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# Response to selection for yield and quality traits under salt affected soil in brinjal (*Solanum melongena* L.)

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**ABSTRACT**

A field experiment was conducted to assess the genetic components such as heritability in narrow sense ($h^2_{ns}$) and genetic advance for nineteen yield,its attributes and biochemical traits of forty five crosses and their ten parents by using the diallel cross analysis (excluding reciprocal) at the Main Experiment Station (MES), Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya (U.P.) India during 2020-2021 ($Y_1$) and 2021-2022 ($Y_2$). High heritabilityin narrow sense ($h^2_{ns}$) coupled with high genetic advance in percent of mean were observed for fruit length, fruit equatorial circumference, number of fruits per plant, average fruit weight, reducing sugars, non-reducing sugar, total sugar,chlorophyll content, total phenol content and total fruit yield per plant in the pooled indicating thereby these traits were less influenced by environment and were mainly under control of additive genes.

***Key word:*** *Heritability, Genetic advance, Genetic components, Biochemical traits.*

## Introduction

Brinjal or eggplant (*Solanum melongena* L. 2n=24) is one of the most cultivated solanaceous vegetable, which is mainly grown for its edible fruit. In India it is known by many regional name *viz.*, Baigan (Hindi), Badanekai (Kannada), Vangi (Marathi), Katharikai (Tamil), Vankai (Telugu) while in world-wide it is popularly known as aubergine (France) or guinea squash. It is the most popular and major fruit vegetable crop in India and many other countries of the world. It is a perennial plant but grown as an annual crop in which self-pollination should be found but some time cross pollination also occurs. According to Zeven and Zhukovsky (1975) brinjal is claimed to be originated in India and spread to China, which became a secondary centre of origin.It is a flexible crop adapted to different agro-climatic regions and can be grown throughout the year. It is an important crop in the tropical regions of world and is being grown commonly in India, China, Turkey, Japan, Italy, Indonesia, Iraq, Syria, Spain and Philippines.

Globally, India ranked second in vegetable production next to China and contributed 10.80 M ha and 196.26 MT to global vegetable area and production, respectively. In India, brinjal occupies an area of 0.758 million hectares with 13.154 million tonnes of annual production which have the 17.5 tonnes per hectare productivity (Anonymous, 2021). In Uttar Pradesh brinjal is existence in cultivation on an area of 0.080 million hectare with annual production of

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2.75 million tonnes with 34.40 tonnes per hectare productivity. In Uttar Pradesh, Agra, Meerut, Lucknow, Kanpur, Aligarh, Chitrakoot and Gorakhpur district share more area and production in the state (Anonymous, 2018).

The plants of brinjal is erect, semi-erect or prostate, herbaceous and branched in nature which is about one meter or lower in height. It is woolly or scurfy, spiny or non-spiny with or without pigmentation which is mainly anthocyanin. Leaves are opposite or sub opposite, large, ovate or oblongish-ovate, shallowly sinate-lobbed, glabrous or nearly glabrous above, bit densly tomentose flowered cyme. Calyx is spiny or non-spiny, persistent and crescent. Corolla is lobed, with purple to light-pink or white colour. Stamens free, erect, yellow with short filaments, flat at the base, long, narrow anther farming a loose cone which surround the style. Each anther opens into two terminal pores, come out of which the mature pollen grain at the time of anthesis. Ovary is 2 locular with multi ovules.

Brinjal fruit is a fairly good source of calcium, phosphorus, iron and vitamins particularly 'B' group, fruits are tasty, improves appetite, works as laxative, analgesic, cardiotonic, lessens inflammation and enriches the blood. The amino acid contents are higher in purple and low in white cultivars. Potassium and Chloride contents are higher in green and lower in purple varieties. Bajaj *et al.*, (1979) reported that, oblong fruited cultivars are rich in total water soluble sugars whereas, the long fruited cultivars contain in abundance of free reducing sugars, anthocyanin, phenols, glycol-alkaloids, dry matter and amide proteins. For processing purposes the fruit should have a high dry matter content and low level of phenolic.Bitterness in brinjal is found due to presence of glycol-alkaloids which are mostly present in plants of solanaceous family. Generally, high amount of glycol-alkaloids (20 mg/100g fresh weight) produces a bitter taste and off flavour.

Analysis of edible parts of fruit (except stalk and calyx) gave the subsequent value as per 100g fresh weight are 92.7g moisture, 1.4g protein, 0.3g fat, 0.3g minerals, 1.3g fiber, 4.0g carbohydrate. The mineral constituents per 100g edible portion are 18 mg Ca, 16mg Mg, 47mg riboflavin, 0.9 mg Fe, 3.0 mg Na, 0.17mg Cu, 44 mg S, 52 mg Cl and 2.4 mg Mn.

The estimates of heritability in narrow and broad sense facilitates the index of transmissibility of the characters and help the breeder for selection of lines with different selection parameters. The genetic advance provides clear information about overall efficiency of the selection for improving a traits (Johnson *et al*., 1955).

Response to selection is depends on the relative proportion of the heritable component (Singh and Mittal, 2003). The heritable components are due to genotype, while, the non-heritable portion is mainly due to the environment factors. Heritability estimate may not provide clear predictability of the breeding value. Johnson *et al.,* 1955 have reported that the estimation of heritability accompanied with genetic advance is generally more useful than heritability alone in prediction of the resultant effect for selecting the best individuals. The variability, heritability and genetic advance were relative measure of the efficiency of selecting genotypic from a highly variable population based on phenotypic.

Keeping in view the above fact the present investigation was conducted to assess the heritability and genetic advance.

## Materials and Methods

The present study was carried out at the main experiment station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (UP), India, during *Kharif*, 2020-21 ($Y_1$) and 2021–22 ($Y_2$). The experimental farm falls under humid subtropical climate and is located between 24.47° and 26.56°N latitude and 82.12° and 83.58°E longitude at an altitude of 113 m above mean sea level. The experimental farm had saline alkali soil with pH above 8.

The experimental materials comprised of ten promising and diverse inbred and varieties of brinjal selected on the basis of genetic variability from the germplasm stock maintained in the department. The selected parental lines *i.e.*; Balfahava ($P_1$), Punjab Sadabahar ($P_2$), NDB-3 ($P_3$), NDB-2 ($P_4$), NDB White-1 ($P_5$), Pusa Kranti ($P_6$), Pant Samrat ($P_7$), Mukta Keshi ($P_8$), NDB Sel-1 ($P_9$) and Co-2 ($P_{10}$) were crossed in all possible cross combinations, excluding reciprocals, during the year, 2019-20 to get 45 $F_1$'s for the study of heritability and genetic advance.

The experiments were conducted in a Randomized Complete Block Design (RBD) with three replications to assess the performance of 45 $F_1$'s hybrids and their 10 parental lines of brinjal. The crop was planted in two rows spaced at 75 cm apart with a plant to plant and spacing of 60 cm. The experi-

ments were transplanted on 12 August, 2020 and 17 August, 2021.

Observations were recorded for ninteen economic traits including biochemical traits, *viz.* days to 50% flowering (days), days to first fruit harvest, leaf length (cm), leaf width (cm), plant height (cm), number of primary branches per plant, harvest duration (days), fruit length (cm), fruit equatorial circumference (cm), number of fruits per plant, average fruit weight (kg), marketable fruit yield per plant (kg), unmarketable fruit yield per plant (kg), reducing sugars (%), non-reducing sugar (%), total sugars (%), chlorophyll content (mg/g), total phenol content (%) and total fruit yield per plant (kg).

Reducing sugars were estimated by Fehling 'A' and 'B' solution method[15]. Non-reducing sugar was calculated by deducting the quantity of reducing sugars from total invert sugars and multiplied by a factor 0.95. The results were expressed asnon-reducing sugar in per cent.

Total sugars were calculated by adding the quantity of reducing and non-reducing sugars. The results were expressed as total sugars in percentage.

Chlorophyll was measured with the help of plant efficiency analyser. Model: X55/M-PEA. The value were expressed as SPAD value. Plant efficiency analyser can measure two parameters (chlorophyll and leaf temperature) at the same time.

Total phenol content was estimated at marketable fruit stage by using 'spectrophotometer' method as described.

The analysis of variance fortesting variation among the characters studies wasestimated as per the procedure given by Mather and Jinks (1971) for narrow sense heritability and expected genetic advance (Ga) was estimated by the formula suggested by Johnson *et al*. (1955).

## Results and Discussion

The knowledge of heritability of a character is important to the breeder since it indicates the possibility and extent to which improvement is possible through selection (Robinson *et al*., 1949). Heritability, which denotes the proportion of additive genetic variance to the total variability, is a measure of genetic relationship between parents and progeny and has been widely used in determining the degree to which character may be transmitted from parent to offspring. Singh *et al*. (2005) pointed out that the heritability in combination with intensity of selection and amount of variability present in the population influences the gains to be obtained from selection. Since the genetic gain is yet another important selection parameter which is although dependent and represents the expected genetic gain under selection. It measures the differences between the mean genotypic values of the selected lines and mean genotypic value of base population from which these lines were selected. Thus, it is necessary to utilize the heritability in conjunction with selection differential, which would indicate the expected genetic gain. The estimate of heritability with genetic advance as per cent of mean provides a better picture to the breeders during the process of selection.The estimates of heritability in narrow-sense ($h^2_{ns}$) have been classified according to Crumpacker and Allard, (1962) as (i) High (> 30%) (ii) Moderate (10% to 30%) and (iii) low (< 10%) and genetic advance was classified into three groups such as (i) high (> 20%) (ii) moderate (> 10% to 20%) and (iii) low (< 10%).

Perusal of Table 1 revealed that high heritability coupled with high genetic advance were observed for fruit length, fruit equatorial circumference, number of fruits per plant, average fruit weight, reducing sugars, non-reducing sugar, total sugar, chlorophyll content, total phenol content and total fruit yield per plant in the pooled.These results are inclose conformity with the findings ofRathava *et al*., 2021; Bajpai *et al.,* 1979; Kumar *et al*., 2019; Singh *et al.,* 2014; Singh *et al*., 2011)

Moderate heritability coupled with high genetic advance were observed for leaf width, primary branches per plant and marketable fruit yield per plant while, the characters such as leaf length showed moderate heritability coupled with moderate genetic advance and the characters days to 50% flowering, days to first fruit harvest and crop duration showed moderate heritability coupled with low genetic advance. Whereas, the character plant height showed low heritability coupled with low genetic advance.Similar finding for moderate estimate of narrow sense heritability for different brinjal traits have been also reported by previous workers (Prasad *et al*., 2004 and Kaur and Thakur, 2007).

Thus, based on the present study it might be concluded that there exist ample scope ofimprovement in fruit yield per plant and its contributing traits through selection in available genetic stock of brinjal.

**Table 1.** Estimates of heritability in narrow sense and genetic advance in per cent of mean for nineteen characters in brinjal over two years $Y_1$ (2020-21), $Y_2$ (2021-22) and over season pooled

| S. No. | Parameters Characters | Heritability ($h^2$ns %) | | | Genetic advance in per cent of mean | | |
|---|---|---|---|---|---|---|---|
| | | $Y_1$ | $Y_2$ | Pooled | $Y_1$ | $Y_2$ | Pooled |
| 1 | Days to 50% flowering | 5.22 | 1.59 | 10.32 | 4.63 | 2.88 | 3.94 |
| 2 | Days to first fruit harvest | 14.35 | 12.42 | 28.49 | 2.83 | 2.73 | 3.13 |
| 3 | Leaf length | 6.25 | 8.60 | 19.82 | 19.23 | 18.73 | 18.66 |
| 4 | Leaf width | 7.93 | 8.09 | 17.70 | 31.58 | 24.72 | 24.86 |
| 5 | Plant height | 4.66 | 1.91 | 5.99 | 11.65 | 14.57 | 7.62 |
| 6 | Primary branches per plant | 2.30 | 14.01 | 20.53 | 26.27 | 34.23 | 29.07 |
| 7 | Crop duration | 6.98 | 0.26 | 12.57 | 1.22 | 1.21 | 1.30 |
| 8 | Fruit length | 57.93 | 55.74 | 78.85 | 37.81 | 33.27 | 34.88 |
| 9 | Fruit equatorial circumference | 57.69 | 59.11 | 63.47 | 36.08 | 33.70 | 33.76 |
| 10 | Number of fruits per plant | 34.64 | 38.16 | 67.90 | 47.45 | 41.68 | 42.32 |
| 11 | Average fruit weight | 83.66 | 67.26 | 71.99 | 55.36 | 57.64 | 53.56 |
| 12 | Marketable fruit yield per plant | 29.99 | 22.20 | 48.90 | 61.22 | 61.39 | 53.42 |
| 13 | Unmarketable fruit yield per plant | 7.74 | 4.68 | 12.88 | 65.47 | 51.04 | 53.16 |
| 14 | Reducing sugar | 39.02 | 53.42 | 65.14 | 50.07 | 46.58 | 46.36 |
| 15 | Non reducing sugar | 32.92 | 34.97 | 53.40 | 33.67 | 33.83 | 30.79 |
| 16 | Total sugar | 58.68 | 80.84 | 87.92 | 33.93 | 32.73 | 31.45 |
| 17 | Chlorophyll content | 25.25 | 16.46 | 36.98 | 23.82 | 21.65 | 21.71 |
| 18 | Total phenol content | 13.42 | 39.49 | 35.39 | 35.32 | 35.14 | 26.80 |
| 19 | Total fruit yield per plant | 24.76 | 19.26 | 38.80 | 51.55 | 48.50 | 44.92 |

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