

# IMPROVEMENT OF BRINJALS (*SOLANUM MELONGENA*, L.) BY SELECTION IN THE BOMBAY PROVINCE

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Received November 12, 1942

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### 1. Introduction

THE question of improvement of indigenous vegetables in India has assumed great importance during recent years. The quality of indigenous vegetables available in the Indian market is very poor. The cultivation also is not very paying. It is observed that the acreage under vegetable cultivation in several districts in this Province has fallen during recent years. The Department of Agriculture in the Province of Bombay realising the importance of this work, prepared a comprehensive scheme relating to the improvement of Brinjals and Chillies in the year 1930. This scheme was accepted and financed from the Sir Sassoon David Trust Fund. This paper deals exclusively with the improvement of Brinjals only by selection of strains which are superior both in quality and yield.

### 2. Previous Literature

Very little work has so far been done in India on the improvement in the quality and yield of indigenous vegetables. The Market Committee appointed by the Government of Bombay,<sup>1</sup> had laid great stress for such improvement. In foreign countries research on some of the important vegetables like chillies and brinjals has attracted some investigators. Most of such work, however, relates to systematic study of varieties, hybridization, inheritance of characters and the analysis of constituent parts. In India the improvement of brinjal crop by selection has not been so far undertaken anywhere. Balaji Rao<sup>12</sup> made an attempt to hybridize the common egg plant with a brinjal variety from Mysore differing greatly in general appearance. This work was done only for one generation.

A very interesting work relating to the improvement of egg plant by selection and hybridization has been carried out in the Philippines. The study of variations and selection of some varieties of egg plant is reported by Macabasco<sup>8</sup>; while Bayla<sup>2</sup> carried out hybridization of egg plant. Studies relating to floral biology and morphology of one of the types of egg plant have also been reported by Magtang.<sup>9</sup> In Puerto Rico, the inheritance of colour in egg plant has been studied by Nolla.<sup>11</sup> Halstead<sup>5</sup> also has studied colour variations in egg plant. Boswell<sup>3</sup> records observations relating to the improvement and genetics of egg plant along with other vegetables in the United States of America. In Japan, also, systematic breeding work has been carried out by some workers.<sup>6,7,13</sup> with good results. Seed catalogues of various countries show that some good quality of brinjal varieties are under cultivation there.

3. *Improvement of Brinjals (Solanum melongena, L.)*

During the year 1937-38, the total area under brinjal in the Bombay Province was 17,073 acres, the distribution in each division being as follows :—

	Acres	Percentage of the total acreage
Deccan .. .. .	7,786	45.6
Karnatak .. .. .	4,155	24.3
Gujerat .. .. .	3,590	21.0
Konkan .. .. .	1,542	9.1
TOTAL .. .. .	17,073	100.0

(Figures for each district are given in Appendix I)

The district of Dharwar has the largest acreage, *i.e.*, 1,775 acres or 10 per cent. of the total. Poona has also nearly as much, *i.e.*, 1,758 acres. The other centres of importance are Satara (1,499 acres), Belgaum (1,331 acres), Sholapur (1,224 acres) and Surat (1,145 acres).

In Gujerat, varieties like ravaiya, round purple and the long purple are generally very popular. In the Karnatak, the Krishna Valley type is much appreciated. In the Deccan, however, the Dorli and the Gote are preferred to other varieties.

The work of Vegetable Research was entrusted to the Horticulturist to Government, B.P., Poona, and was located at the Ganeshkhind Fruit Experiment Station, Kirkee. One Agricultural Overseer\* and Sub-overseer were appointed and the work was started early in 1931.

During the first four seasons, unit selection was done and high yielding biotypes were isolated. These were tested finally for yield during the next four seasons in order to get conclusive results before the best ones could be tried on field scale and subsequently distributed to the cultivators. The selected seed is now available for trial on the cultivators' field. Further work on this crop is, however, stopped.

A. *Material*

A collection of 45 representative samples from all the important brinjal growing centres in the Province was made and their history recorded

\* Mr. S. M. Patel .. 13-1-1931 to 21-5-1932,  
 Mr. I. A. Sayed .. 21-5-1932 to 5-9-1932,  
 Mr. N. G. Masur .. 5-9-1932 to 31-3-1936,  
 Mr. S. K. Patwardhan .. 1-4-1936 to 30-9-1938.

(Appendix II). This collection includes three foreign types. With two more exotic types added, work was started with 47 samples. These samples were grown in duplicate plots in the rabi season of 1931.

### *B. Varieties of the Bombay Province*

A systematic study of the different varieties of brinjal has not been made by any one in India. According to Gammie,<sup>4</sup> the majority of brinjals belong to the variety *esculenta* with all parts having prickles. The varieties mentioned by him are :—

- (1) Purple, club-shaped fruits, a foot long. Common variety.
- (2) Purple, large and almost globular fruits, diameter 8 inches.
- (3) and (4) Purple or rarely white-small ovoid sorts.

Mollison<sup>10</sup> has grouped the Bombay brinjals into the three following classes according to their size and shape :—

- (1) Purple, large fruits, tapering gradually from the attachment to flower stalk to a round, full thick end, 10" to 12" long. Common variety.
- (2) Purple, large and round fruits, pomelo size.
- (3) Purple, small nearly round or slightly oval. Orange size variety. Favourite of the Surat District.

The author further adds that the colour of fruit, classified as above, varies from purple to variegated purple and green or yellowish green, faintly marked with purple.

The study of the plant and fruit characters of the samples grown showed 35 distinct types. Half of these were smooth and the rest thorny all over. In regard to the latter character, Gammie<sup>4</sup> says, "the absence of defensive armour in the superior varieties may be the result of long continued cultivation". In his opinion, European seeds usually give plants without prickles. Quoting Duthie, Mollison<sup>10</sup> says, "brinjal is often met with as an escape from cultivation in which condition it becomes prickly and more prolific as to the number of fruits". In our collection, the foreign varieties, the Gujerat types and almost all Konkan types are found to be smooth. The Deccan types, however, which mostly comprise the Dorli and the Gote are thorny and have remained so in spite of "long continued cultivation".

An attempt has been made to classify the representative types in our collection. After a detailed study of the fruit characters they have been classed under 11 groups with several horticultural forms under each. The description of these varieties is given in Table I.

TABLE I  
Classification of Brinjal Varieties

Group	Colour		Shape	Size	Group named as	Culture Nos. under these groups	Remarks
	Ground	Mottling					
I	Purple	..	Conical	Big	Foreign	3, 4, 5, 6, 7	Comprises the foreign types
II	do.	..	Medium to long	..	Long purple	13, 14, 21, 25, 35, 38, 39, 41, 42, 46, 48, 49	Long purple (Appendix II)
III	do.	..	Round or oval	Medium or small	Round purple	10, 15, 16, 36, 45	The "Surti" Round
IV	Reddish purple	White	Round	Medium	Round thorny	28, 31, 32, 34, 50	The "Gote" vangi of Deccan
V	Green	Purple patches	Oval or round	do.	do.	32-10, 34-27	Fruits slightly ridged
VI	do.	White	do.	Small	Small thorny	8, 20, 22, 26	The "Dorli" vangi of Deccan
VII	do.	Purple	Oval-round or elongated	do.	Green purple	27	do.
VIII	do.	White	Round	Medium	Round green	23	Fruits bigger than in group VI
IX	do.	White and purple	do.	do.	do.	11, 11 CH, 37	The "Krishna Valley" type
X	do.	Purple	Elongated	Fairly big	Long green	17, 18, 24, 40, 43, 44	Long green (Appendix II)
XI	Purple	Green or green and white	Round or elongated	Very small	Purple green	33	Dorli type but fruits very small

### *C. Method of Cultivation*

Work on brinjal improvement was started in the rabi season of 1931. The usual tillage operations were given and the plot was manured with Farmyard Manure at the rate of 30 cartloads per acre. The seeds were sown on raised beds in the second week of September. The attack of aphid was controlled by spraying the seedlings with 2 ozs. of Fish Oil Rosin Soap in one gallon of water. The curly leaf and malformation of leaves which often occur in the early stages, were controlled by Black Leaf 40 (3/4 oz. Black Leaf 40, 5 gallons water and 3 ozs. bar soap).

The plants were irrigated at intervals of 8 days. The soil round-about the plants was stirred at different intervals and heaped round the plants. After about a month, it became necessary to control the curly leaf attack by spraying the plants with Black Leaf 40. The aphid attack at subsequent stages of growth was checked by spraying the plants with Fish Oil Rosin Soap.

### *D. Study of Plant and Fruit Characters*

Plant growth records were maintained and promising plants were bagged. For the purpose of selection, the following ideals were kept in view :—

- (1) High yield.
- (2) Fruits with least number of seeds.
- (3) Fruits having pleasant taste.
- (4) Resistant to disease types.
- (5) Brinjals having short maturity period.

Special attention was paid to the selection of round or oval shaped fruit of medium size with attractive colour.

The study of plant and fruit characters had been closely followed and selections exhibiting pure characters were bagged. In the year 1933-34, a detailed study of the following plant and fruit characters was undertaken.

- (i) *Plant characters*
  - (a) Habit of growth
  - (b) Leaf size, shape and margin
  - (c) Prickles on plant parts
  - (d) Colour on plant parts

(ii) *Fruit characters*

(1) Yield per plant

(a) Length, diameter and weight

(b) Shape

(2) Fruit colour

*i. Plant Characters*

(a) *Habit of growth.*—A considerable variation in this character was noticed and the cultures under study were grouped into the following four grades :—

TABLE II

Habit	Culture Nos.	Type	Group Nos.
1. Tall .. .. .	11-2-11	Krishna Valley	IX
	11 CH-9-4	do.	IX
	23-3-24	Dorli Vangi	V
	27-32-6	do.	V
2. Spreading .. .. .	8-3-24	Dorli Vangi	V
	8 C-2-24	do.	V
	10-3-20	Surti Round	III
	15-31-20	do.	III
	28-21-24	Gote Vangi	IV
	32-7-3	do.	IV
	34-27-21	do.	IV
32-10-3	do.	IV	
3. Erect .. .. .	25-32-22	Long Purple	II
	38-33-20	do.	II
	39-23-6	do.	II
	40-16-6	Long Green	X
4. Dwarf .. .. .	3-3-22	Black Beauty	I
	7-1-5	New York Improved Purple	II

The plants grouped under the second grade do not grow tall but have a tendency to spread out. The plants of Dorli vangi falling under the first grade are slightly bigger in size than those under the second grade.

(b) and (c). *Leaf and prickles on plant parts.*—The different types of brinjals have their own characteristic leaves. The leaves vary in surface area and have either a wavy or nearly entire margin. In some types, the margin is lobed. There are two classes of brinjals so far as the character of prickles borne on plant parts is concerned. In one, the internodes, petioles and leaves are all prickly and in the other, they are totally absent.

The cultures belonging to these groups are shown below :—

TABLE III  
*Prickles on plant parts*

Prickly	Type	Without prickles	Type
28-21	Gote Vangi	23-3-24	Dorli Vangi
32-7	do.	25-32-22	Long Purple
32-10	do.	38-33-20	do.
34-27	do.	39-23-6	do.
8 C-2-24	Dorli Vangi	10-3-20	Round Purple (Surti)
8-3-24	do.	15-31-20	do.
27-32-6	do.	3-3-22	Black Beauty
		7-1-5	New York Improved Purple
		11-2-11	Krishna Valley
		11 CH-9-4	do.
		40-16-6	Long Green

Gammie<sup>4</sup> describes the prickly type as *esculenta* and alludes to the presence of "prickles" on the under-surface of the leaves only. There are, however, some types in our collection having prickles on both the surfaces of the leaves. These are found in the following Gote and Dorli selections :—

Gote—28-21-24 ; 32-7-3 ; 32-10-3 and 34-27-21.

Dorli—8 C-2-24 ; 8-3-24 ; and 27-32-6.

(d) *Colour on the plant parts.*—There is a clear distinction between varieties in this respect. The parts mostly concerned are internodes, tender leaves, veins and prickles when present.

*Internodes.*—These are either green or purple with varying intensities of the latter.

*Leaves.*—These are generally tinged purple in the young stage, being deeper in types having purple internodes. As the leaf gets older, the colour changes to green or dark green so that there is little difference between adult leaves of different types. In the extreme, however, the adult leaves are very deep or dark purple with similar veins showing velvety appearance.

*Veins.*—The colour of the veins is either green or purple in varying intensities of the latter. Generally speaking, the colour is more intense on the vein in types having purple internodes.

*Prickles.*—These are similar in colour to the veins, being more intense. It may be stated in general that in the case of the coloured types (purple), there appears to be a regular gradation in the intensity of the purple colour from internodes to petioles, petioles to leaves, leaves to veins and



finally from veins to prickles, the last being the most intense. The strains representing this gradation are given in Table IV.

TABLE IV

Plant parts	Colour	Groups		
		I Foreign	II Long Purple	III Round Purple
1. Internode to petiole ..	Slightly Purple	3-3-22 7-1-5	25-32-22 25-32-27 38-33-20 39-23-6	10-3-20 15-31-20
2. Petiole to leaves ..	Purple	3-3-22 7-1-5	25-32-22 25-32-27 38-33-20 39-23-6	10-3-20 15-31-20
3. Leaves to veins ..	Deep Purple	3-3-22 7-1-5	25-32-22 25-32-27 38-33-20 39-23-6	10-3-20 15-31-20
4. Veins to prickles ..	Deep Purple	3-3-22 7-1-5	25-32-22 25-32-27 38-33-20 39-23-6	10-3-20 15-31-20

The remaining groups (Nos. IV and V—Gote Vangi ; VI, VII, VIII—Dorli Vangi ; IX—Krishna Valley ; X—Long Green and XI—Small Dorli) are green and have no colour on their plant parts.

Purple varieties are popular in Gujerat and non-purple ones in the Deccan and the Karnatak.

### ii. Fruit Characters

#### (1) Yield per plant

(a) *Length, diameter and weight.*—In expressing this character, two factors, viz., the total number of fruits and the average weight of fruits per unit area are generally taken into consideration. The latter varies according to the size of fruits. The character is given major importance in the selection of the best type.

In brinjals, the yield factor may be said to be a definite varietal character. The statement of yield, length of fruit and diameter of the different varieties is given in Table V.

TABLE V

Name of the variety	Length (cms.) Mean	Diameter (cms.) Mean	No. of fruits per plant	Weight of fruits (ozs.) Mean
Long Purple .. ..	24.16	7.15	12.7	8.66
Long Green .. ..	15.21	8.18	16.3	9.35
Round Purple .. ..	13.04	11.35	16.9	10.60
Round Green .. ..	10.79	10.31	12.5	8.76
Gote .. ..	10.38	7.50	24.6	4.93
Dorli .. ..	6.84	6.45	33.9	2.12

From the above table, it can be seen that the size (length and diameter) of an individual fruit has a great bearing on the average number and weight of fruits. These characters are considered as definite varietal characters. A significant correlation exists between the size and the average number of fruits per plant. The variety bearing smallest fruits, namely, Dorli, has the largest number of fruits.

(b) *Shape*.—There are almost innumerable forms so far as the shape of the fruit is concerned. Broadly speaking, the fruits may be grouped into the following classes so far as shape is concerned.

*Conical*.—This shape is met with in the foreign types. In these, the end of the fruit is almost flat with a slight depression so that the fruit can stand erect with its stalk upwards.

*Long or elongated*.—The fruit in these types is either straight or slightly curved at the stigma end and the length is more than twice the diameter.

*Round*.—The fruit appears round but the length is slightly more than the diameter and sometimes is nearly twice. In some cases, however, the fruits tend to bulge out in the centre and in such cases the length is less than the maximum diameter.

*Oval*.—In these types, the fruit appears almost egg-shaped and the length varies from 1.3 to 1.9 times the diameter.

## (2) *Fruit colour*

The large number of horticultural forms met with in brinjal present equally variable shades of colour also. The more important ones are the following :—

- (a) Purple in varying intensities.
- (b) Green either light or deep.
- (c) White.

The cultures, the fruit of which show colour variations mentioned above, are grouped in Table VI.

TABLE VI

Purple	Purple shining	Dark Purple			Dusty Purple
..	5-31-18 ; 6-2-25 ; 24-8-8	3-3-22 ; 10-3-20 ; 7-1-5 ; 15-31-20 ; 25-32-22 ; 25-32-27 ; 38-33-20 ; 39-23-6 ; 4-31-3			39-23-6

Green with White	Purple Green White	Green Purple	Pale Green	Green Purple White
8 C-1-2-10 8 C-1-1-3-7 8 C-2-24 23-3-24 11-4-28 23-10-25 23-34-24 11-2-11-22-3 11-2-11-22-8 19-33-7 23-10-2 20-7-12	8-3-24 30-18-23 27-32-6 27-32-6-10 26-5-32	40-16-6 40-16-14	23-14 11-8	11 CH-9-4-4 11 CH-9-4-13

Pink White	Reddish Purple White			
23-10-25-4 8 C-1-1-2-7	28-8-21-21 ; 28-12-9-6 ; 28-21-24 ; 28-21-24-10 ; 32-10-3-3 ; 32-10-15 ; 34-27-21 ; 34-27-21-3			

The above noted colours are present, very often, in different combinations and intensities. With experience, it is easy to distinguish between the ground or the main colours and the mottling or other shades. The mottling appears either as spots or in patches.

Very often, the spots are close to each other and appear as if they were in continuous lines. When mottling presents more than one colour, it is also possible to determine the intensity or prominence of one of them. Thus, green with purple and white means that purple occupies a larger proportion of the mottling. If the fruit is green with white and purple the colour white is more pronounced. These characters have been used in the classification of the eleven groups shown above.

#### 4. Breeding by Selection

##### A. Line Culture Study and Selections

It has already been mentioned that all brinjal types, as a result of detailed study of various plant and fruit characters, are grouped in 11

classes. One type out of each group was selected for further studies. In addition to these, five more selections were included for further studies. So in all, the following selections were on hand for further work:—

Culture Nos.	Locality	Representing
<i>1. Round type</i>		
10	Surti Round	Gujerat
11	Krishna Valley	Karnatak
17	Thana Local	Konkan
28	Gote Vangi of Poona	Deccan
32	do.	do.
34	Malvanki from Belgaum	Karnatak
<i>2. Long type</i>		
25	Nasik Bengali	Deccan
38	Thana Pandhari vel Vangi	Konkan
39	Thana Kali vel Vangi	do.
40	Thana Pandhari vel Vangi	do.
<i>3. Dorli</i>		
8 C	Poona Dorli	Deccan
8-3	do.	do.
23	Nasik	do.
27	Bengali	do.
<i>4. Exotic variety</i>		
3-3	Black Beauty	Foreign
<i>5. Exotic variety</i>		
7-1	New York Improved Purple	Foreign

These selections were thoroughly studied for their purity. On the basis of attractive colour, less number of seeds, medium size of fruit and yield, the following cultures were further selected for trials during the year 1932-33.

- (1) 38 cultures representing the Deccan and the Gujerat tracts,
- (2) 13 cultures representing the Karnatak tract,
- (3) 23 cultures representing the Konkan tract, and
- (4) 8 foreign types.

#### *B. Detailed Study of Selections*

After a detailed study, only twenty promising cultures out of the above collections were selected and their performance was recorded. The behaviour of these selections for the two years is given in Table VII.

TABLE VII

Statement showing the performance of some promising Brinjal types during 1932-33 and 1933-34

Culture Nos.	Tract	Average length of fruits (cm.)		Average No. of fruits per plant		Average yield per plant	
		1932-33	1933-34	1932-33	1933-34	1932-33 lb.	1933-34 oz.
25-32	Deccan Konkan do. do.	21.7	22.2	5.6	7.1	2	8
38-2		21.3	25.2	12.7	13.2	5	11
39-23		20.6	24.5	12.7	17.8	4	12
Local		..	..	..	..	3	15
10-3-20	Gujerat do. do.	10.2	10.6	10.5	14.6	4	11
15-31-20		10.5	11.2	4.8	20.1	2	12
Local		..	..	..	..	4	7
28-8	Deccan do. do. do. Karnatak do.	9.6	8.1	12.6	35.7	4	0
28-21		8.3	7.5	17.0	18.3	5	5
32-7		8.9	8.4	19.2	28.6	5	12
32-10		8.8	8.4	18.7	19.0	6	1
34-27		8.2	9.1	14.1	22.0	6	7
Local		..	..	..	..	4	8
8 C-1-1	Deccan do. do. do. do. do.	8.8	7.2	22.4	39.8	2	2
8 C-2-24		6.8	6.1	26.1	40.0	2	9
8-3-24		3.9	4.6	37.7	47.0	1	14
23-3		7.9	7.7	16.0	34.7	1	13
27-32		6.4	6.3	27.5	21.2	4	0
30-18		5.2	5.7	29.4	20.7	2	14
Local	..	..	..	..	3	1	
11 CH-4	Karnatak do. do.	7.9	8.3	12.2	10.2	4	4
11-2-11		7.8	7.9	9.1	13.1	3	12
Local		..	..	..	..	3	10
40-16	Konkan do. do.	21.7	16.9	10.5	13.3	4	9
40-31		18.8	16.3	12.7	9.8	7	15
Local		..	..	..	..	1	9

Remarks.—All the cultures with the exception of 32-8 put up satisfactory performance. Further individual selections were made and tested along with a few more during the next year.

During the year 1934-35, there were in all 48 cultures under study. There was severe cold during the month of January and many cultures suffered badly. Those that showed resistance and gave a satisfactory yield were studied. These were compared with their respective locals in the group. The performance in respect of their important characters is given in Table VIII.

TABLE VIII

Statement showing the performance of the cultures of Brinjal during 1934-35

Culture Nos.	Tract	Fruit length Mean (cms.)	No. of fruits per plant	Total yield		Yield per plant	
				lb.	oz.	lb.	oz.
<i>Group II. Long Purple</i>							
Local .. ..	..	16.72	10.9	103	2½	4	2.0
25-32-22-30 ..	Deccan	24.20	10.6	128	6½	4	15.0
38-33-20-15 ..	Konkan	17.87	7.1	103	9½	3	9.2
38-33-20-16 ..	do.	20.64	8.7	172	3½	5	11.8
39-23-6-4 ..	do.	19.14	5.9	106	2½	4	3.9
Duplicate 39-23-6-4	do.	17.55	6.2	71	15½	3	15.9
<i>Group III. Round Purple</i>							
Local .. ..	..	10.92	9.4	166	1	5	9.9
10-3-20-21-5 ..	Gujerat	12.13	7.9	136	13½	5	15.2
15-12-9-18 ..	do.	11.46	10.1	157	14½	6	5.0
15-31-20-2 ..	do.	11.22	9.6	120	13½	6	0.6
15-31-20-5 ..	do.	11.59	9.4	185	3½	6	13.7
15-12-9-4 ..	do.	11.21	10.4	270	15½	7	8.2
<i>Group IV. Gote Vangi</i>							
Local .. ..	..	7.75	21.2	104	11	4	3.0
28-8-21-21 ..	Deccan	9.60	20.5	140	0	4	13.2
28-12-9-5 ..	do.	8.55	8.9	128	6½	4	9.3
28-12-9-6 ..	do.	10.06	13.4	131	13	5	7.8
28-21-24-3 ..	do.	9.34	20.2	192	11	7	2.1
28-21-24-10 ..	do.	8.58	22.4	161	1	6	7.0
32-7-3-7 ..	do.	9.25	17.6	166	11½	5	15.2
32-10-3-3 ..	do.	8.87	15.1	121	14½	5	4.7
32-10-15-4 ..	do.	9.54	19.6	202	14½	6	15.9
34-27-21-2 ..	Karnatak	9.89	16.4	175	4½	6	7.8
34-27-21-3 ..	do.	9.20	20.4	180	9½	6	15.1
<i>Groups VI, VII, VIII and XI. Dorli Vangi</i>							
Local .. ..	Deccan	7.95	31.3	80	2½	3	1.2
8 C-1-12-7 ..	do.	7.79	27.6	69	4½	2	10.6
8 C-1-1-3-7 ..	do.	7.42	28.2	75	2½	3	6.2
8 C-1-1-3-13 ..	do.	9.00	14.5	149	13½	5	2.6
8 C-2-24-10-3 ..	do.	5.62	50.2	112	6½	4	0
23-3-24-3 ..	do.	7.12	28.0	74	12½	2	10.6
23-3-24-4 ..	do.	6.37	32.6	117	4½	3	14.5
8-3-24-2-3 ..	do.	4.73	52.2	98	14½	3	4.7
8-3-24-2-13 ..	do.	4.39	49.9	81	4½	2	14.8
30-18-23-2 ..	do.	5.30	24.2	91	2½	3	4.1
27-32-6-9 ..	do.	7.95	23.7	178	10½	6	6.1
27-32-6-10 ..	do.	7.05	27.5	141	13½	4	14.2

The strains in bold figures were further selected. It was, however, decided that yield tests of the Dorli and the Gote selections being Poona brinjals should be taken up first for comparative yield trials. The other selections were maintained for subsequent trials. Only such selections as would conform to the ideal were selected.

**C. Yield Tests**

*i. Gote selections.*—It will be seen from Table VIII that some of the selections have put up very good performance and given high yields over the check. It was, therefore, decided to test the best selections by regular replicated trials (Latin Square). The Gote and the Dorli being the popular brinjals, the following Gote and Dorli selections, viz., Gote 28-21, 32-7, 32-10 and 34-27 and Dorli 8-3, 8C-2, 23-3 and 27-32 were grown under their respective locals from 1935-39. The results of all the four Gote trials are summarised in the table below :—

(a) *Summary of results of yield trials of Gote selections*

Selection Nos. :—(A) 28-21, (B) 32-7, (C) 32-10, (D) 34-27, (E) Local.

TABLE IX  
Mean acre yield in lbs.

Year	Selections					Z test P=0.05	Crt. dif. P=0.05	Remarks
	A	B	C	D	E			
1935-36	27347.2	24497.6	23038.4	23374.4	22932.8	..	..	.....
1936-37	14394.4	15072.0	13564.8	13344.8	9315.2	16.41	2410.48	<u>B A C D E</u>
1937-38	25607.2	23923.2	22296.0	20572.0	22382.4	2.41	3770.40	<u>A B E C D</u>
1938-39	6538.4	4929.6	4128.8	3844.8	4059.6	5.15	1499.152	<u>A B C E D</u>

In 1935-36 the test as a whole was not statistically significant. However, selection Nos. 28-21 (A) and 32-7 (B) showed increase in yield of 20 and 7 per cent. respectively over the local.

In 1936-37 the yield test as a whole was highly significant. Selections B, A, C and D were found superior in yield over the local.

In 1937-38 the result was significant on the whole. Among the strains, selection No. 28-21 (A) was found to be significantly better than selection No. 34-27 (D). The percentage superiority of A over the local was found to be 13.6.

In 1938-39, the test as a whole was significant. Strain No. 28-21 (A) is significantly better than the local (E) and other selections.

The combined analysis for 1935-36 and 1937-38 and also of 1936-37 and 1938-39 shows that the selections are superior to the local as can be seen from Tables X and XI.

(b) *Combined analysis of variance of Gote selections.*—Some of the selections do not show any significance when the results are studied from year to year. An attempt was, therefore, made to see if a combined analysis would show any significance in the results. A combined analysis, however, can be considered to be strictly valid only if separate year's error variances do not differ significantly. By this test, the combined yields of the years (1) 1935-36 and 1937-38, (2) 1936-37 and 1938-39 were found to be significant. These results lead us to the general conclusions that some of the selections are significantly superior to the local as will be seen from the analysis given below :—

i. *Combined analysis of Gote selections: 1935-36 and 1937-38*

TABLE X

Due to	Deg. of freedom	Sum of squares	Mean square	Obs. F.	Crt. dif.
Rows .. ..	8	264575·8000	33071·9750		
Columns .. ..	8	22444·4114	2805·5514		
Varieties .. ..	4	20396·7673	5099·1918	*	386
Years .. ..	1	3209·1265	3209·1265		
Years × Varieties .. ..	4	1502·4598	375·6149		
Error .. ..	24	41970·1520	1748·7563		
TOTAL .. ..	49	354098·7170	..	..	..

\* Sig. at P=0·05

*Conclusions* :—The experiment as a whole is significant. Selection No. 28-21 (A) has given 16 per cent. better yield over the local as can be seen from the variety totals given below :—

A	B	C	D	E
2455·02	2260·76	2113·45	2016·18	2115·59

The generalized conclusions are :

A B E C D



ii. Combined analysis of Gote selections: 1936-37 and 1938-39

TABLE XI

Due to	Deg. of freedom	Sum of squares	Mean square	Obs. F.	Crt. dif.
Rows .. ..	8	12677.0183	1584.6273		
Columns .. ..	8	8004.6965	1000.5871		
Varieties .. ..	4	13529.8136	3382.4534	**	
Years .. ..	1	139065.8870	139065.8870	**	182.5
Years × Varieties .. ..	4	6049.7752	1512.4438	**	
Error .. ..	24	5108.4539	212.8523		
TOTAL ..	49	184435.6445	..	..	..

\*\* Sig. at P = 0.01

Conclusions : The variety totals are :—

A	B	C	D	E
1308.30	1250.08	1105.83	1074.38	835.80

The generalized conclusions are :—

A B C D E

The following statement giving percentage increase or decrease from 1935-36 to 1938-39 shows that selection No. 28-21 gives 26% over the local.

TABLE XII

Strain Nos.	*Total yield per acre in lbs.				Total yield lbs.	Percentage over local
	1935-36 total area 1½ gts.	1936-37 total area 2½ gts.	1937-38 total area 2½ gts.	1938-39 total area 2½ gts.		
28-21 (A)	27346.88	14394.08	25606.88	6538.72	73886.66	26.0
32-7 (B)	24497.60	15072.00	23923.36	4929.28	68422.24	17.0
32-10 (C)	23038.40	13564.48	22296.00	4128.80	63027.68	7.0
34-27 (D)	23373.76	13344.96	20572.00	3845.12	61135.84	4.0
Local (E)	22933.44	9314.88	22382.72	4057.92	58683.96	..

\* The total yield is calculated from actual plot yields

i. Gote Selections

Gote selection No. 28-21 has a sweet taste and possesses less number of seeds and more pulp. It has an attractive colour and lustre and is much appreciated in the market. Being of uniformly medium size, it can be cooked like Dorli (whole fruit partially cut and stuffed with spices). This selection was given a trial on the Dharwar Farm for two years and it

is reported that it excelled all other varieties there. This selection, therefore is considered to be the suitable type of brinjal for this province.

### ii. Dorli Selections

From Dorli varieties of brinjal, four selections, viz., 8-3-24, 8C-2-24, 23-3-24 and 27-32-6 were made and in the year 1935-36 were replicated with the local on  $\frac{1}{4}$  guntha plots by Latin Square method. In three replications there were many gaps due to death of plants and in other plots the plants did not put forth satisfactory growth. Due to these conditions, the results were badly vitiated and they have not been, therefore, represented here.

The yield tests of Dorli selections from 1936-39 are summarised in the following table.

#### (a) Summary of results of yield trials of Dorli selections

Selection Nos. (A) 8-3-24, (B) 8C-2-24, (C) 23-3-24, (D) 27-32-6, (E) Local.

TABLE XIII

Mean acre yield in lbs.

Year	Selections					Z test P = 0.05	Crt. dif. P = 0.05	Remarks
	A	B	C	D	E			
1935-36	..	..	..	..	..	..	..	..
1936-37	8356.8	7732.8	6599.2	8120.8	7246.4	..	..	..
1937-38	13056.8	11463.2	10316.8	11684.0	9843.2	..	..	..
1938-39	5133.6	4408.0	4498.4	6138.4	4026.4	..	..	..

The results when analysed individually from year to year do not give any significant result. In 1936-37, however, selection Nos. 27-32-6 and 8-3-24 give 19.11 and 11.88 per cent. increase respectively over the local.

In 1937-38, selection Nos. 8-3-24, 27-32-6 and 8C-2-24 showed, 30.36, 18.18 and 61.22 per cent. superiority over the local.

In 1938-39 selection Nos. 27-32-6, 8-3-24 and 8C-2-24 exceeded the local by 47.09, 26.16 and 12.73 per cent. respectively.

The combined analysis of variance of Dorli selections for all the three years, however, shows clear significance in favour of Nos. (D) 27-32-6 and (A) 8-3-24 over the others as can be seen from the following table.

(b) *Combined analysis of Dorli Selections 1936-37 to 1938-39 (3 years)*

TABLE XIV

Rows, varieties and years are compared against the interaction "varieties × years", using the latter as 'error' giving 7.65 as variance ratio.

Due to	Deg. of freedom	Sum of squares	Mean square	Obs. F.	Crt. dif.
Rows .. ..	12	79172.6897	6597.7241	**	291
Columns .. ..	12	12246.9971	1020.5831	**	
Varieties .. ..	4	7698.8307	1924.7077	**	
Years .. ..	2	81940.2192	40970.1096	**	
Years × Varieties .. ..	8	2012.6019	251.5753		
Error .. ..	36	19338.9692	537.1936		
TOTAL .. ..	74	202410.3078			

\*\* Sig. at P= 0.01

*Conclusions :—*

The variety totals are :—

A	B	C	D	E
1659.19	1481.51	1319.64	1671.43	1332.25

The generalized conclusions are:—

D A B E C

These results can be regarded as holding good over a period of years of which the three experimental years can be regarded as a random sample.

In the statement given below the percentage increase or decrease from 1935-36 to 1938-39 is given. It will be seen that selection No. 27-32-6 (D) has given the highest percentage of yield over the local. Selection No. 8-3-24 (A) comes next with regard to yield.

TABLE XV

*Statement showing percentage of increase or decrease in yield of Dorli selections from 1935-36 to 1938-39*

Strain Nos.	*Total yield per acre in lbs.				Total yield lbs.	Percentage over local
	1935-36 total area 1½ gts.	1936-37 total area 2½ gts.	1937-38 total area 2½ gts.	1938-39 total area 2½ gts.		
8-3-24 (A)	..	8356.96	13056.80	5133.28	26547.04	24.54
8 C-2-24 (B)	..	7732.80	11463.20	4408.16	23704.16	11.20
23-3-24 (C)	..	6599.04	10316.64	4198.56	21114.24	- 0.94
27-32-6 (D)	..	8920.80	11684.00	6138.08	26742.88	25.46
Local (E)	..	7446.56	9843.20	4026.24	21316.00	..

\* The total yield is calculated from actual plot yields

*Dorli Selections.*—The Dorli variety is the most seedy and the smallest among brinjals. Selection No. 27-32-6, however, bears bigger sized fruit with less number of seeds. It is tasty and has an attractive colour. Further, it is an early type which can be put on the market by about a fortnight earlier. This is also considered to be suitable for the Deccan tract.

#### *Summary*

Very little work has been done in India on the improvement of the brinjal crop by selection. In the Province of Bombay this work was started in the rabi season of 1931 and was financed by the Sir Sassoon David Trust Fund. Various collections of samples of brinjals cultivated in different tracts of the Bombay Province were made and studied in detail for their fruit and plant characters. As a result of these studies the various brinjal types have been grouped under 11 classes with several horticultural forms in each. Gammie and Mollison have grouped all brinjals under three classes only.

Promising selections have been isolated and their behaviour has been further studied for their purity and other characters. Selections from the Gote and the Dorli varieties only were compared with their respective local varieties, in the Fisher's randomization method. These trials were made for four seasons. Gote selection No. 24-21 gave significant results during the two years of trial. This strain bears fruits of uniform medium size and has attractive colour and lustre. As it is less seedy and has more and tasty pulp it is highly appreciated in the market. Dorli selection No. 27-32 gives appreciably better yield than any other Dorli strain or the local. This is a promising selection. Dorli brinjals are the smallest and the most seedy among all brinjal types known. This selection, however, bears bigger-sized fruits and has less seeds. It has an attractive colour and is very tasty. It flowers earlier by about a fortnight and is in great demand in the market.

Further work, as chalked out in the Scheme, had to be discontinued for want of funds. The selections are, however, maintained in their pure condition and are being distributed for trial all over the districts.

#### *Acknowledgment*

The authors are very grateful to Dr. P. V. Sukhatme, Statistician to the Imperial Council of Agricultural Research, for checking the statistical data and for adding the combined analysis of variance to this work.

The authors are indebted to all those who are responsible for collecting the data, especially Messrs. S. M. Patel, I. A. Sayed, N. G. Masur and S. K. Patwardhan.

The authors are very much thankful to the Trustees of the Sir Sassoon David Trust Fund for financing this research. They are also thankful to Mr. T. F. Main, Director of Agriculture, Bombay Province, Poona, who helped greatly in starting this work and to Mr. W. J. Jenkins, Director of Agriculture, B.P., Poona, for taking keen interest in this work and for giving permission to publish this work in the *Proceedings of the Indian Academy of Sciences*.

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## Appendices

## APPENDIX I

*Acreege under brinjal crop during 1937-38*

	Acres	Percentage for the district
<i>Gujerat—</i>		
1. Ahmedabad .. ..	989	
2. Kaira .. ..	688	
3. Broach and Panchmahals .. ..	768	
4. Surat .. ..	1,145	
TOTAL ..	3,590	21·0
<i>Deccan—</i>		
1. West Khandesh .. ..	500	
2. East Khandesh .. ..	1,051	
3. Nasik .. ..	845	
4. Ahmednagar .. ..	909	
5. Poona .. ..	1,758	
6. Sholapur .. ..	1,224	
7. Satara .. ..	1,499	
TOTAL ..	7,786	45·6
<i>Karnatak—</i>		
1. Belgaum .. ..	1,331	
2. Bijapur .. ..	1,049	
3. Dharwar .. ..	1,775	
TOTAL ..	4,155	24·3
<i>Konkan—</i>		
1. Thana .. ..	662	
2. Bombay Suburban .. ..	85	
3. Kolaba .. ..	220	
4. Ratnagiri .. ..	455	
5. Kanara .. ..	80	
TOTAL ..	1,542	9·1

Grand total for the Province of Bombay : 17,073 acres

APPENDIX II

Brinjals—Statement showing the history of the original samples

Ser. Nos.	Original Nos.	Source, etc.	Fruit length cms.	Diameter cms.	Local name	Nature of fruit
<i>Foreign types</i>						
1	3	Foreign	16.4	15.5	Black Beauty	Purple, conical
2	4	do.	10.1	4.8	Early Dwarf	Purple, oval, bigger than an egg
3	5	do.	17.5	8.5	Early Long Purple	Purple, oval
<i>Deccan types</i>						
4	8	Poona, Nasik and Sinnar	5.2	3.1	Dorli	Small, round
5	8 C	do.	7.4	5.1	do.	do.
6	23	Nasik	6.7	3.5	do.	do.
7	24	do.	20.6	4.5	Bengali lamb hiravi	Long, green
8	25	do.	21.0	4.7	Bengali lamb kali	Long, black
9	26	Poona	8.3	3.7	Gavati	Thorny fruit
10	27	do.	7.8	6.0	Dorli	Small, oval, thorny
11	28	do.	10.0	6.3	Gote vangi	Round, thorny
12	29	do.	11.0	5.8	Mothi binkateri	Big, thornless
13	30	do.	4.8	4.0	Lahan kate vangi	Small, thorny
14	31	Ahmednagar	7.5	3.7	Gavati	Local
15	32	Sholapur	10.0	7.3	Lamb gole gote	Large, round gote
16	33	do.	10.0	7.2	Lambdi lahan	Small, long
17	18	E. Khandesh	8.5	7.5	Gavati	Local
18	19	do.	5.5	3.8	Kali vangi	..
19	20	do.	7.7	4.0	Lahan kateri vangi	Small, early, thorny
20	21	do.	19.0	5.1	Lamb kali	Long, black
21	22	do.	7.7	5.4	Lahan gol	Small, round, striped, thorny
<i>Karnatak types</i>						
22	11	Belgaum	7.4	5.1	Krishna-tir	Round, green
23	34	do.	10.6	8.5	Malvanki	Round, thorny
24	35	Dharwar	10.0	6.0	Lamb kali	Long, black
25	36	do.	12.7	6.9	Lahan gol	Small, round
26	37	Bijapur	11.9	11.8	Gavati	Local
<i>Gujerat types</i>						
27	10	Surat	10.5	5.6	Surti	Round, purple
28	13	Ahmedabad	14.2	5.2	..	Long, black and thick
29	14	Kaira	18.0	5.6	Surti	Round, purple
30	15	Broach	11.4	8.3	..	Big, round with less number of seeds
31	16	Surat	4.4	3.3	Surti Ravaya	Small type
<i>Konkan types</i>						
32	17	Thana	6.6	5.2	..	Thin rind, less seeds and sweet
33	38	do.	17.5	5.9	Pandhri vel vangi	Long
34	39	do.	23.0	8.5	Kali vel vangi	Long, black
35	40	do.	16.9	7.6	Gol kabri	Long, green
36	41	do.	23.1	6.3	Lamb jabhari	Long, purple,
37	42	do.	16.0	4.5	Vel vangi	do.
38	43	do.	15.3	5.4	Kas vangi	Long, green
39	44	Kolaba	14.8	9.0	..	Long variety, less seeds
40	45	do.	7.3	8.2	Mushakdanti	Sweet, round, purple
41	46	Ratnagiri	17.0	6.0	..	Long, purple
42	47	do.	18.8	5.8	..	Long, black
43	48	do.	16.7	6.1	..	Long, mixed colour
44	49	do.	8.8	7.4	..	Long, black
45	50	do.	8.4	7.8	..	Red, round

Added two exotic varieties later

## APPENDIX III

*Information in respect of the plot and the method of cultivation followed  
in growing brinjal selections*

*Season and Year.*—The Gote and the Dorli selections were grown as rabi crop under irrigation throughout the experimental work. The sowing was done in the first week of September and the seedlings were transplanted after 6 weeks.

*Nature of comparison.*—Gote selections Nos. 28-21, 32-7, 32-10 and 34-27 were compared with the Gote local and the Dorli selections Nos. 8-3-24, 8C-2-24, 23-3-24, and 27-32-6 were compared with the Dorli local in Latin Square.

*Previous cropping.*—Jowar was invariably raised for fodder before planting the rabi brinjal crop.

*Nature of plot.*—The plot is on river side and has loose soil all over.

*No. of replications.*—The number of replications in each trial is 5. Each sub-plot measured  $\frac{1}{4}$  guntha\* in the first year and  $\frac{1}{2}$  guntha in all subsequent years.

*Cultivation.*—The seedlings were planted at 3 ft. apart on ridges 3 ft. apart. The plot was regularly irrigated at 8-10 days interval, manured with 15 cartloads of F. Y. M. and regularly weeded. The plants were earthed up and the furrows for irrigation were frequently repaired.

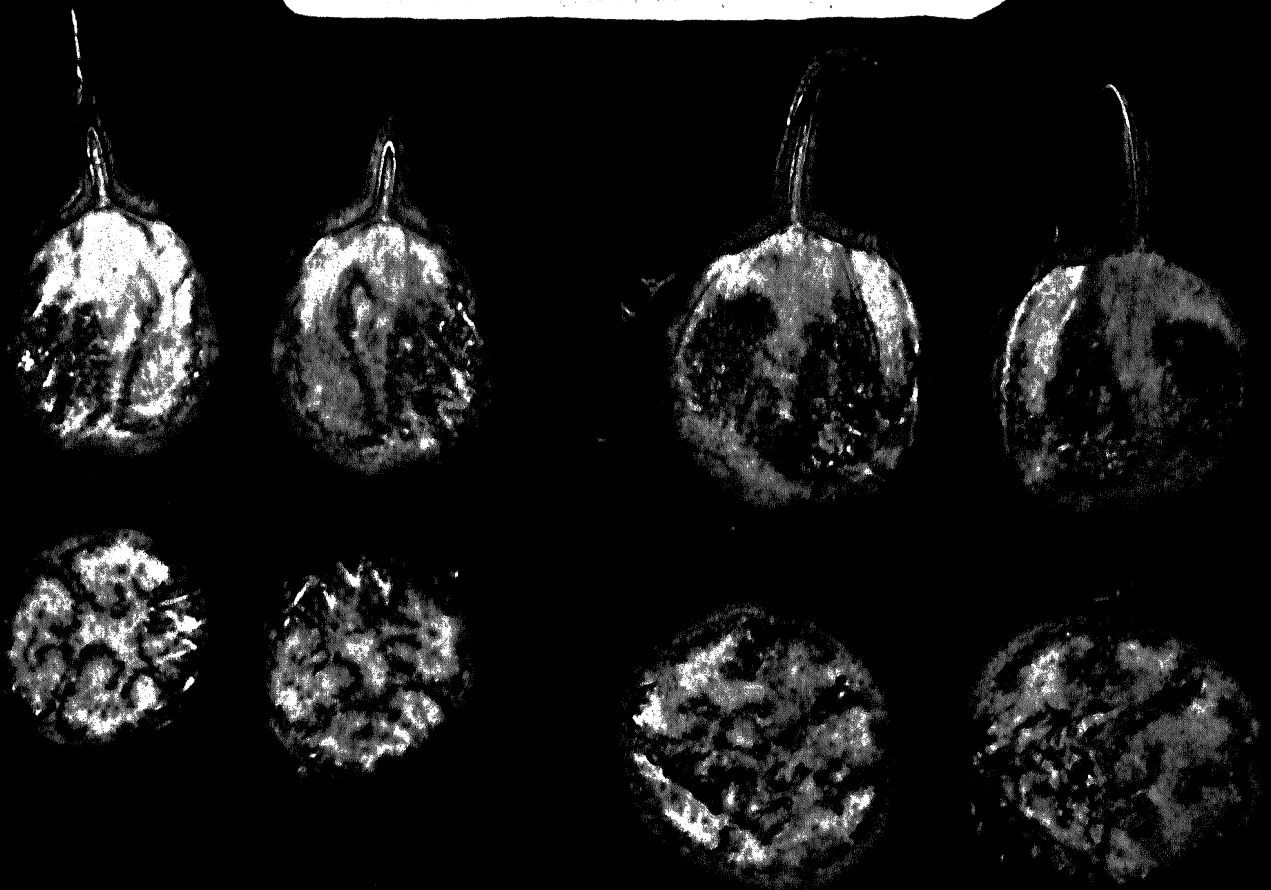
*General.*—All weather changes and condition of crop from season to season was recorded and taken note of.

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\* *Note.*—One guntha is equivalent to  $\frac{1}{40}$  of an acre.



S. No. 28-21 Vs. Local Gote

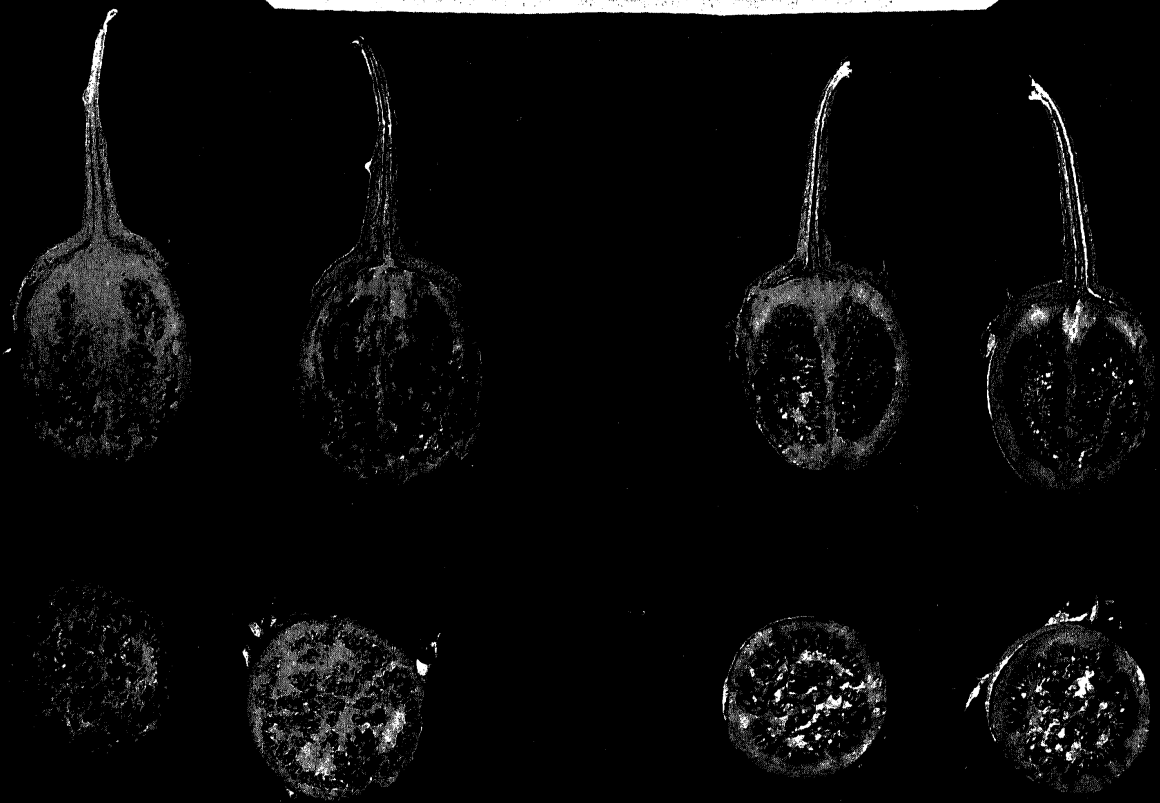


Fruits of No. 28-21 selection are of uniform size and contain less seeds and more pulp  
as compared with Gote local

Left - Selection on 28-21

Right - Local

S. No. 27-32-6 Vs. Local Dorli



Fruits of No. 27-32-6 selection are bigger in size and less seedy as compared with the Local Dorli

Left—Selection No. 27-32-6 Dorli

Right—Local