep-yellow	Deep-yellow	Deep-yellow	Deep-yellow

Table 2: Details of some yield related characters observed in four lines of plastic cultivar

Characters	Line 01	Line 02	Line 03	Line 04
Number of flowers per inflorescence	3	4	4	3
Length of mature fruit (cm)	20.2	23.5	22.92	19.6
Fruits diameter at broadest part (cm)	4.47	5.12	4.97	4.26
No of fruits per inflorescence	1	1	1	1
Average number of fruits per plant at one shot harvest	4	6	5	3
Weight of fruit at table use maturity (g)	88	96	92	87

were depicted in the table 2. The observed value indicated that the line number 01 and 04 had three flowers per inflorescence while this value was four in line number 2 and 3. Correspondingly the length of the mature fruit also had around 3 cm longer than that in fruits of line number 1 and 4. Number of fruits per plant at one shot harvesting was highest in line number 2 (6) while low in line number 4 (3). Weight of the fruit at table use maturity also had the highest value in line number 2 (96 g) flowed by the line number 3 (92 g).

Originally developed five lines were advanced for three seasons and line number 5 was dropped out from the third season owing toit's low yielding performance. Yield evaluation was conducted in the fourth and fifth seasons with remaining four selected lines and it indicated that there were significant improvement and differences in their yield performance among these lines on theselectioninconitnuesseason(Table3). Selection is the most important tool in plant breeding and it's effective in changing gene and genotype frequencies.

Table 3: Diversified yield performances of selected plastic cultivar lines

	2016/17 *Maha*		2017*Yala*		2017/18 *Maha*	
Line	Marketable Yield t/ha	None Marketable Yield t/ha	Marketable Yield t/ha	None Marketable Yield t/ha	Marketable Yield t/ha	None Marketable Yield t/ha
Line-01	12.83^{b}±0.30	5.72^{a}	10.75^{b}±0.32	4.66^{a}	17.17^{c}±0.27	6.38^{b}
Line-02	16.28^{a}±0.65	4.17^{d}	17.11^{a}±0.27	3.69^{d}	22.88^{a}±0.27	4.75^{d}
Line-03	16.88^{a}±0.50	4.88^{c}	17.08^{a}±0.75	3.94^{c}	22.25^{b}±0.36	5.48^{c}
Line-04	12.84^{b}±0.38	5.29^{b}	10.26^{b}±0.50	4.28^{b}	16.05^{d}±0.27	7.45^{a}
Line-05	8.72^{c}	5.37^{ab}	-	-	-	-
LSD	1.65	0.40	1.53	0.23	0.28	0.46
CV	6.65	4.32	5.57	2.85	0.73	3.88

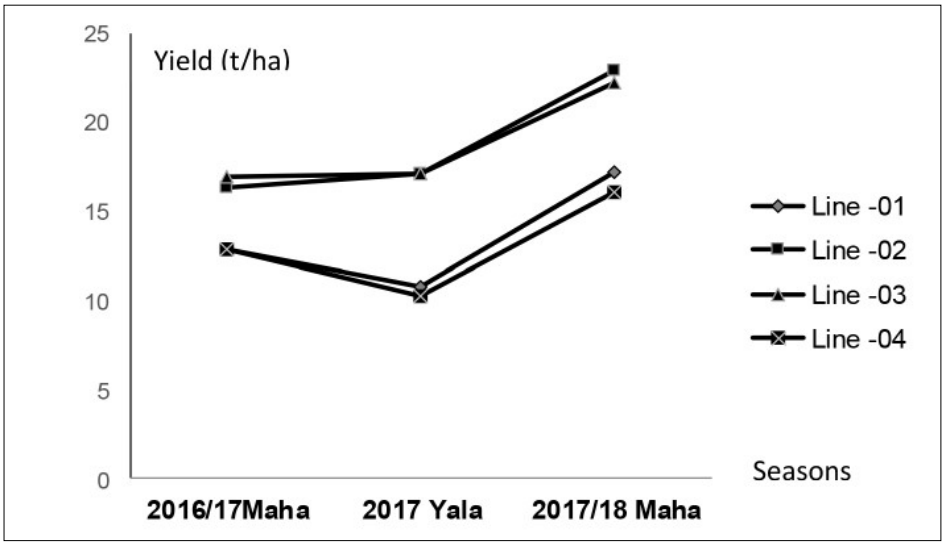

Figure 1: Comparison of the yield variation among the lines with the season

As a result, it alters the mean in the direction of selection and new genotype appear due to new gene combinations (Singh, 1993).

Notably, the selection procedure has led to an increased yield nearly five ton/ha all four seasons. This may be attributed due to the recurrent selection of high performing individuals and by the open pollination within the flowers of the same plant which mitigated inbreeding depression.

A recurrent selection through the season on high performing individuals yielded with two superior lines out of four subjected for population improvement. Line number 01 and 04 relatively had the same yield in *Maha* and *Yala* season. However, other two lines one and four had relatively notable yield reduction in *Yala* season, wherein generally brinjal yields are lower than that of *Maha*. However, final season yield was increased in all four lines this might also be attributed due to the recurrent selection and open-pollination. Therefore, this study has yielded two superior breeding lines with the uniform population having high yield more than 22 t/ha and attractive fruits for marketing also had preferred canopy and transportable fruits. Thus these two lines could be promoted as improved lines of plastic cultivar.

Conclusion

Purification programme of plastic cultivar has been completed and four generated lines were characterized. While improving the population yield evaluation was made. Thus two high performing uniform lines 2 and 3 were generated through population improvement. The seeds are available to be distributed among the Vanni farmers. These two lines as could be promoted as promising variety after conducting multi location trials.

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