III. Screening and selection of Brinjal varieties on the basis of their performance againist shoot and fruit borer.

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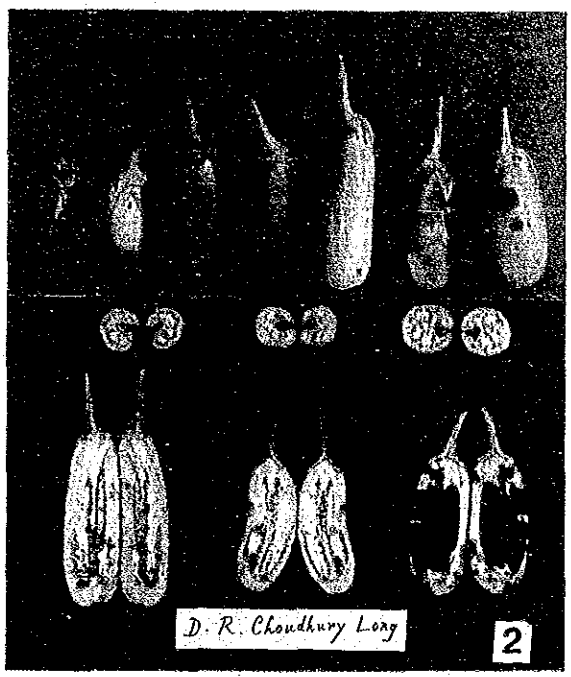
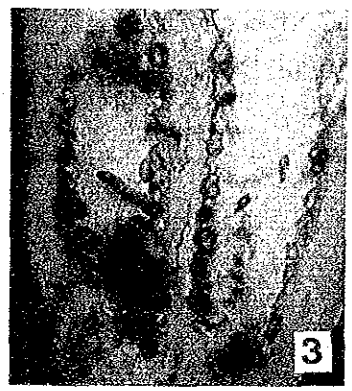
Borer infested shoot with hole

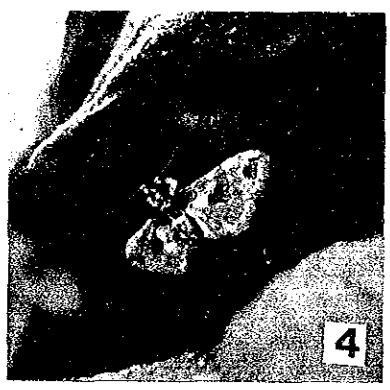
Borer infested fruit with hole



Borer larvae on fruit



Adult on fruit



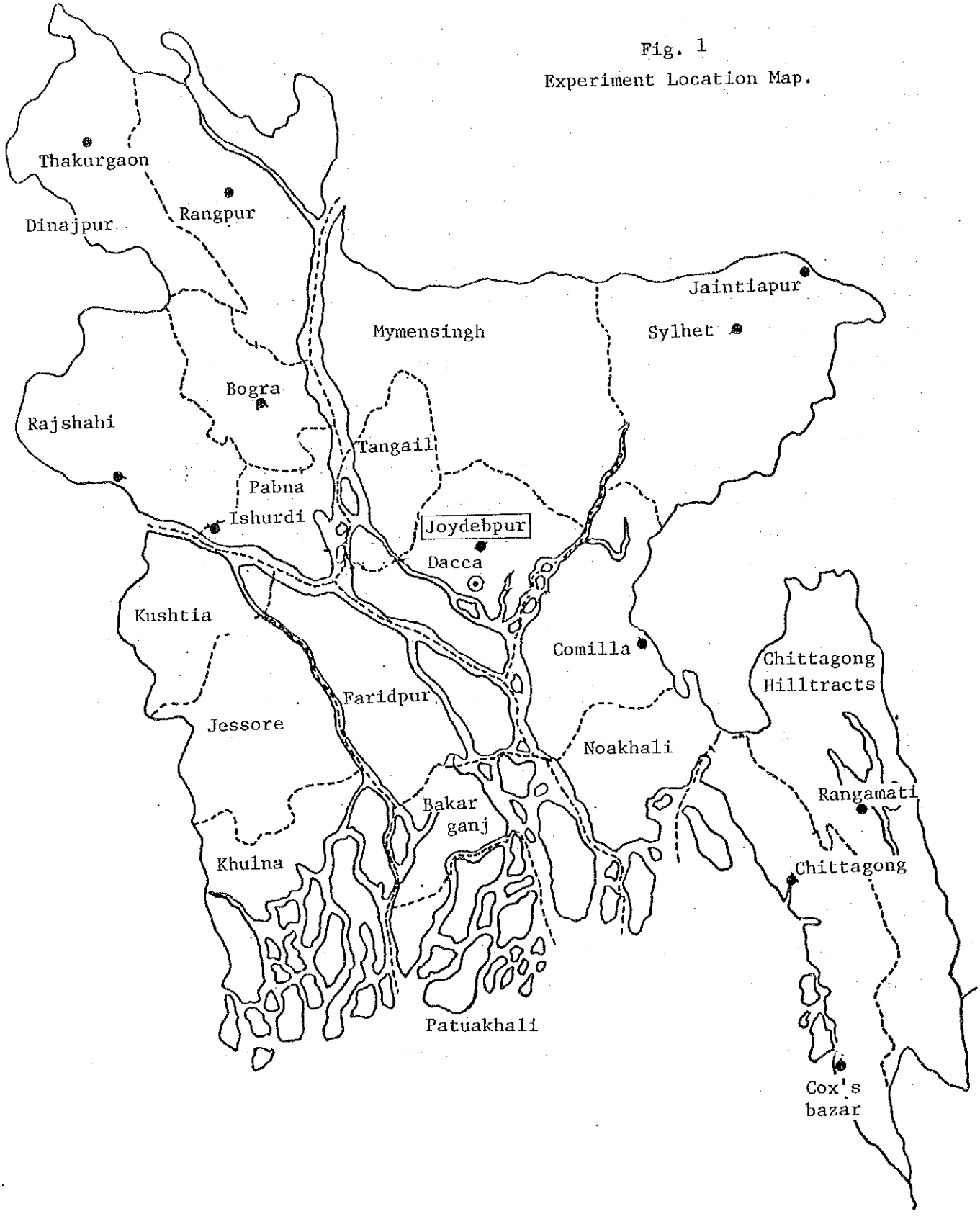
Introduction:

Brinjal shoot and fruit borer (Leucinodes orbonoli Guen.,) is one of the most important insect pests of brinjal/egg plant (Solanum emlongena Linn) in Bangladesh. Brinjal is a very popular vegetable grown in various agro-climatic conditions all the year round in the country. But insect pests, expecially the shoot and fruit borer, are found to have been causing considerable damage to the crop resulting in shortfall in expected yields. Lefroy (1903) and Beeson (1941) stated it as a minor pest of bronjal but according to Flecher (1914) it is a serious pest. M.Z. Alam (1969) also stated that it is serious pest of brinjal. For the purpose of this research, nine brinjal varieties, namely, Singhnath, Malaysia, Bhangar, Nayankazal, Khatkhatia-long, Purple King, Pusa Purple-long, D.R. Choudhury-long and Pusa Kanti were selected and their susceptibility to the attack of this insect was investigated. Eggplant is subjected to this insect's infestation right from a few weeks after transplantation, and infestation persists and continues upto the fruit bearing stage when the fruit also gets damaged. When petioles of the leaves and shoots are bored into by the caterpillar, the plant droops, withers, looks stunted in growth and, in worst case, may finally dry up. The fruits, if attacked by the borer, bear holes plugged with its excreta. This pest has been found to be very common in the brinjal growing areas of the country and a severe cause of yield loss in absence of adequate counter-effective measures. In order to help farmers attain higher brinjal yield, the importance of identifying a number of varieties with relatively higher resistance to the onslaught of this pest can hardly be over-emphasized. The experiment for this piece of research was conducted keeping the above as the underscored objective.

Materials and Methods:

Experiments were conducted at the Bangladesh Agricultural Research Institute (BARI) farm in Joydebpur, about 22 miles from Dacca city (See Figure 1, for location), from May to October in 1981. Nine brinjal varieties originating from Bangladesh, Malaysia and India were randomly chosen for experimentation.

Fig. 1
Experiment Location Map.



Name of variety	Source	Country of Origin
Singhnath	Rajshahi District	Bangladesh
Bhangar	Jessore "	"
Nayankazal	Rajshahi "	"
Khatkhatia-long	Khulna "	"
Purple King	" "	"
D.R. Choudhury-long	Rajshahi "	"
Malaysia	M.A.R.D.I.* "	Malaysia
Pusa Purple-long	A.R.I.	India
Pusa Kanti	"	"

* M.A.R.D.I. Stands for Malaysian Agricultural Research Development Institute

The randomized block design taking three replications in each of the nine selected varieties, mentioned above, was used. Each unit plot was of 6 x 15 squre feet size having five plants transplanted at 3 feet and 6 feet plant-to-plant and row-to row distances respectively. The soil was sandly loam requiring occasional irrigation.

Seeds were sown in greenhouse trays in late May and 10 day old seedlings were transfered from trays to seedbed allowing 5 inch space both ways. At their 3-4 leaf stage, these sedlings were ultimately transplanted in the experimental plots on July 1, 1981. Application of manures and fertilizers was done as per following doses and sequences for all varieties.

	Total dose per acre	Basic dose	1st top dressing	2nd top dressing	3rd top dressing	4th top dressing
Compost	6,000 Kg.	Entire	-	-	-	-
Urea	130 Kg.	50 Kg.	20 Kg.	20 Kg.	20 Kg.	20 Kg.
T.S.P.*	40 Kg.	Entire	-	-	-	-
M.P.**	70 Kg.	40 Kg.	-	-	30 Kg.	-

Irrigation was given as and when necessary. Mulching, weeding and earthing up were done after each top-dressing.

* T.S.P. stands for triple superphosphate.

** M.P. stands for muriate of potash.

Collection of data from samples, starting from the second week of transplantation of seedlings, was done every week until the end of October. For the purpose of sampling, two plants from each plot for each replication were selected. Leaves, stems and fruits, infested by borers, were taken for observation; whereas, in case of control plots the infested shoots and fruits were alllowed to remain as they were. In all, eighteen observations, taken at weekly intervals, were recorded for analyses.

Results and Discussion:

Data obtained from the experiments conducted in the field are summarised in graphical and tabular forms in this section. Figures 2 to 10 are charts presenting weekly obsrvations on borer's infestation on brinjal shoots. These charts clearly indicate that the intensity of borer's attack on brinjal shoots was high during the six-week period from mid-August to end of September. Analysis of data collected from the test plots shows that borers caused severest damage on or around September 1 to all varieties excepting Malaysia which showed highest infestation a week later. Among the nine varieties put under trial, Khatkatia-long was found to be most susceptible to borer infestation (25.19 percent), followed closely by Bhangar (22.22 percent) Singhnath (20.14 percent) and Nayankazal (19.13 percent) in this period. Significantly, borer attack on the exotic varieties like Malaysia, Pusa Purple-long and Pusa Kanti was less severe. Data taken from control plants indicate almost the s same pattern of borer's varietal preferences with variations in the degree of intensity. Table 1 shows that the earliest incidence of borer attack was found in case of Bhangar and Pusa Purple-long varieties (date of incidence 14.7.81, seedling age 14 days). Varieties Purple King and D.R. Choudhury-long reported to be infested as late as on 11.8.81 at plant age of 42 days. All varieties grown on control plots showed symptoms of borer infestation one to four weeks later than test plot plants excepting Pusa Kanti which was attacked at the same time on the test and control plots. But this earlier infestation does not necessarily mean higher susceptibility of a given variety, as is evident from subsequent analyses.

For this purpose of this research, it was considered relevant to investigate into the extent of damage on both shoots and fruits of the egg plant in order to determine the overall varietal resistance to the pest. In test plots, the percentage of damade of shoots of egg plant was found to have varied between,1.46 and 8.65% (table 2 and Figure 11) whareas in case of

control plots, extent of damage varied from 1.25 to 8.65% (Table-3 and figure 11).

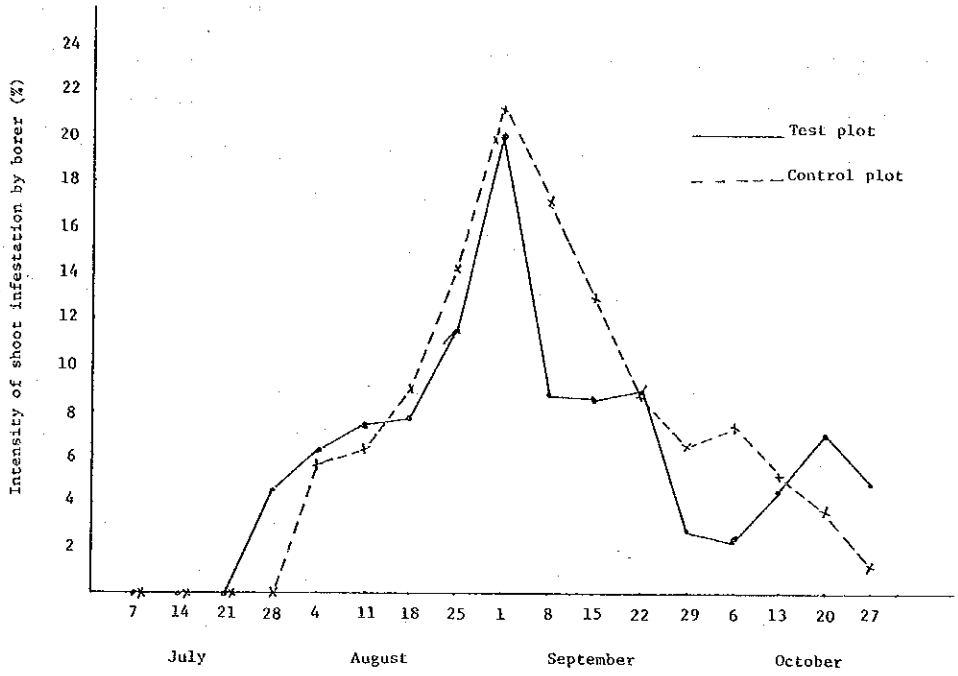


Fig. 2 Infestation curve for Singhnath

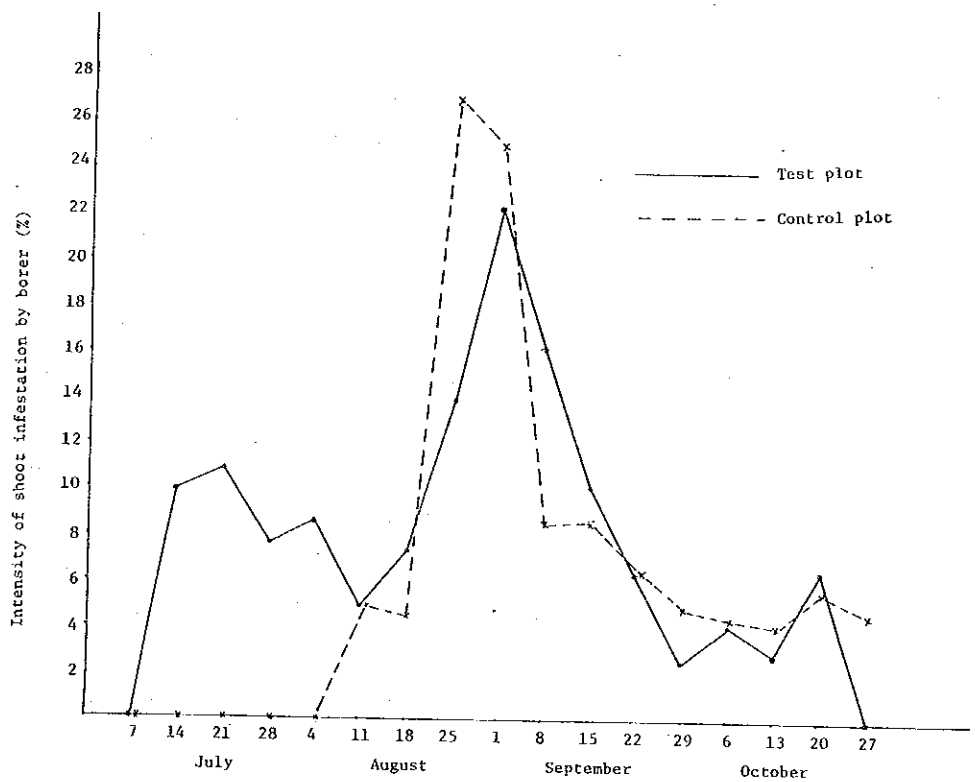


Fig. 3 Infestation curve for Bhangar

On analysis of field data, the variations of borer damage on brinjal fruits were observed to range from 32.96 to 61.64 percent (Table 4 and figure 12) among nine varieties resulting in substantial amount of direct yield loss. Computed percentages of infestation formed the basis for ranking the varieties and assigning them relative resistance scores accordingly. The rank order of varieties was separately established for the three sets of data collected from test plot shoots, control plot shoots and brinjal fruits (Table 2, 3 & 4). The tabulated data also indicate, in spite of varietal variations in percentages of infested shoots, the emergence of four varieties at the top in the same rank order. These varieties are Pusa Purple long, Pusa Kantk, D.R. Choudhury long and Malaysia in order of relative resistance. Table 4 on pest infestation in fruits also indentifies the same four varieties as more resistant, but with a slightly changed order. Table 5 consolidates the borer resitance scores obtained by the varieties and tabulated in the preceding three tables. Then an average resistance score for each of the experimented varieties was computed. On the basis of the average resistance score, the nine varieties were then clustered in seven categories as follows: the variety showing highest resistance to borer attack was Pusa Purple long, ranked first Pusa Kanti was ranked second, D.R. Chowdhury long third, Malaysia fourth and so forth (Table 5). On the basis of data presented in Table 2, 3, 4 & 5, three varieties namely Pusa Purple long, Pusa Kanti and D.R. Chudhury long, having percentage of infestation less than average and higher resistance to borer attack, can be identified as relatively resistant brinjal varieties.

The primary objective of this research work, as described earlier, was to test the borer resistance characteristics of a number of randomly selected eggplant varieties available in Bangladesh. It was not aimed at recommending some brinjal varieites on the basis of their performance in this experiment. It would be neither proper nor logical to come up with firm recommendations as to varieties in view of the scope of this experiment which was conducted in a limited scale on one location in one season only. Despite the scope and limitation of the present study, the experiment, however, successfully assessed varietal performance regarding shoot and fruit borer resistance and established a firm base for further researches which would lead to identification of several varieties suitable for different brinjal growing areas of the country.

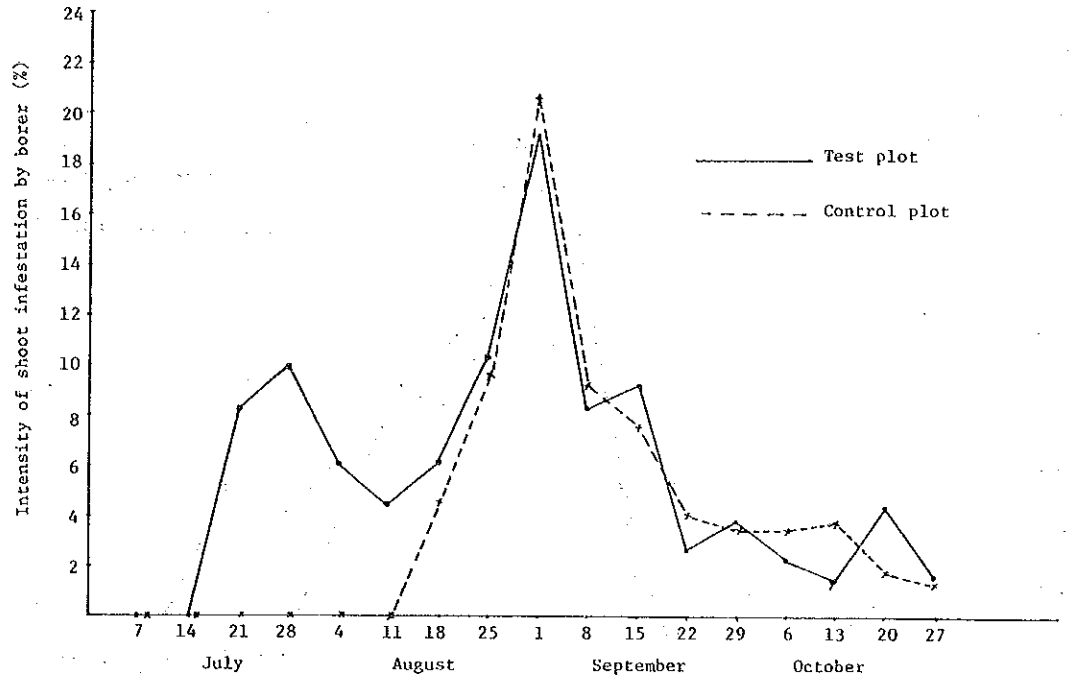


Fig. 4 Infestation curve for Nayankazai

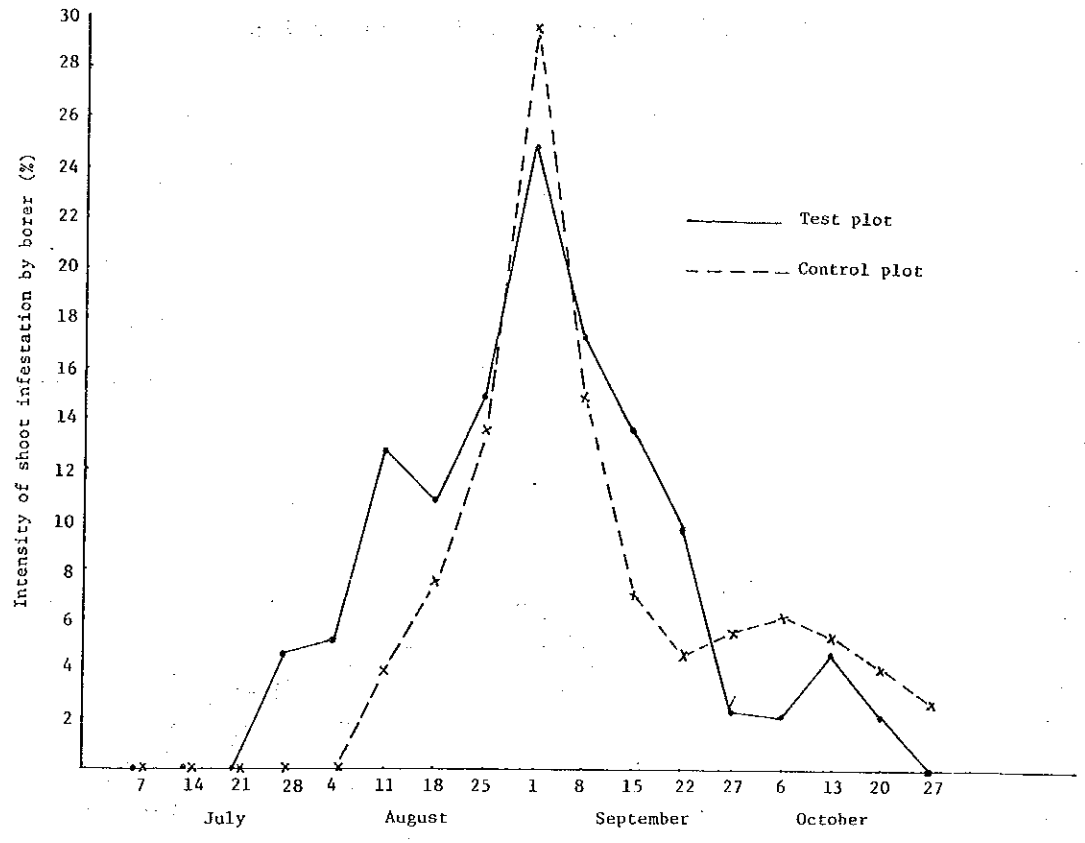


Fig. 5 Infestation curve for K.K. long

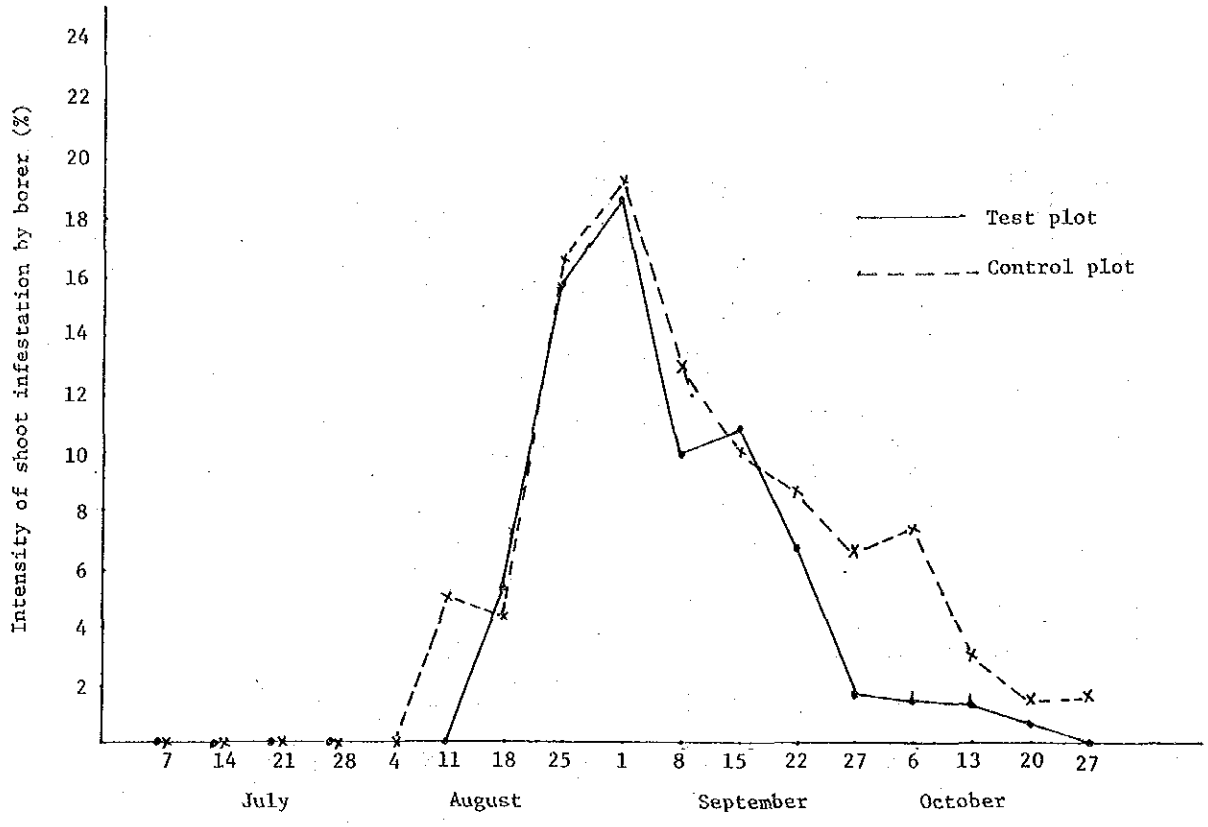


Fig. 6 Infestation curve for Purple King

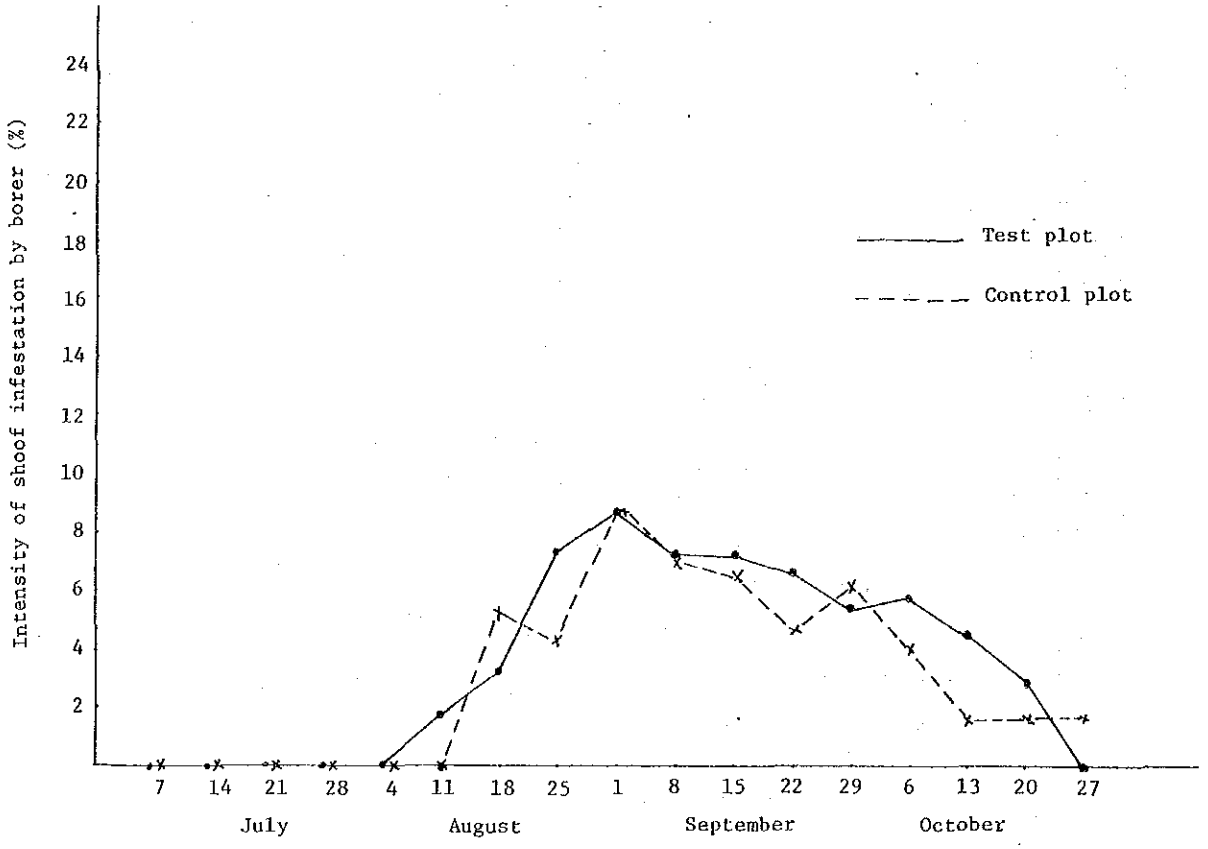


Fig. 7 Infestation curve for D.R. Chou. long

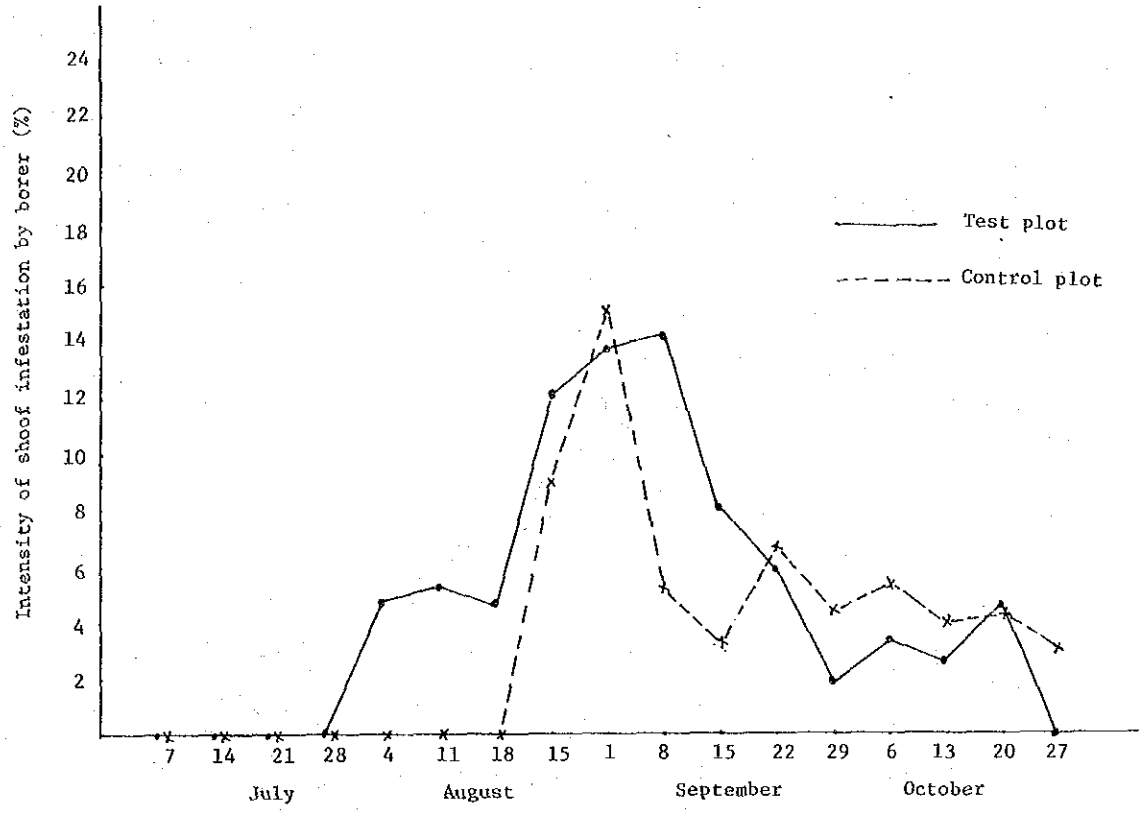


Fig. 8 Infestation curve for Malaysia

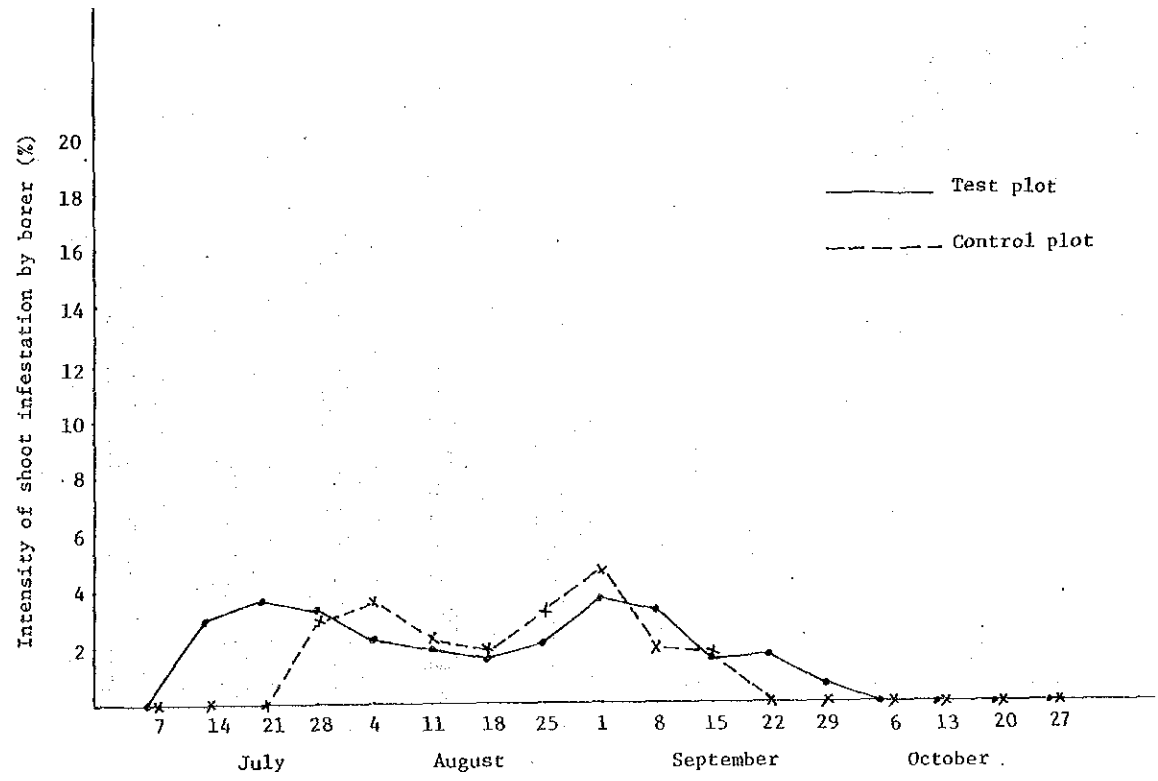


Fig. 9 Infestation curve for P.P. long

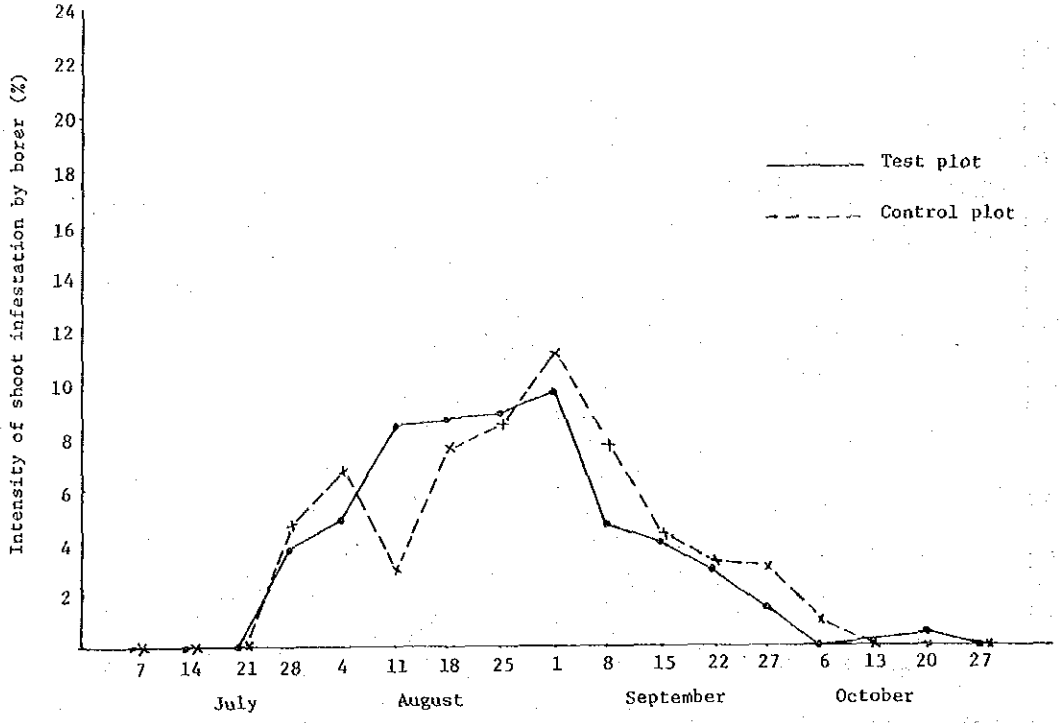


Fig. 10 Infestation curve for Pusa Kanti

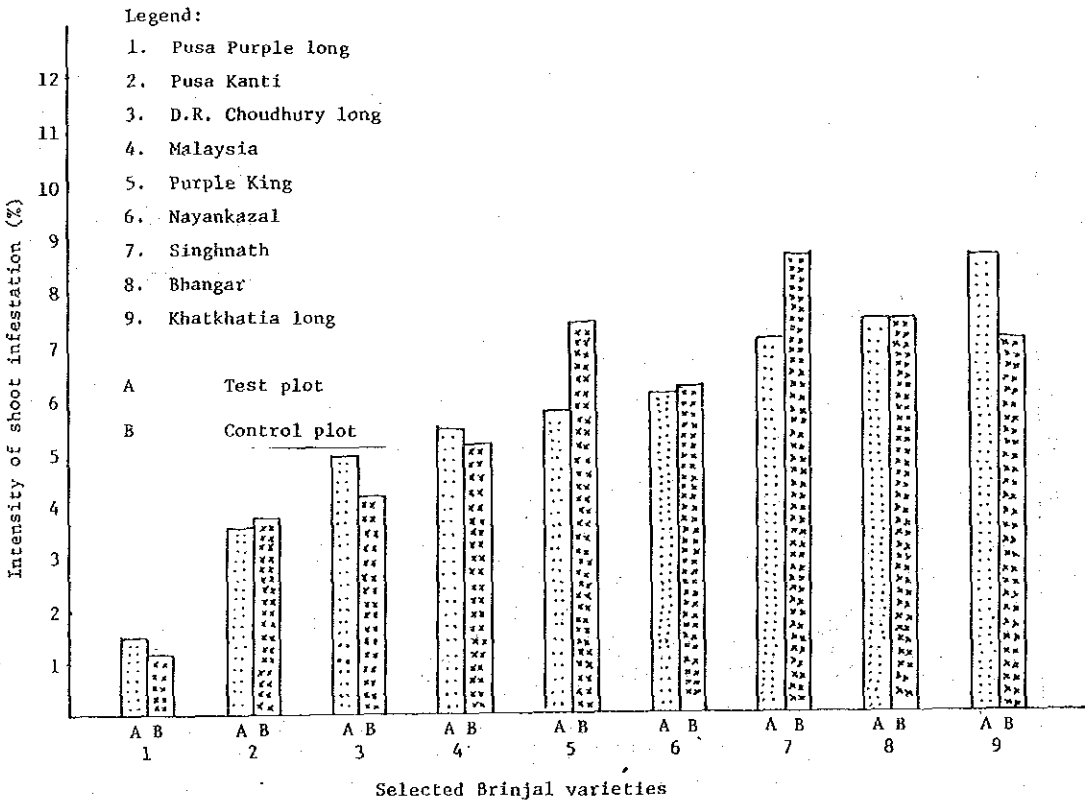


Fig. 11 Extent of Borers attack on brinjal shoots

Follow-up of experiment in Laboratory:

The above experiment was followed up in laboratory and further analysis of data from the end of November until the end of December were made.

Table 1 Borer's First Incidence of Damage on Brinjal Shoots

Name of variety	Reported date of first incidence On test plot	On control plot
Singhnath	28.7.81 (28)	4.8.81 (35)
Bhangar	14.7.81 (14)	11.8.81 (42)
Nayankazal	21.7.81 (21)	18.8.81 (49)
Khatkhatia-long	28.7.81 (28)	11.8.81 (42)
Purple King	11.8.81 (42)	18.8.81 (49)
D.R. Choudhury-long	11.8.81 (42)	18.8.81 (49)
Malaysia	4.8.81 (35)	25.8.81 (46)
Pusa Purple-long	14.7.81 (14)	28.7.81 (28)
Pusa Kanti	28.7.81 (28)	28.7.81 (28)

Note: Figures in parentheses give the age of seedling in days

Table 2 Extent of Borer's Attack on Brinjal Shoots (in test plots)

Name of variety	Healthy shoot	Damaged shoot	Total shoot	Percentage of infestation	Rank order
Pusa Purple long	2766	41	2807	1.46	1
Pusa Kanti	3113	116	3229	3.59	2
D.R. Choudhury-long	1469	76	1545	4.91	3
Malaysia	1522	87	1609	5.40	4
Purple King	1557	70	1227	5.70	5
Nayankazal	1329	86	1415	6.07	6
Singhnath	1823	139	1962	7.08	7
Bhangar	1459	117	1576	7.42	8
Khatkhatia-long	1572	149	1721	8.65	9
Total:	16210	881	17091	5.15	

Table 3 Extent of Borer's Attack on Brinjal Shoots (in control plots)

Name of variety	Healthy shoot	Damaged shoot	Total shoot	Percentage of infestation	Rank order
Puse Purple long	1106	14	1120	1.25	1
Pusa Kanti	920	35	955	3.66	2
D.R. Choudhury long	483	21	504	4.16	3
Malaysia	628	34	662	5.13	4
Nayankazal	565	37	602	6.14	5
Khatkhatia long	551	42	593	7.08	6
Purple King	582	47	629	7.47	7
Bhanger	543	44	587	7.49	8
Singhnath	718	68	786	8.65	9
Total:	6096	342	6438	5.31	

Table 4 Extent of Borer's Attack on Brinjal Fruits

Name of variety	Healthy fruits	Damaged fruits	Total fruits	Percentage of infestation	Rank order
Pusa Purple	120	59	179	32.96	1
Pusa Kanti	137	92	229	40.17	2
Malaysia	69	43	122	43.44	3
D.R. Choudhury long	175	59	134	44.02	4
Purple King	110	95	205	46.34	5
Nayankazal	61	62	123	50.40	6
Singhnath	96	120	216	55.55	7
Khatkhatia long	62	80	142	56.33	8
Bhangar	28	45	73	61.64	9
Total:	758	665	1432	46.73	

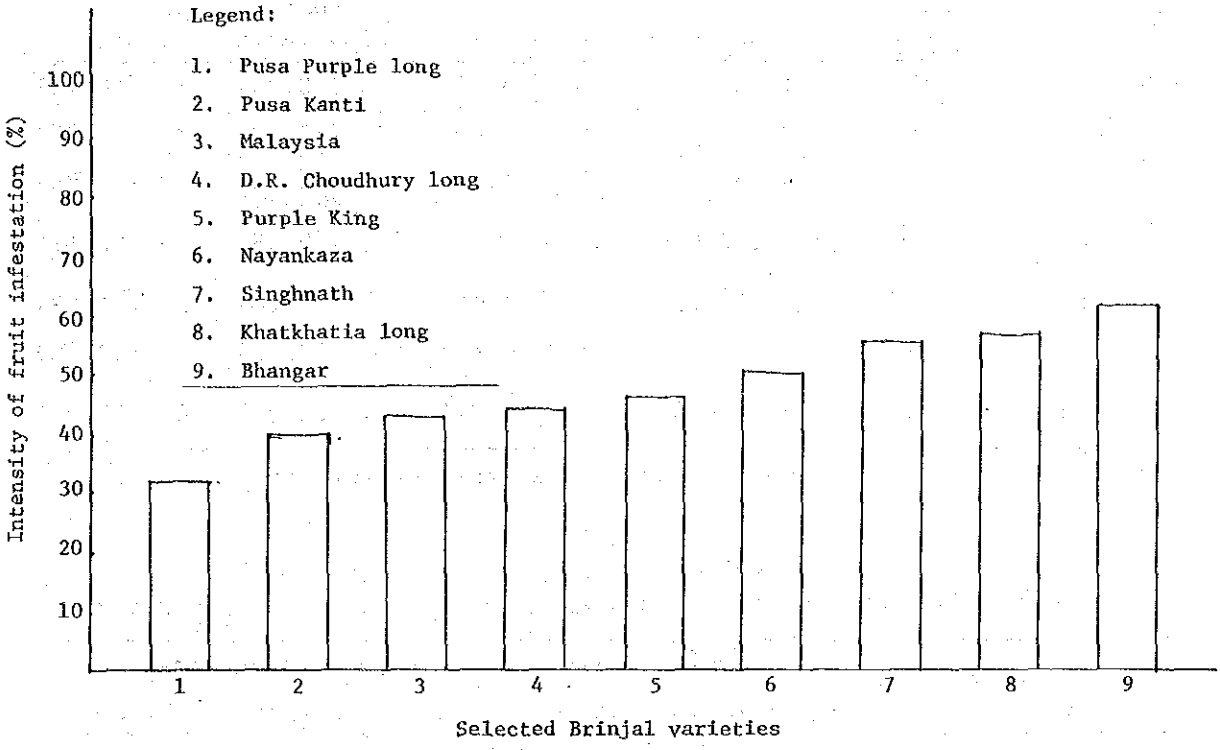


Fig. 12 Extent of Borer's Damage or Brinjal Fruits

Table 5 Rank Order of Brinjal Varieties on their Relative Resistance to Shoot and Fruit Borer

Name of variety	Resistance score on rank order			Average Resistance score	Rank order based on average resistance score
	Test plot shoot	Control plot shoot	Fruit		
Pusa Purple-long	1	1	1	1	1
Pusa Kanti	2	2	2	2	2
D.R. Choudhury-long	3	3	4	3.33	3
Malaysia	4	4	3	3.67	4
Purple King	5	7	5	5.67	4
Nayankazal	6	5	6	5.67	5
Singhnath	7	9	7	7.67	6
Bhangar	8	8	9	8.33	7
Khatkhatia-long	9	6	8	7.67	6

Table 6 Effect of Insecticide Treatment on Fruit Infestation

Treatment	Total fruit	Fruit without larve		Fruit with larva	Damaged fruit
		without hole	with hole		
EPN	97	81 (83.50)	8 (8.24)	8 (8.24)	16 (16.43)
Dipterex	90	52 (57.77)	17 (18.88)	21 (23.33)	38 (42.22)
Carphos	143	124 (86.71)	17 (11.88)	2 (1.33)	19 (13.28)
Total (Mean)	330	257 (77.87)	42 (12.72)	31 (9.39)	73 (22.12)
Control I	39	19 (48.71)	9 (23.07)	11 (28.20)	20 (51.28)
Control II	45	19 (40.00)	21 (46.66)	6 (13.33)	27 (60.00)
Total (Mean)	84	37 (44.04)	30 (35.71)	17 (20.23)	47 (55.95)

Note: Figures in parentheses are percentages

Table 7 Comparative Damage on Brinjal Shoots and Fruits by Borer

Variety	Fruit damage		Shoot damage	
	Total larvae	Alive larvae	Total larvae	Alive larvae
Khatkhatia long	4	3 (75.00)	11	4 (36.36)
Singhnath	8	7 (87.50)	15	8 (53.33)
D.R. Choudhury-long	10	10(100.00)	6	6(100.00)
Bhangar	5	5(100.00)	3	2 (66.67)
Malaysia	9	8 (88.89)	7	5 (71.42)
Total (Mean)	36	33 (91.66)	42	25 (59.52)

Note: Figures in parentheses are percentages

Three insecticides, namely (a) EPN 1000 times solution, (b) Dipterex 1000 times solution, and (c) Carphos 500 times solution were selected for chemical control of borer. Each insecticide was sprayed on 15 brinjal plants. Spraying for the first time was done on 23 November, 1981 and was continued three more times at seven days intervals. Fruits were plucked from plants for laboratory tests on expiry of 7 days after the final spray done on the 23rd December. In the laboratory fruits were examined to observe the presence of holes and larvae inside. On examination of holes and larvae, it was found that furits of plants sprayed with EPN were 16.4 percent, Dipterex 42.2 percent and carphos 13.3 percent infested (Table 6). The average infestation was 22.1 percent on treated plants and 55.9 percent on control plants.

Among the three insecticides, carphos was found most effective against this pest.

For the follow-up experiment five brinjal varieties, namely Khatkhatia long, Singnath, D.R. Choudhury long, Bhangar and Malaysia were considered. Data were collected on number of holes and larvae found in brinjal shoots and fruits which were brought in the laboratory. It was observed that borers had a general preference for fruits rather than shoots as fruits can provide them with a better food and shelter protecting them from environmental hazards. The percentage of larvae alive inside fruits was 91.7, whereas inside shoots it was only 59.5 percent (Table 7).

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My grateful thanks are due to:

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2. Dr. A.K.M. Amzad Hossain, Principal Scientific Officer, CVSRC
3. Mr. S. Aihara, Team Leader, CVSRC
4. Mr. E. Kawase, Vegetable Entomologist, CVSRC
5. Mr. T. Nakagawa, Co-ordinator, CVSRC
6. Mr. S. Tasaki, Vegetable Expert, CVSRC

Above personnel are working with the researcher in the Bangladesh Agricultural Research Institute, Dacca.

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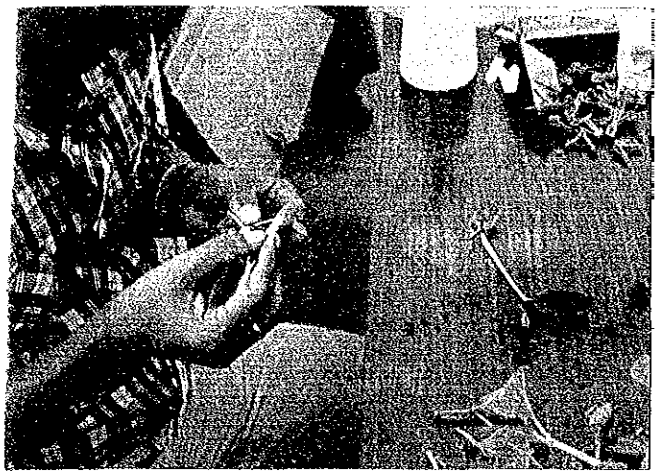
IV. A Summary on the Watermelon Experiments

(November 10th 1982 to February 5th 1983)

Submitted by Mr. Isamu IGARASHI

Contents



The clipping method of grafting; cutting the scion aslant.

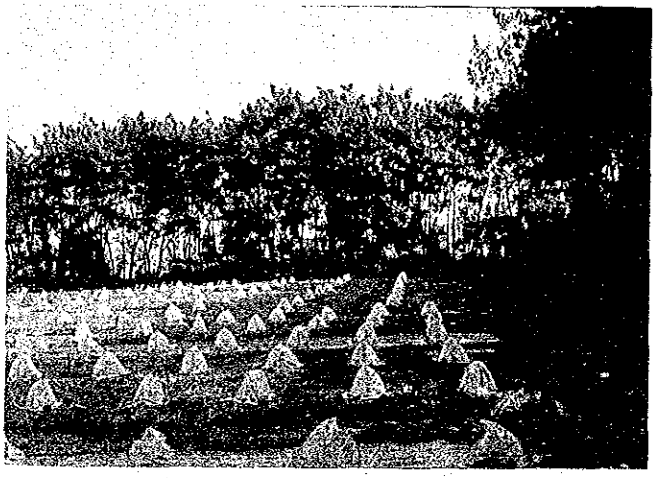
Growth of self rooted watermelon "Sugar Baby" is poorer than that of watermelon grafted on the pumpkin "Local -1" (right side).

Growth of watermelon grafted on pumpkin "Sirokikuza" (left) is better than that of grafted on pumpkin Bangla "Local-1" (right).

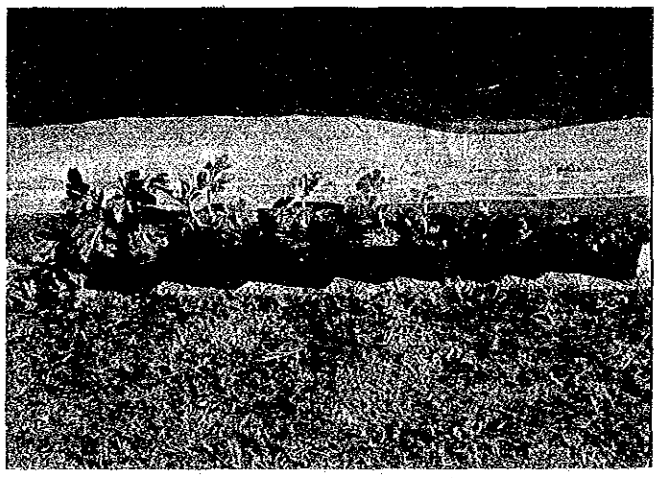
Cephalandra indica, a wild indigenous cucurbit (left) showed moderate graft affinity to watermelon compered with bottle gourd (right)

Growth of pumpkin varieties used for stock; "Tetsukabuto" in front, is better than Bangla locals behind.

Furrow irrigation at watermelon field.



Watermelon seedlings planted in the field after treatments of age of seedling and night temperature, are covered with hot caps.



Seedling response of watermelon, during seedling, with different age of seedling and night temperature treatments.
From left to right: Lh, Lm, Ll, Mh, Mm, Ml, Sh, Sm and Sl respectively.
Duration of raising seedling; L:48 days,M:33 days,S:18 days and night temperature; h:17°C, m:9°C, l:7-8°C

1. Introduction

I was assigned by JICA as a short term vegetable breeder to work in cucurbit crops during the period from November 10th 1982 to February 5th 1983 in the Citrus and Vegetable Seed Research Centre under Bangladesh Agricultural Research Institute.

During my stay here for three months, I had mainly conducted the following three problems (1) to select more suitable watermelon stocks in Bangladesh, (2) to improve cultivation method of watermelon for seed production, (3) to investigate an adaptability and morphological characters of newly introduced white gourd variety "Fusiuri" to popularize it. More over I planned some experiments and worked with our local resercher Mr. A. Rashid (S.O. Vegetable) in order to make progress in his future research field.

I would like to express my sincere gratitude to Japanese team leader Dr. H. Sakai, Vegetable expert Mr. S. Tasaki and co-ordinator Mr. T. Nakagawa for helping me to execute my work and to Dr. A. K. Amzat Hossain (P. S. O.), and people of C.V.S.R.C. for their helpful co-operation. Lastly I express my gratitude to Mr. A. Rashid (S. O. Vegetable) and other staff of C.V.S.R.C. for their help during my stay in Bangladesh.

2. Studies on suitable rootstocks for watermelon

(1) Objective:

Grafting in vegetable production is not yet practical in Bangladesh. During the growing seasons of watermelon, self rooted plants are often injured with many fungi, nematodes and insects, at the result the yield and quality fall down severely. It is possible to overcome such maladies by using the root stocks which is resistant to these pathogens. The *Cucurbita* spp., *Lagenaria* spp., and *Benincasa* spp. were used for rootstocks on watermelon in advanced countries not only because they have high resistance to Fusarium wilt but also they have stronger root system, and grafted plant can grow even under infavorable environmental condition for the root of watermelon. But such experiments concerning about the avoiding of disease by grafting and resistant varieties on watermelon have not been done except by Japanese short term experts, Mr. Iwanaga and Mr. Umekawa in Bangladesh. Mr. Umekawa made the screenning test of Fusarium wilt on 14 watermelon varieties. Mr. Iwanage examined grafting affinity of 6 cultivars of 2 cucurbits species as rootstocks for watermelon, but the test was ceased in very young seedling stage. Therefore in this experiment 26 cultivars of 8 cucurbit

species were used as rootstocks and in the field these would be screened to determine the more suitable rootstocks for watermelon scion variety "Sugar Baby" which is one of the most promising varieties in future in this country.

(2) Materials and Method:

Materials: The watermelon variety used for scion was "Sugar Baby". Stock species and varieites used were shown in Table 1.

Table 1 Kinds of rootstocks for watermelon

Species/varieties	Remarks
Cucurbita moschata (pumpkin)	
1. Okinawa Local	Japanese subtropical local variety supposed to be strong on WMV, Powdery mildew, Phytophythora and the fruit of it has an ability of long term storage.
2. Huga No. 14	Winter season culture variety in Japan.
3. Shirokikuza	Rootstock variety for watermelon and muskmelon in Japan.
4. Local - 1	Bangladesh local strain.
5. do - 2	do
6. Bee Bee	Bangladesh local variety
7. Mammoth King	do
Cucurbita F_1 (*C. maxima* x *moschata*)	
8. Tetsukabuto	Popular rootstock variety for watermelon, muskmelon and cucumber in Japan.
Lagenaria leucantha (bottle gourd)	
9. Sennari hyotan	Variety for ornamental use
10. Muteki	Rootstock F_1 variety for watermelon, resistant to Fusarium wilt
11. FR Aioi	do
12. FR - 7	do
13. Local - 1	Bangladesh local strain.
14. do - 2	do
15. do - 3	do

Table - 1 (continued)

Species/varieties	Remarks
16. Long	Bangladesh local variety
17. Round - 20	do
18. Summer King	do
19. Singapur Giant Long	do
Benincasa hispida (white gourd)	
20. Fushiuri	Chinese edible variety
21. Daimaru	Japanese edible variety
22. Local	Bangladesh local strain
Luffa cylindrica (luffa)	
23. Futo Hechima	Variety for fiver use in Japan
Citrullus lanatus (watermelon)	
24. African Wild	Introduced variety from Africa, extremely vigorous, used for food of domestic animals
Sicyos angulatus a	
25. Arechiuri	One of the Japanese naturalizated weed, used for cucumber stock, strong to Fusarium wilt, nematoda and have low temperature elongation
Cephalandra indica	
26. (C. indica)	Wild indigenous cucurbit in Bangladesh
Control - 1	
27. (Self root)	Watermelon variety "Sugar Baby"
Control - 2 *Cucurbita maxima* (winter squash)	
28. Delicious	
29. Kurokawaguri	Old variety in Japan
	do

a Japanese family name

This experiment was laid out in randamized complete block design with 2 replicates. Initially 10 plants were grafted in each replication, and 6 plants from each replication were planted in the field finally. On a few varieties, due to poor germination less number of plants were planted.

Watermelon was sown on November 11th 1982, luffa, white gourds, "Arechiuri" on November 13th, pumpkins on November 17th.

Watermelons were grafted on the stock varieites on November 30th by clipping method, except some late germinated stock varieties shown at the footnotes of Table 2 were grafted on December 5th. Scion root of grafted plants were cut down on December 7th and December 12th respectively.

Night temperature was kept higher than 15 °C by electrical heaters after grafting, and allowed to natural temperature (9 ∿ 11 °C) from 7 days before planting. But the maximum temperature of day time were higher than 25 °C.

The grafted plants were planted in an open field on December 27th and on January 4th 1983, respectively. Stock plants were planted in the field on December 23rd.

Planting space and distance were all 3m x 1m.

Grafted plants were plunned out time to time until fruit setting stage except the main vine and other 2 lateral vines. In the case of stock plants only main vine was allowed to extend. Lateral vines of lower nodes were removed from the bottom, other nodes were prunned remaining one leaf.

Total fertilizer applied as component, N; P_2O_5; K_2O were 21; 22; 17 Kg/10a respectively and as basal fertilizer, N; P_2O_5; K_2O were given in the ratio 13; 22; 17 Kg/10a. Others were given by top dressing near the plants in the row two times. Other field husbandry was done by usual way in this country.

Investigations were done on the percentage of graft success plants, heights of grafted and stock plants at the time of planting on 27th December and 14, 22, 36 days after planting and the leaf area of grafted plants on 27th January, further more other items that made their characteristics obscure were also recorded.

(3) Result

The germination of scion and some stock varieties were not so good and final number of seedlings was decreased in some stock varieties.

Table 2 Graft success and growth during raising seedling of grafted and stock plants

Species/Varieties	grafted plant					stock plant		
	percentage of graft success[a,c]		percentage of dwalf plants[c]	plant height[c]		thichness of stem[d]	lenght of cotyledon[d]	leaf stage[d]
	preadjust values	adjusted values[b]		pre-adjust values	adjuested values			
Cucurbita moshcata (pumpkin)	%	%	%	cm	cm	cm	cm	
1. Okinawa Local	100	100	0	7.3	7.3	0.36	6.25	2 ∿ 2.5
2. Huga No. 14	85	95	6	-[e]	-[e]	0.36	5.12	2.5
3. Shirokikuza	65[f]	76[f]	27	7.5	9.3	0.42	5.44	4
4. Local - 1	100	100	44	5.4	7.3	0.49	5.91	3.5 ∿ 4
5. do 2	85	100	38	7.3	9.4	0.55	6.51	3
6. Bee Bee	75	94	70	4.1	5.8	0.49	7.33	3
7. Mammoth King	63	91	80	3.8	5.0	0.48	8.71	2.5 ∿ 3
Cucurbita F_1 (*C. maxima* x *moschata*)								
8. Tetsukabuto	90	90	37	4.8	5.3	0.53	6.87	4 ∿ 4.5
Lagenaria leucantha (bottle gourd)								
9. Sennari hyotan	80	84	8	5.1	5.3	0.26	3.52	
10. Muteki	100	100	20	4.1	4.6	0.37	4.93	2.5
11. FR Aioi	85	100	0	5.8	5.8	0.34	5.21	2
12. FR - 7	70	93	0	6.3	6.3	0.35	5.75	2
13. Local - 1	92	92	0	4.7	4.7	0.41	6.52	2 ∿ 3
14. do 2	100	100	0	6.5	6.5	0.35	5.70	2 ∿ 3
15. do 3	80	80	0	5.3	5.3	0.35	5.77	3 ∿ 4
16. Long	90	95	0	8.6	8.6	0.40	5.40	2 ∿ 3
17. Round - 20	100	100	0	8.5	8.5	0.40	6.22	3 ∿ 4
18. Summer King	94	100	7	-[e]	-[e]	0.34	6.61	2
19. Singapur Giant Long	100	100	0	-[e]	-[e]	-	-	-
Benincasa hispida (white gourd)								
20. Fushiuri	53	88	0	7.3	7.3	0.26	3.57	1 ∿ 2
21. Daimaru	75	89	0	-[e]	-[e]	0.29	3.96	1
22. Local	53	100	0	-[e]	-[e]	0.23	2.35	1 ∿ 2
Luffa cylindrica (luffa)								
23. Futo Hechima	77	100	0	6.2	6.2	0.23	3.64	1 ∿ 2
Citrullus lanatus								
24. African Wild	90	95	0	8.5	8.5	0.24	3.66	1 ∿ 2
Sicyos angulatus								
25. Arechiuri	77	100	44	5.6	7.0	0.20	3.00	4 ∿ 5
Cephalandra indica								
26. (C. indica)	55	85	0	6.1	6.1	0.19	-	4 ∿ 7
Control - 1								
27. (self root)	-	-	0	-	-	0.25	-	2 ∿ 3.5

a. observed on 13 Dec., b. exempted the mistreated grafted plants c. measured on 26 Dec.,
d. measured on 14 Dec., e. no investigation because their germinations were too late, so they were grafted 5 days later and planted 8 days later than other grafted plants
f. seedling were moved 5 days after grafting

Table 3 Low temperature, draight damage and plant growth of grafted and stock plants after planting

Species/Varieties	grafted plant		vine lenght after planting					degree of[c] wilt stock plants because of draught and hotness
			grafted plant			stock plant		
	percentage[a] of wilted plants because of cold	leaf[b] area	after planting days			after planting days		
			14	22	36	22	36	
Cucurbita moschata (pumpkin)	%	cm	cm	cm	cm	cm	cm	
1. Okinawa Local	0	77.0	24	68	258	39	92	0.0
2. Huga No. 14	0	69.8	13	35	180	32	103	2.0
3. Shirokikuza	0	79.4	26	83	235	78	165	1.8
4. Local - 1	0	34.0	21	49	120	41	122	0.6
5. do 2	0	38.9	24	67	154	55	193	0.6
6. Bee Bee	0	47.1	18	45	153	75	223	0.0
7. Mammoth King	0	51.9	15	46	159	77	205	0.8
Cucurbita F_1 (*C. maxima* x *moschata*)								
8. Tetsukabuto	0	96.6	19	76	284	99	261	1.1
Legenaria leucantha (bottle gourd)								
9. Sennari hyotan	0	61.9	14	38	170	11	33	0.0
10. Muteki	0	68.7	18	50	196	30	82	0.0
11. FR Aioi	0	65.2	22	71	237	38	131	0.0
12. FR - 7	0	63.4	21	62	230	44	127	0.0
13 Local - 1	0	75.3	19	71	232	31	124	0.0
14. do 2	0	63.6	21	55	201	22	114	0.0
15. do 3	0	68.4	15	43	187	15	108	0.0
16. Long	0	65.0	26	77	241	22	98	0.4
17. Round - 20	0	63.6	24	63	214	32	158	0.5
18. Summer King	0	53.2	12	28	133	32	166	0.6
19. Singapur Giant Long	0	57.9	10	24	148	10	31	0.0
Benincasa hispida (white gourd)								
20. Fushiuri	0	51.6	17	37	120	6	25	0.0
21. Daimaru	0	49.0	12	12	55	8	29	0.0
22. Local	0	37.2	9	14	55	4	20	0.0
Luffa cylindrica (luffa)								
23. Futo Hechima	10	13.2	9	14	25	25	44	0.0
Citrullus lanatus								
24. African Wild	100	36.7	21	34	118	7	16	0.0
Sicyos angulatus								
25. Arechiuri	0	86.8	16	55	195	101	107	0.0
Cephalandra indica								
26. (C. indica)	29	28.1	13	22	67	21	35	0.0
Control - 1								
27. (self root)	25	50.9	12	28	140	28	140	0.0

a. measured from 26th Dec. to 28th Dec. in this time minimum temperature fell down till 8 °C

b. measured the are of 9th true leaf on 27th Jan.,

c. investigated on 4th Feb., and evaluation were as follows that 0; no wilting, 3; severe wilting because of draught and hot temperature.

At the grafting time, the age of scion and stocks varied from one true leaf stage to cotyledon openning stage. Particularly the germination of pumpkin "Bee Bee, Mammoth King", bottle gourd "FR 7, Summer King, Singapur Giant Long", white gourd "Daimaru, Local" and "Arechiuri" delayed.

Results were shown in Table 2, 3. Varietal differences were obvious in the "percentage of graft success (preadjust values)", but the reason of failure of grafting were almost because of clip size, which was too wide compared with the stem of the grafted plants. In those cases, the joints were disconnected easily. When stem thickness of stock plants were thin because of varietal character or delay of germination, "percentage of graft success (preadjust values)" decreased. Such was the case of pumkin "Bee Bee, Mammoth King" white gourd "Fusiuri, Daimaru, Local" luffa "Futohechima", "Arechiuri", *Cephalandra indica*. But when such mistreated plants were exempted from the calculation, " percentage of true grafted (adjusted values)" became very high as shown in the table 2, and varietal differences were not observed except "Sirokikuza" which was moved 5 days after grafting and disconnected in some materials.

The plant height of grafted plant during raising seedling differed a little among the varieties. Almost watermelon grafted on pumpkins, some of bottle gourds and "Arechiuri" were dwarf but vigorous. When dwarf plants were exempted from calculation, the plants lenght of watermelon grafted on pumpkin "Shirokikuza, Local 2" came first and next came bottle gourd "Long, Round 20". But varietal differences were not so high while raising seedling, and on our observation, plants grafted on pumpkin were all vigorous compared with others. Pumpkin "Local 2, Bee Bee, Mammoth King, Tetsukabuto" stock plants themselves had very big cotyledon (Table 2).

Few days after planting in the field, minimum temperature extremely fell down till 7 °C in the morning. Self root plant of "African Wild", *Sepharandra indica*, luffa "Futohechima" wilted, so they seemed to be weak to cold temperature.

Vine length of grafted plants after planting differed very much compared with that of during raising seedling. Vine extention of watermelon grafted on luffa "Futohechima" was almost stopped and the leaf curled. On the contrary shoot extension of watermelon grafted on Japanese introduced pumpkins "Okinawa Local Shirokikuza, Tetsukabuto" bottle gourd "FR Aioi, FR 7, Local 1, Long, Round 20" were good.

Leaf area of the watermelon grafted on various kind of stocks had also same varietal tendency as the result of vine length. Vine length of stock plants have also same varietal tendency as that of grafted plants except the pumpkin local varieties.

(4) Discussion

Growth of watermelons grafted on all stocks tested was good, so it seemed that varietal differences of graft adaptability couldn't became obvious so many in raising seedling. Grafting was conducted by clipping method because it was very easy without cautious environmental control, and it seemed to suit in this country where people never tried grafting in watermelon cropping.

There were some relations between the kinds of rootstocks and the percentage of graft success. When the stem thickness is more than 0.3 cm, percentage of graft success became high. The reason of it is because when the stem thickness is less than 0.3 cm, the grafted part is too thin compared with the size of grafting clip to stand. So when thin stem stock kind is used as a grafting material, it needs waiting till to 1∿2 true leaf stage.

In a field the growth of watermelons grafted on many cucurbit rootstocks differed from each other very much. The watermelon grafted on luffa "Futohe-chima" became dwarf and in curled leaves severely. This may be the case of graft incompatibility to watermelon.

Others did not show dwarf and curled leaves so severly. But the growth of watermelons grafted on pumpkin Bangladesh local varieties, strains, *S. indica*, watermelon rootstock "African Wild" and self root were poor, so these grafted plants seemed to lack of graft adaptability in this season.

On the contrary to them, the growth of watermelons grafted on the Japanese pumpkins, "Okinawa Local, Huga No. 14, Shirokikuza, Tetsukabuto", and bottle gourds "FR Aioi, FR 7, Local 1, Long, Round 20", and "Arechiuri" were good, so they seemed to have high graft adaptability in this season.

The growth behaviour of grafted plants resembled to stock plants in some parts. White gourd, watermelon "African Wild" and *C. indica* growed poor both as a stock and self root. We can predict the growth of grafted plant from the growth of stock plant, and we can do the first selection with the growing condition of stock plant.

Further more the damages caused by aphid, cucurbit beetle and virus became serious, from the end of January. I couldn't investigate them in detail but I observed that many aphids attached to "Arechiuri", although

cucurbit beetle seldom seen attached it. Many cucurbit beetles attached and severe virus symptons appeared in bottle gourd varieties, *C. maxima* and C. F_1 "Tetsukabuto", although on *C. moschata* these maradies were slight.

"Okinawa Local", one of *C. moshcata* varieties didn't wilt against the draught and hot condition at the beginning of February. This variety was native in Okinawa district, subtropical area in Japan, and seemed to have a high adaptability in Bangladesh.

Such varietal differences were not observed obviously in the grafted plants during my assigned period, but it could be suggested that such characters of many kind of cucurbit species and varieties might appear in the watermelon grafted on them in the later cropping season or under the bad condition.

In Japan, pumpkins were thought to be undesirable rootstocks for watermelon and muskmelon because they easily caused the decrease of quality and quantity on fruits. But in Bangladesh inferior change of fruits were not severe compared to the security of cropping. So Japanese pumpkins could be desirable rootstocks in this country.

But by the information from Mr. Tasaki, this test had ended on the half way because of hailstone on April, 1983. Further examinations would be needed by using some hopeful rootstocks to make clear the later period crop adaptability, quality and quantity of fruit in a future.

Hailstone fell from April to May every year. Common sowing date of watermelon was on the begining of February and harvesting was usually on June to July in Bangladesh, so watermelon production is extremely unstable for the reason of hailstone falling in this country. Early watermelon cultivation and harvesting can be possible in order to avoid the damage of hailstone by the use of pumpkin, bottle gourd and "Arechiuri" for rootstock, because they have low temperature elongation ability.

— General characteristics, of hopeful species for watermelon rootstock —

Pumpkin; Pumpkins are commonly used as stocks for watermelon, muskmelon and cucumber. They have high resistance to many kind of Fusarium wilt and have an ability of low temperature elongation, but these growth habit are too strong that decrease of fruit setting and inferior change of fruit texture are often seen.

Bottle gourd: Bottle gourds are commonly used for watermelon stocks in Japan. Many bottle gourds are weak to Fusarium wilt of bottle gourd, but these growth habit are moderate and inferior changes of texture and shape in fruit are not serious.

"Arechiuri": "Arechiuri" is used for cucumber stock but isn't used for watermelon stock even though graft compatibility with watermelon is not poor in Japan. The reason why it is not used for watermelon stock, I don't know, but I think it because "Arechiuri" is weak to gummy stem blight compared with the pumpkin and bottle gourd. In this country gummy stem blight is not a matter in dry season. "Arechiuri" is said to have high resistance to many kinds of Fusarium wilt of cucurbits, resistance to namatoda and an ability of low temperature elongation. Out test that was done in this country also showed "Arechiuri" had an ability of low temperature elongation and extreme resistance to cucurbit beetle. So "Arechiuri" can be the good stock for watermelon in this country.

Caphalandra indica: *Cephalandra indica* is a common weed in this country, it grows on summer. So it may be inadequate to use it in winter, furthermore its stem is extremely thin to use as a stock. Such way *C. indica* has two serious weak points, but we have a little hope because it is a weed at rainny season so on later period in summer season it may show the dominancy to others.

3. Improvement of cultivation method for watermelon seed production

Objective:

In Bangladesh watermelon is one of the most important economic vegetables. But cropping method is not established yet in this country. Raising seedling is not usually done and suitable managements are not cleared yet. Such way proper management of raising seedling isn't done, so young seedlings often die on many injuries, growth delay often occur, at the result of them yield and quality always fall down.

Particularly the decline of plant growth during later period causes serious down of such yield and quality. This study aims some what to solve these problem.

1) Effect of age of seedlings and method of night temperature management during the raising seedling period on the growth and yield performance of watermelon.

(1) Objective:

Recently raising of watermelon seedling is done on some places in Bangladesh, but the management practice of raising seedling is not established. This study was undertaken to assertain the effect of the age of seedling and night temperature management during the raising seedling period on the

growth and yield performance of watermelon.

(2) Material and Method:

a. Material: Watermelon variety used was "Sugar Baby".

b. Treatments: On age of seedling, 48 days (P 48), 33 days (P 33) and 18 days (P 18) plot were prepared.

On the method of night temperature maintaining management, three plots were prepared, 2 hold of vinyl tonnels over electric hot bed to maintain at least 17 °C minimum, (H): 2 sheets of vinyl films on one tonnel to maintain at least 9 °C minimum, (H): in an open field to be the course of nature 7 ∿ 8 °C minimum, (L). This experiment was laid out in factorial design having 2 replications of 8 plants.

Forty-eight days seedling were sown on November 26th 1982, 33 days seedling were on December 11th and 18 days seedling were on December 26th respectively. 48 days seedling were transplanted in 15 x 15 cm square black pots, 33 days seedling were in 12 cm diameter black pots, 33 days seedling were in 12 cm diameter black pots, 18 days seedling were in 9 cm diameter black pots from sowing box 5 ∿ 7 days after sowing planter.

All seedling were planted in a field on January 13th, 1983. Planting space and distance were 3 x 2.5 cm. These were covered with hot caps after planting. Main vine and other 4 lateral vines will be kept to bear 4 fruits. Other field husbandry was conducted by same way as experiement 2.

(3) Result and Discussion:

On the high temperature (H) test plot, electricity didn't work from January 1st, till January 5th, and minimum temperature fell down till 9 ∿ 11 °C. At the result growth of high temperature and middle seedling age combined (H + P33) plot didn't arrive well. In Japan, method of standerd raising seedling is thought to be 30 days on raising period and 17 °C on night temperature. For the recovery of growth delay, these were kept for 33 days in seedling bed. The growth was shown in Table 4.

Difference of growth on each plot were obvious and long period (P 48) and high temperature (H) plots were bigger than short period (P 33 or P 18) and low temperature (M or L) plots in seedling period.

This examination also ended on half way by a hailstone on April. And further investigations were not done.

Table 4 Effect of seeding term and night temperature management on growth of watermelon[d]

item	Period of raising seedling								
	48 days			33 days			18 days		
management of night temperature	High[a]	Middle[b]	Low[c]	High[a]	Middle[b]	Low[c]	High[a]	Middle[b]	Low[c]
plant length[d] (cm)	38.1	14.0	6.1	6.4	5.2	4.9	3.7	2.9	3.0
No. of leaves	7.3	5.6	4.4	3.8	3.1	2.1	1.0	0.6	0.1
fresh weight of upper ground (g)	30.3	13.7	6.9	4.3	3.2	1.6	0.8	0.5	0.5

Notice:

a. 2 hold of vinyl tonnels with electoric line in it to maintain at least 17 °C minimum

b. 2 sheets of vinyl on one tunnel to maintein at least 9 °C minimum

c. Open field from 14° to 7 °C minimum

d. investigated on 13th Jan. directly before setting

2) Effect of mulching on the growth and yield of watermelong

(1) Objective:

Moisture and soil temperature are most important for the root development of watermelon. Remarkable difference of moisture and temperature due to frequent irrigation is very harmful for the root development of watermelon. This study was undertaken to assess the effect of mulching on the growth and yield of watermelon by using different mulching materials.

(2) Material and Method:

a. Material: watermelon "Sugar Baby"

b. Treatment: For the mulching test, using black polyethylene film plot, using straw plot and no mulching control plot were prepared. This experiment was laid out in factorial design having 2 replications. 7 plants were observed from each replication.

Sowing date was on November 26th 1982., planting date was on January 5th 1983 in hot caps.

Other husbandry was conducted same as the examination 2.

(3) Result and Discussion:

The growth of watermelon seedling was still slow in hot caps on my leaving day. So no investigation of plant growth was done. Temperature

of 9 A. M. showed that straw mulch plot was always the highest, poly mulch plot in the next place and 1 °C lower than the former, last came no mulch plot that was 1 °C lower than poly mulch plot. But at 2 P.M. the temperature of poly mulch plot was 21 ∿ 24 °C and always highest of all, next came no mulch plot and 2 °C lower than poly mulch plot, last came straw mulch plot 2 °C lower than no mulch plot. This examination also failed on half way by a hailstone.

4. Studies on the morphological characters of the newly introduced white gourd variety.

(1) Objective:

Most of the white gourd varieties in Bangladesh are late flowering and less yielding. The newly introduced variety "Fusiuri" bears female flowers to many nodes and also bears a large number of fruits. This study aims to study the morphological characters and adaptability of this variety to popularise it.

(2) Materials and Method:

Materials: Chinese introduced variety "Fusiuri" and as controls, Japanese "Daimaru", Bangladesh "Local" were used.

This experiment was laid out in randamized complete block design having 2 replicates and in each replication 4 plants were observed.

Other husbandry was done same as experiment 2.

(3) Result:

The growth of white gourd seedlings were still slow on my leaving day, so no investigation was done.

This examination also failed by a hailstone.

V. STUDIES ON MEANS FOR MAINTAINING OF GROWTH VIGOUR OF EGGPLANT IN BANGLADESH

CITRUS AND VEGETABLE SEED RESEARCH CNETRE, B.A.R.I.

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Abstract:

In order to clarify the effects of rate of nitrogen, phosphorus and potassium which have been recommended for eggplant cultivation in Bangladesh has been compared whith existing Japanese standard doses on the growth and yeild of some different cultivars to maintain vigour with longer period.

The experiment was conducted on the amount of fertilizers, defective test of 6 major elements and different composition of nursing soil. From the results of the experiment, the following facts were clarified.

1. The best result was obtained in case of N = 60 Kg. P_2O_5 = 30 Kg. and K_2O = 30 Kg. as the total amount of supplied fertilizers in 10 areas when the half amount of N, K_2O and whole of P_2O_5 applied as basal application, and the remaining ones were applied as top-dressing into three equal instalments.
2. Though, nitrogen, phosphorus and potassium were most indispensable elements, however, it is necessary to study further in future for optimum balanced doses, not only on these major elements but also on calcium, magnesium and sulphur.
3. There were clear varietal differences on fertilizer response. The varieties namely, Rajshahi No. 9, Pusa Kanti and Pusa purple long have shown higher response.
4. It can be said that by the furrow irrigation system widely following in the country, the fertilizer components were accumulated at upper layer of soil by vertical movement of soil water. Therefore, further study is needed on improving irrigation method, timing and doses for top-dressing and method of application.
5. Regarding the most suitable combination of soil, sand and cowdung for nursing soil, the ratio 1: 1: 1 was the best. However, it can be said that the cowdung can not be expected as fertilizer source owing to their low fertilizer content, except to utilize as material for improvement of soil-physical properties.

Introduction:

Eggplant (Solanum melongena L.) is one of the most important and widely cultivated vegetable crop in Bangladesh. However, its yield in the country is extremely low as compared with the yield in Japan. The average yield in this country is approximately 0.6 ton per 10 acres against 5 to 6 ton in Japan.

The main reason of lower yield in the country is the old cultivation techniques to state it more concrelely, reasons are (i) There are not enough number of superior or leading varieties to be recommended. (ii) Rather rough cultivation method for nursing of seedlings. (iii) Lower rates of fertilizers and inefficient application method. (iv) Inexperienced means on irrigation drainage system[2].

Due to the above mentioned several reasons, the plant can not maintain their growth vigours for longer period, moreover, there is another big constraint that is shoot and fruit borer (Leucinodes orbobalis GUEN.) which occurs huge damage and there is no effective control measure for it[16].

To overcome these problems in sound cultivation of eggplant, and in order to find out improved varieties[3),4),5),7)], and efficient management practices,[6),8)], this study was taken up under the climatic and environmental conditions previously in Bangladesh.

In this paper, some results of studies on proper soil composition for nursing seedlings and fertilizers application for eggplant growth will be reported.

During the stay in Bangladesh, the experts have pointed out the errors on cultivation method of eggplant that are, (i) generally, the nursing seedlings in Bangladesh are excedingly extensive management and being bellitted on the influence on after that of growth and yield. The seedlings are usually raised in the flat seed bed with height of 10 cm without appling any chemical fertilizers except either applied 5 to 9 Kg. per square meter of cowdung or 1 to 2 Kg of grass and weed ashes[2]. And, (ii) when the seedlings are collected from nursery bed to set in the actual field, the seedlings are being handled carelessly to pull up and without any cares to avoid to cutting and damage of root system. (iii) many cases occur due to these improper manner for handling of seedlings such as lower ratio and delay of taking root when they are planted in the field[2]. By contrast in case of Japan, the growth of seedlings in the nursery is equal to the half crop, this means that the quality of seedlings and their subsequent growth would greatly affect the yield.

However, it has been widely known here that is very difficult to get the organic matters which should be reduced to the field soil in order to improve or maintain the physical properties of soil texture, because of, most of the organic matters being used for food of cattles and fuel purposes. On the other hand, the soil of this Joydebpur area had formed well weathered

clay soil of alluvium having very low porosity, should be, of course, needed to improve its physical properties. Accordingly, this studies were attempt to clarify on the most appropriate ratio of composition for nursery soil mixed in a disguised ratio of soil, sand and cowdung, to evalute a view of physical properties of soil as well as growth performance of seedlings[2]. Furthermore, the significance of shading for seedlings provied usually after transplanting as common practices was also examined the effects on the growth and yield of eggplant.

The status of application amount of fertilizers of poor farmer's use is on very low level or almost nill in this country.

Because of, Bangladesh people are very proud of her fertile soil so called Golden Land of Bangladesh. It is necessarily true, it is in fact rich in mineral elements, even phosphorus and potassium in some location, because, calcareous soil spread widely in flood plains. However, we should know that nitrogen fertility of the soil in the country is very low. During monsoon season mighty rivers deposit a huge quantity of silt in flood plains, however, it contains almost nil of nitrogen[15].

Accordingly, the results of studied[9),10),11),12), on the recommendable fertilizer doses of egfplant, potato and onion which had been done and has being followed in Bangladesh, had been examined by far lower level in comparison with general doses in Japan.

Therefore, in this studies made the attempt to compare the standard doses in Japan (N = 50 to 60 Kg./10 ares) within Bangladesh (N = 5 to 6 Kg/10 ares) and to confirm the effect of doses of Japan on the verietal response of growth and yield of exotic and indigenous eggplant cultivars.

Secondly, the fertility of soil nearby this Centre has been examined through the effect of defective test on six major elements such as nitrogen, phosphorus, potassium, calcium, magnesium and sulphur on the growth response.

And on the subject of nitrogen which is the most essential element has also examined on the effect of both high and low levels of phosphorus, potassium, calcium and magnesium which combinated with different levels of nitrogen.

Then, it was considered synthetically to set up a standard and acceptable fertilizer doses for farmer which towards maximizing yield and extend longer cultivation period with balanced fertilization mainly nitrogenous fertilizer application in Bangladesh, according to the results of the above three fertilizer requirements test.

However, it should be, of course, needed follows by fair and honest works such as to finding out the optimum times for top-dressing, place or position of application, balanced combination of each fertilizers and method of irrigation to minimize the loss of nitrogen washed away by surface water during watering, in order to finalized to have the applicable and acceptable fertilizer recommendation under certain particular condition like Bangladesh.

I. EXPERIMENT ON THE EFFECT OF VARIOUS LEVELS OF THREE MAJOR ELEMENTS ON SOME EGGPLANT CULTIVARS.

Materials and Methods

The research work conducted at the Citrus and Vegetable Seed Research Centre No. 2 field in BARI campus, Joydebpur, during the period from August 1982 to December 1982. There were twelve different local and exotic varieties in this trial, the name of varieties and origin are presented in Table No. 1. The seeds were sown in the seed bed on 8th August and the young seedlings were transplanted in the black coloured polyethylene film pots (9 cm diameter) at 10 days after their emergence. The seedlings were finally set in the actual plot on 7th October. The unit plot size was 6 square meter, and the distance between rows and plants were 1.25 m and 0.6 m. The number of plants per unit plot were 8, to put it concetly, 1,666 plants per 10 ares.
The experiment was laid out in RCBD with two replications.

The amounts of fertilizers applied in this study are shown in Table 2. There were three different levels in each of N (from ammonium suphate), P_2O_5 (from super phosphate) and K_2O (from potassium suphate) respectively.
The basal dose of fertilizers was broadcasted into soil during the final land preparation in order to enougly to mix them well with soil, which was done 2 days before the setting of plants. The first, second and third top-dressing were done every 30 days interval.

Table 1 Variety Name and Its Origin

	Variety Name	Origin
1.	Rajishahi No. 3	Bangladesh
2.	Rajishahi No. 5	"
3.	Rajishahi No. 8	"
4.	Rajishahi No. 9	"
5.	Khot Khotia Long	"
6.	Pusa Kanti	India
7.	Pusa purple long	"
8.	Longla	Bangladesh
9.	Bangar	"
10.	Hon Naga Nasu	Japan
11.	Kurume Naga Nasu	"
12.	Taiwan Naga Nasu*	"

* Acctually, this variety came from Taiwan, but the seeds which used in this trial has been produced in Japan.

Table 2 Application Amount of Fertilizers

(unit = Kg per 10 ares)

Plots	Fertilizer Component	Basal	Top dressing			Total
			1st	2nd	3rd	
High	N	30	10	10	10	60
	P_2O_5	30	-	-	-	30
	K_2O	30	10	10	10	60
Medium	N	15	5	5	5	30
	P_2O_5	15	-	-	-	15
	K_2O	15	5	5	5	30
Low	N	6	3	3	3	15
	P_2O_5	7	-	-	-	7
	K_2O	6	3	3	3	15

But from the 4th, the times of application depended upon soil electrical Conductivity (EC was measured immidiately after taken the soil sample using fresh soil, then, shaken with distilled water as 5 times volume of for measuring) and growth vigour of soil and plant.

Mulching, weeding and earthing up were done after each top dressing. Furrow irrigation was given at an interval of 7 ∿ 10 days during the whole experimental period. Spraying of insecticides, especially to control for the brinjal shoot and fruit borer was done every alternate day with Sumithion, D.D.V.P. and Nicotine sulfate durin the whole period of experiment.

Before setting the experiment, Dhaincha (Sesbania aculeata) a green manuring crop was cultivated at the plot in the previous season and throughly ploughed down in order to supply the organic matter to the soil.

Result and Discussion:

Though the setting time was rather delayed due to off-season rain fall, still, the condition of taking root was good. The severe damage by brinjal shoot and fruit borer had occured 4 days after setting of the plants. The situation of damaging by brinjal shoot and fruit borer was shown in Table 4.

Table 4 No. of Plants damaged by Shoot & Fruit Borer

	Var. Name	Fertilizer Level			Total	%
		H	M	L		
1.	Rajishahi No. 3	3	0	3	6	13
2.	Rajishahi No. 5	3	4	2	9	19
3.	Rajishahi No. 8	1	0	1	2	4
4.	Rajishahi No. 9	3	1	0	4	8
5.	Khot Khotia Long	3	9	5	16	33
6.	Pusa Kanti	0	1	0	1	4
7.	Pusa purple long	1	0	0	1	2
8.	Longla	4	1	4	9	19
9.	Bangar	3	5	4	12	25
10.	Hon Naga Nasu	0	5	0	5	10
11.	Kurume Naga Nasu	2	0	2	4	8
12.	Taiwan Naga Nasu	0	2	0	4	8
	Grand Total	23	28	23	74	13

There were very clear varietal differences against attack by borer than difference on the doses of fertilizers.

The growth condition on 30th day after setting of plants which was exhibited by stem diameter, dry matter weight with 4 - 5th leaves were shown in Table 5.

Table 5 Growth Condition on 30 days after setting

	Var. Name	Stem Diameter[1] (cm)					Leaf Weight[2] (g)				
		H	M	L	Mean	H/L	H	M	L	Mean	H/L
1.	Rajishahi No. 3	1.14	1.09	0.91	1.05	125	0.61	0.52	0.38	0.50	158
2.	Rajishahi No. 5	1.18	1.03	0.88	1.03	134	0.83	0.65	0.50	0.66	167
3.	Rajishahi No. 8	1.24	1.12	0.97	1.11	122	0.78	0.74	0.41	0.64	193
4.	Rajishahi No. 9	1.29	1.08	0.89	1.09	145	0.95	0.66	0.34	0.65	279
5.	Khot Khotia long	1.38	1.24	1.01	1.21	137	1.00	0.92	0.62	0.85	161
6.	Pusa purple long	1.39	1.14	0.99	1.17	140	0.70	0.59	0.30	0.53	235
7.	Pusa Kanti	1.30	1.14	0.90	1.11	144	0.48	0.41	0.18	0.36	265
8.	Longla	1.17	1.09	0.95	1.07	123	0.86	0.93	0.62	0.80	139
9.	Bangar	1.27	1.11	0.93	1.10	137	0.94	0.90	0.57	0.80	164
10.	Non Naga Nasu	1.23	1.15	0.99	1.12	124	1.54	1.42	0.80	1.25	193
11.	Kumme Naga Nasu	1.28	1.14	1.07	1.16	120	1.26	0.92	0.84	1.01	151
12.	Taiwan Naga Nasu	1.24	1.07	0.98	1.10	127	0.90	0.83	0.49	0.74	184
	Grand Means	1.26	1.17	0.96	1.11	131	0.90	0.79	0.52	0.73	180

1) Diameter measured at grand level

2) Leaf weight has been measured on 4 - 5th leave, weigh shows the dried matter of one leaf.

Regarding the stem diameter, the varieites such as Khot Khotia Long, Pusa purple long and Kurume Naga Nasu were much thicker than others. Rajshahi No. 5 and No. 3 were slendered.

In respect of leaf weight, the variety Hon Naga Nasu was the highest which was followed by Kurume Naga Nasu, Pusa Knati, Rajshahi No. 3 and Pusa purple long respectively.

In clearly revealed that the higher doses of fertilizer resulted vigorous growth but lower doses resulted poor-growth of the plant and showed symptom like nitrogen defficiency.

Among the tested cultivars, there were distinct differences in response to fertilizers. Rajshahi No. 9, Pusa Kanti and Pusa purple long had responded much sensitively that the other ones.

The change on standing of EC of soil suspension were shown in Table 6.

Table 6 The change on standing of EC of sail

Treatment	Horizon 1)	7/Oct.	(pH)	14/Oct.	21/Oct.	24/Oct.	31/Oct.	8/Nov.	17/Nov.
1. Control	Upper	0.02	(7.5)	0.08	0.12	0.04	0.04	0.04	0.03
2. "	Lower	-	-	-	0.02	0.02	0.02	0.02	0.02
3. Less Dose	Upper	0.24	(7.4)	0.32	0.42	0.18	0.14	0.17	0.37
4.	Lower	-	-	-	0.08	0.08	0.04	0.03	0.15
5. Medium Dose	Upper	0.34	(6.9)	0.52	0.74	0.50	0.43	0.38	0.69
6.	Lower	-	-	-	0.15	0.16	0.12	0.12	0.18
7. High Dose	Upper	0.74	(6.4)	0.90	0.85	0.72	0.78	0.75	1.05
8.	Lower	-	-	-	0.35	0.32	0.55	0.16	0.54

1) Soil Horizon ..... Upper is 0∿10 cm dept, Lower is 10∿20 cm

2) It were rain fall on 22/Oct. was 25 mm, 10/Nov. was 22 mm and on 11/Nov. was 7 mm

3) On 15/Nov., topdressing has done and 16/Nov. irigation has done.

The Electric Conductivity (hereafter, abbreviated as EC) of upper soil horizon of all treated plots have continuously raised until rain fall on 22nd October.

It was proved that the bases were accumulated at upper layer of soil by vertical movement of soil water. However, it was also noted that the higher doses of fertilizer was the lower pH level.

The fluctuation of soil moisture at initial growing stage was shown in Fig. 1.

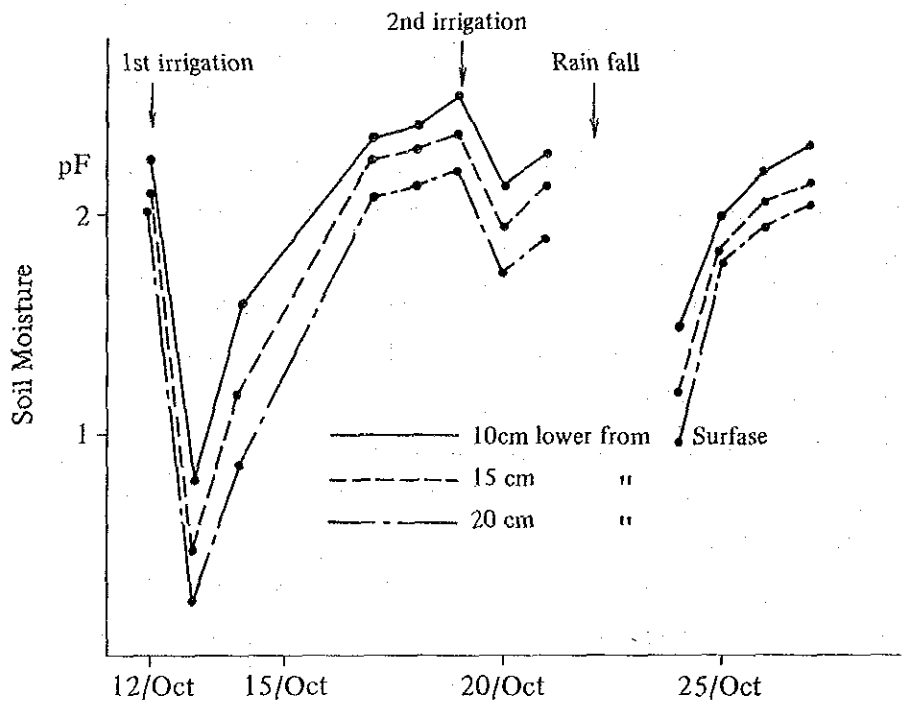

Fig. 1 The fluctuation of Soil Moisture

On the 1st irrigation, it was observed that the soil layer till 10 cm deep was enoughly moisted beyond the water holding capacity of soil, but, in later cases, it was not same.

However, due to rain fall on 22nd October, soil pF had been declined.

The contents of nitrogen, phosphoric acid, potassium, calcium and magnesium on 4 - 5th leaves of respective varieties in each different fertilizer level were shown in Table 7 and the content of micronutrients were shown in Table 8.

Table 7 % of element contented in leaf (%)

	N				P_2O_5			K_2O			CaO			MgO		
	H	M	L	H/L	H	M	L	H	M	L	H	M	L	H	M	L
1. Rajishahi No.3	4.32	4.09	3.25	1.33	0.43	0.42	0.47	5.50	4.96	4.50	2.24	2.20	2.16	0.79	0.87	0.96
2. " No.5	5.16	4.65	2.94	1.76	0.34	0.36	0.37	5.64	5.50	4.50	2.16	2.70	3.64	0.84	1.02	1.59
3. " No.8	4.43	4.17	3.42	1.30	0.41	0.39	0.37	6.54	5.20	4.50	2.16	2.42	2.46	0.84	0.93	0.88
4. " No.9	4.99	4.15	2.24	2.23	0.34	0.28	0.39	5.88	4.74	4.50	2.38	2.42	2.16	0.91	0.85	0.87
5. Khot khotia long	4.99	4.54	3.45	1.45	0.31	0.39	0.32	5.50	4.28	4.76	2.46	2.42	2.02	1.00	1.67	0.87
6. Pusa purple long	4.99	4.17	3.00	1.66	0.39	0.35	0.42	6.56	5.64	5.20	2.46	2.60	3.08	1.35	0.88	1.71
7. Pusa kanti	5.16	4.37	3.25	1.59	0.39	0.40	0.38	5.50	5.88	5.20	2.64	2.78	3.48	1.09	0.80	0.75
8. Longla	4.88	3.84	3.11	1.57	0.35	0.29	0.36	5.20	5.50	5.20	2.20	2.70	2.30	1.15	1.18	0.96
9. Bangar	5.35	4.15	3.42	1.56	0.29	0.37	0.35	5.50	5.20	4.76	1.86	2.16	2.66	0.80	0.97	0.96
10. Hon Naga Nosu	4.56	4.37	3.98	1.15	0.29	0.37	0.41	5.64	5.64	4.28	1.98	2.24	1.98	0.96	1.57	1.20
11. Kurume Naga Nasu	5.32	4.46	3.47	1.53	0.37	0.42	0.34	6.50	4.04	4.76	2.03	2.84	2.90	0.84	1.21	1.09
12. Taiwan Naga Nasu	5.07	4.88	4.03	1.26	0.37	0.39	0.42	5.64	5.50	4.76	2.34	2.66	3.10	0.87	0.91	0.96
Means	4.93	4.32	3.30	1.49	0.36	0.37	0.38	5.80	5.17	4.74	2.24	2.51	2.66	0.95	1.17	1.07

Analyzed on 4 ∿ 5th leaves

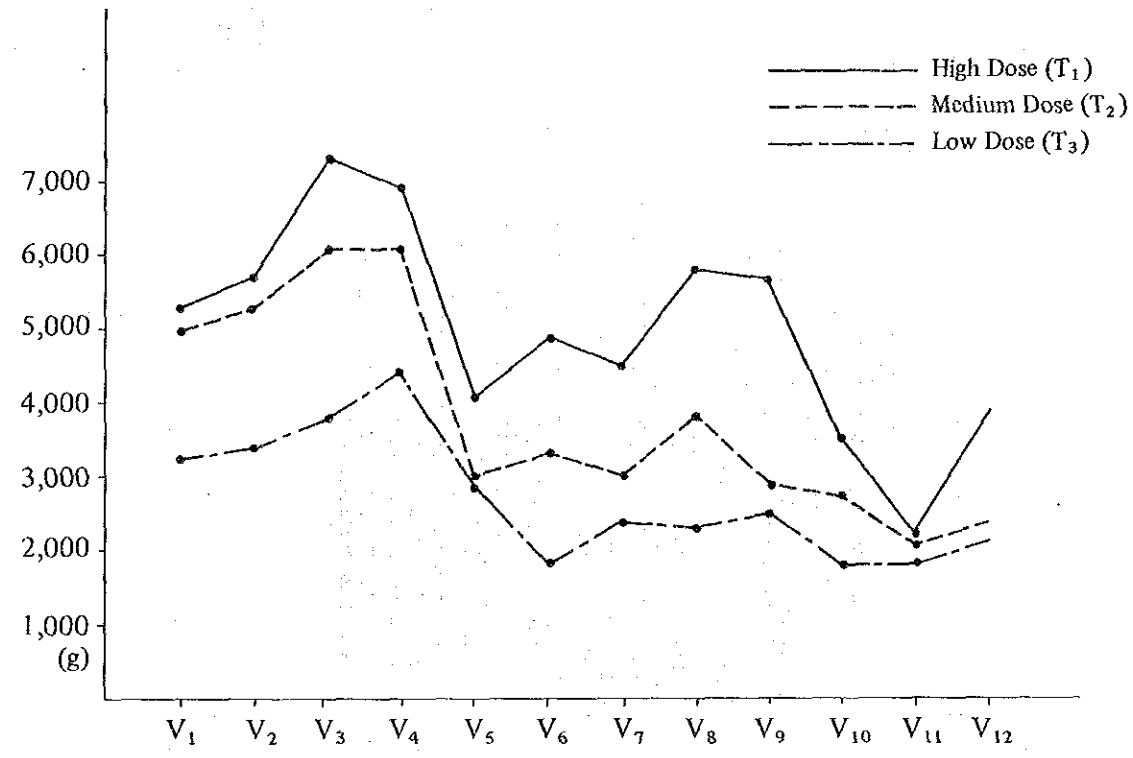

Fig. 2 Total Harvested Fruit Weight/plant of 12 varieties at different fertilizer does

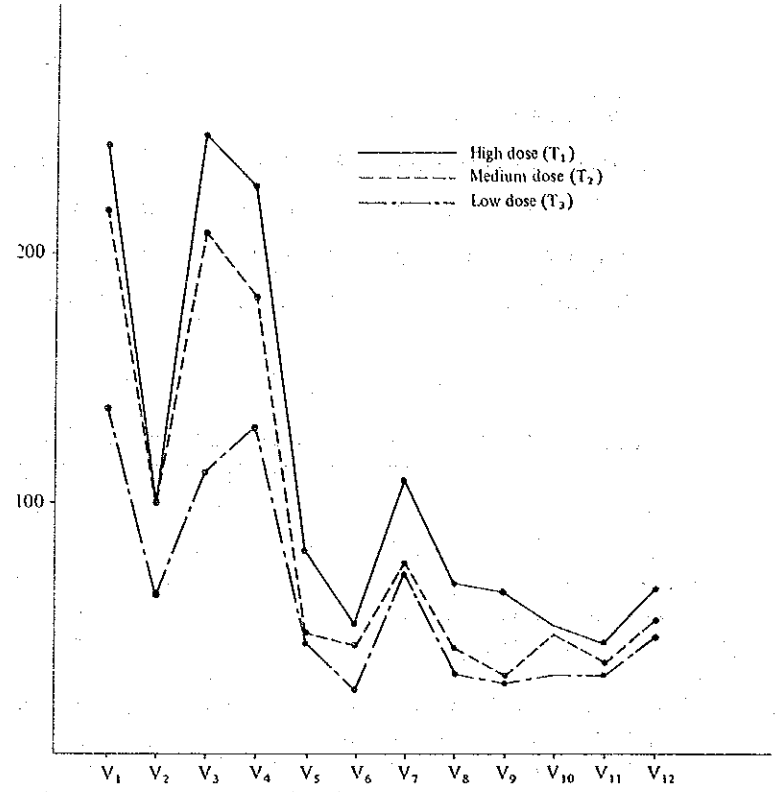

Fig. 3 Total harvested fruit number/plant of 12 varieties at different fertrilizer doses

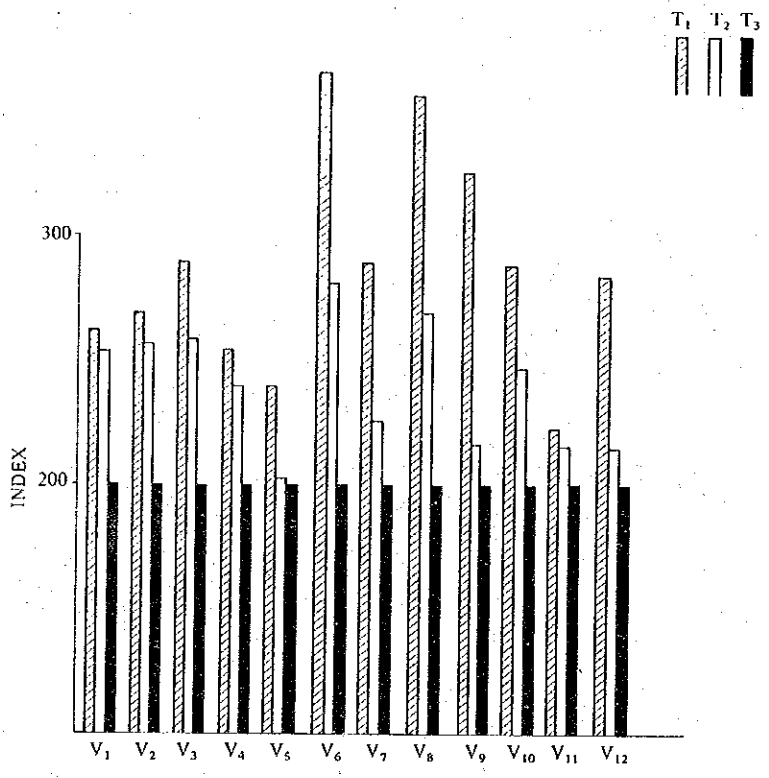

Fig. 4 The index of harvested fruit weight per plant taking T_3 as index 100

II. STUDIES ON THE EFFECTS OF SIX MAJOR ELEMENTS OF THE GROWTH OF EGGPLANT

Materials and Methods.

The aims of this experiment was to clerify the effect of lack of six indispensable elements on the growth of eggplant. The seeds were sown on 16th September 1982, seedlings were potted on 2nd October, and then set the seedling into the Wagner's pots (1/2,000 are) on 19th Oct. The Wagner's pots were filled up with grey terrace soil that was available in No. 2 field of CVSRC, Joyedebpur.

The tested variety for this experiment was Pusa purple long which had been selected by screening from the last trial with 38 exotic and local culltivars as a promising variety in respect of earliness, having some degree of tolerance against brinjal shoot and fruit borer and high yield performance. The total treatments were 8 from T_1 to T_8. T_1 (control) contained all the six elements such as, N, P, Z, Ca Mg and S, whereas, in T_8 all of them were absent. In other treatments from T_2 to T_7 any one of the elements was lacking. All element were applied at the rate of N = 30 mg/100 g, P_2O_5 = 30, S = 30, K_2O = 30, CaO = 30, and MgO = 30 mg/100 g of soil. The treatments combination along with sources of fertilizers were as follows.

T_1 (Control)	+N, +P, +K, +S, +Ca, +Ma
T_2	-N
T_3	-P
T_4	-K
T_5	-Ca
T_6	-Mg
T_7	-S
T_8	-N, -P, -K, -S, -Ca, -Mg

The sources of each element were,

N	Urea
P_2O_5	TSP and/or Super Phosphate
K_2O	Potassium Sulfate and/or Potassium Carbonate
S	Ammonium Sulfate
CaO	Calcium Carbonate
MgO	Magnesium Sulfate

The countermeasure had been taken to avoid the contamination with other irons exception with carbonate.

The each treatment consisted of 5 plants one in each pot (1/2,000 a) and each treatment replicated 5 times.

The seedlings were grown in open place, and tap water was used for watering.

Results and Discussion:

The effects of lacking of the six major elements on the growth of eggplant and weight of aerial part (control as index 100) were shown in Table 9 and Fig. 2 respectively.

Table 9 The effect of lack of 6 major element on growth of eggplant

Treatment	Plant height	Leaf weight	Aerial weight	Lower Stem Dia.	No. of fruit/ 5 plants	Date of flowering 1st	2nd (cluster)
T_1 (Control)	41 cm	3.6 g	140 g	8.9 cm	1	7/11	12/11
T_2 - N	39	1.8	76	7.8	3	6/11	12/11
T_3 - P	33	2.3	66	6.9	0	7/11	13/11
T_4 - K	38	2.1	88	7.8	1	6/11	13/11
T_5 - Ca	40	3.5	127	9.5	0	7/11	14/11
T_6 - Mg	42	3.3	124	8.6	0	7/11	14/11
T_7 - S	41	3.0	140	9.6	0	7/11	14/11
T_8 0	31	1.2	32	6.7	3	7/11	14/11

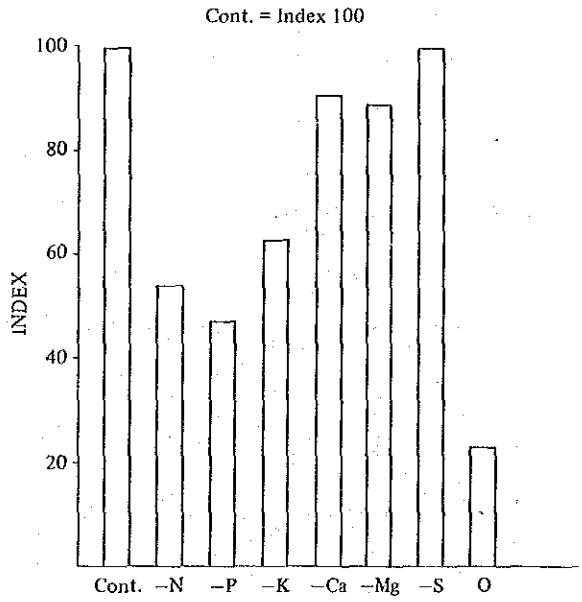

Fig. 2 The correlation of growth between aeral weight and lack of elements

N plot has shown clear effect evidenced by fading of leaf colour in early stage of growth and as a result, leaf weight, aerial weight and stem diameter were lower than the others. However, fruit bearing was stimulated.

P plot has shown lowest plant height, aerial weight and stem diameter.

S plot and control plot were identical in plant height, but, in case of stem diameter, -Ca and -S plots were superior to control plot.

In case of flowering date, no difference was found in any of the treatment.

In Fig. 2, the tendency of general growth has been shown taking control as index 100.

Table 10 Element contents[1)] in leaf and pH, EC of treated soil

Treatment	N	P_2O_5	K_2O	CaO	MgO	S	Zn	Fe	Mn	Cu	pH	EC
Cont.	5.72%	0.34%	7.24%	2.24%	0.78%	0.38%	77ppm	292ppm	270ppm	12ppm	4.6	0.53
-N	3.39	0.42	6.32	2.66	0.93	0.61	96	244	208	15	4.0	0.25
-P	5.49	0.25	6.32	2.38	0.94	0.40	113	250	203	12	5.0	0.75
-K	5.66	0.29	3.60	3.10	1.91	0.43	111	292	244	12	5.7	0.76
-Ca	5.94	0.45	7.46	1.72	0.76	0.56	63	280	214	12	4.5	0.41
-Mg	5.66	0.34	6.80	1.80	0.52	1.22	63	416	296	12	4.4	0.34
-S	5.10	0.36	6.50	2.82	0.73	0.25	78	300	198	12	5.0	0.18
0	3.42	0.25	6.80	1.44	1.33	0.52	57	320	386	10	4.0	0.1

1) Plant analyzed in collaboration with Dr. H. Sakai (plant nutrition expert).

2) Soil pH was drew using by KCℓ solution.

It was analyzed chemically on 4 - 5th young leaves from top. As shown in Table 10, extraordinarily low levels of nitrogen were obtained in -N plot and T_8 plot. The highest level was found out from control plot of course.

Phosphate content was severely low in -P and 0 plots. However, -Ca, -N plots were rather higher in phosphate content than the others.

Potassium content was low in -K plot as a matter of course. However, highest content of potassium was found in -Ca followed by control and 0 plots in order. In case of calcium, -K plot was extremely high, but -Ca, -Mg and 0 plots were low in calcium.

Magnesium was, of course, low in -Mg plot, but in -K and 0 plots it was extremely in high level.

Sulfur was also low in -S plot but it was highest in -Mg plot.

Zinc was low in 0 plot but rather high in -N plot.

Table 11 The content of the ingredients of tested water, soil and cowdung.

Items	pH	NH_4-N	N_{03}-N	P_2O_5	K_2O	CaO	MgO	Unit
1) Soil	7.5	1.1	0.4	3.0	39	33	52	mg/100g
2) Condung Compost	7.5	1.0	-	-	252	434	236	mg/100g
3) Tap. Water	7.0	tr.	0.3	0.7	16	24	36	ppm

III. EFFECT OF NITROGEN APPLICATION AND UPTAKE OF EGGPLANT.

Materials and Methods

The tested plant were sown on 16th Sep. 1982, and transplanted to the black coloured polyethlene film pot (9 cm dia.) on 2nd October, then, finally set in the Wagnar's pots on 25th October. The name of tested cultivar was Pusa purple long which has been found as promising variety for winter season cultivation. The experiment was carried out in the main field of CVSRC at Joyedbpur. The levels of Nitrogin was N = 0, 5, 10 20, 40, 60, 80 and 100 mg/100g of soil, and in each treatment, K_2O = 40, P_2O_5 = 40, S = 75, CaO = 140 and MgO = 10 mg/100g of soil had been mixed as high dose plot and K_2O = 20, P_2O_5 = 20, S = 38, CaO = 54 and MgO = 0 mg/100g of soil were mixed as low dose plot. Urea, super phosphate, potassium sulfate and hulime were used as the sources of fertilizer. The component of water used for irrigation was pH = 6.8, NO_3-N = 0.07, PO_4 = 0.13, SO_4 = 0.09, K_2O = 2.05, Na = 24.9, CaO = 71.6 and MgO = 18.7 ppm.

The watering was done at the rate of 500 ml/day in each 1/2,000 are scale of Wagnar's pot. The each treatment consisted of 5 plants one in each pot replication 5 times.

Result and Discussion:

The growth performance has been presented in Table 12,

Table 12 The effect of different application dose of nitrogen on the growth of eggplant

Treatment	Plant height	Plant weight	Aerial weight	Stem diameter
H x 0	32 cm	1.9g	62g	8.6mm
H x 5	39	2.4	82	8.3
H x 10	39	2.1	105	8.9
H x 20	42	3.4	131	8.6
H x 40	41	2.7	118	9.0
H x 60	40	3.6	127	9.8
H x 80	38	2.5	119	9.3
H x 100	34	3.1	97	9.1
L x 0	34	1.6	55	7.2
L x 5	36	1.5	59	7.9
L x 10	36	1.6	58	7.5
L x 20	35	2.5	81	8.8
L x 40	38	2.4	111	8.6
L x 60	38	3.1	98	9.0
L x 80	36	2.5	100	9.3
L x 100	38	2.7	102	8.6

It had revealed that the plots with K and P except N showed better growth tha low level plots. However, in case of N = 100 mg/100g high level plot, growth was low as compared with N = 100 mg/100g low level plot.

With high level of K and P, N = 20 plot was the best in growth, but, in case of ow level of K and P, the plot of N = 40 mg/100g of soil showed highest growth.

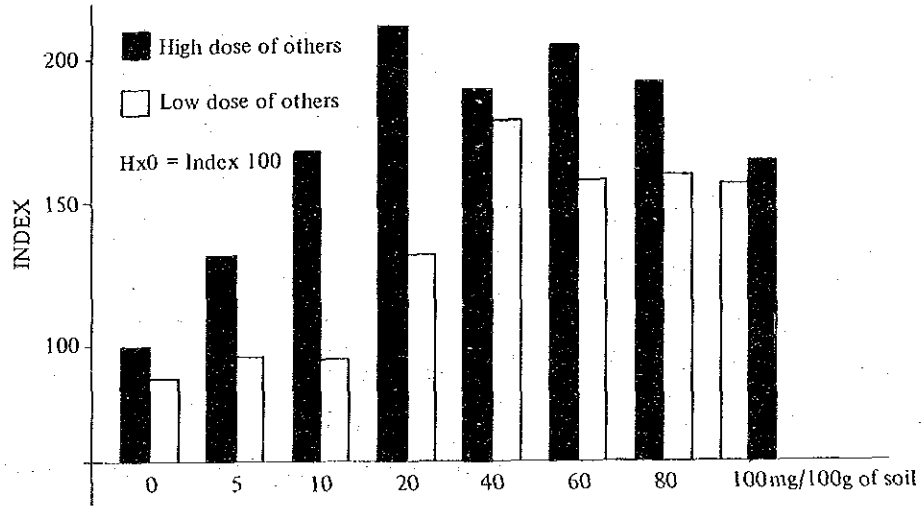

Fig. 3 The correlation between aeral weight and rate of nitrogen

When as index = 100 as the aerial weight of N = 0 mg/100g of soil with high dose of other elements shown in Fig. 3.

Table 13 The content of ingredients in leaf (%)

Treatments	N		P		K		Ca		Mg	
	H	L	H	L	H	L	H	L	H	L
0	4.51	4.26	0.48	0.29	6.56	5.50	2.30	1.98	0.93	1.06
5	5.44	4.51	0.49	0.31	5.20	5.50	1.84	2.02	0.91	1.14
10	5.52	5.10	0.45	0.35	7.46	4.96	1.94	1.94	1.02	0.84
20	5.72	5.69	0.47	0.41	6.50	6.32	1.94	1.58	0.91	0.70
40	6.19	6.29	0.44	0.36	5.64	5.88	1.54	1.72	0.73	0.73
60	5.60	5.10	0.45	0.36	7.24	6.32	1.58	1.72	0.60	0.64
80	6.72	6.36	0.42	0.34	6.56	6.50	1.36	-	0.58	-
100	7.96	7.13	0.31	0.36	6.50	5.64	-	1.54	1.26	0.61
Mean	5.96	5.56	0.44	0.35	6.46	5.83	1.79	1.80	0.87	0.86

Taking aerail weight of N = 0 mg/100 g of soil with other elements as index 100, effects of different levels of N have been shown in Fig. 3.

Table 14 The content of micronutrients in leaf (ppm)

Treatments	Zn		Fe		Mn		Cu	
	H	L	H	L	H	L	H	L
0	69	57	428	376	606	490	14	10
5	74	89	676	314	244	616	14	13
10	67	104	386	324	184	596	-	12
20	71	63	450	564	244	444	15	13
40	111	80	604	468	254	244	13	13
60	84	66	376	376	286	362	12	13
80	74	50	420	344	282	314	13	11
100	70	61	420	500	324	384	12	12
Mean	78	71	470	408	303	431	13	12

The contents of ingredients and micronutrients of 4 - 5th leaves counted from top were presented as shown in Table 13 and 14.

In case of nitrogen, it showed that the higher dose of nitrogenic

fertilizer increases the amount of micronutrients except Mg. Regarding the content of phosphate and potassium, there were certain tendency related to the different dose of nitrogen. However, the content in high level plot was higher than low nitrogen plot.

On the other hand, it has been found that the contents of calcium and magnesium on above 40 mg/100g of soil decrease when the dose of nitrogen increases.

In case of micronutrients, the content of iron in the high level of other elements is rather higher than the content of low level. However, the content of manganese was higher in case of low level of other elements. The remaining elements like zinc and copper have not shown fixed tendency against the different dose and level of nitrogen and other elements.

IV. EXPERIMENT ON THE SOIL COMPOSITION OF NURSERY SOIL

Generally, garden soil consists of organic matter, mineral matter, air and water. The relative amount of each of these in the soil is an important factor in determining the growth rate of vegetable crops. And, air and water are present between soil particles. Sandy soil has more air among the soil particles but has poor water holding capacity. Insufficient water in sandy soil frequently results in a high soil temperature and wilting of plants during hot days.

On the other hand, clay soil holds more water but its aeration is usually poorer and this may result in poor root growth, sometimes, excess water and poor aeration may even cause root rot which very oftenly happens in this soil area. Soil in this Joydebpur area is known as heavy clay loam having inaptitude physical properties for raising seedlings of vegetable crops. Therefore, this experiment was done for determing the suitable soil component for raising seedlings of eggplant.

Materials and Methods:

The experiment has been carried out at CVSRC, Joydebpur. The seeds were sown on 20th September and transplanted on 7th October 1982. The tested cultivar was Rajishahi No. 9. The materials for composition of nursery soil were sub-soil of CVSRC field, cowdung and river sand and these were thoroughly mixed. The mixing ration (volume ratio) of these materials were as follows.

Plot No.	Sub-soil		Cowdung		Sand
1	1	:	0		0
2	3	:	1	:	0
3	1	:	1	:	0
4	1	:	3	:	0
5	3	:	0	:	1
6	1	:	0	:	1
7	1	:	0	:	3
8	1	:	1	:	1
9	0	:	1	:	0
10	0	:	0	:	1

Moreover, in order to know the effect of shading for plants which is usually provided after transplanting of seedling, shading and non-shading plots have been designed with the above stated 10 treatments. The light intensity of shading plot was just 70% of non-shading plot as at noon.

Initially, the fertilizers such as nitrogen from ammonium sulfate, phosphate from super phosphate and potassium from potassium sulfate were applied at the rate of 2 grams per 10 litters of soil, except the plots with cowdung, in anticipation of supplying nitrogen from cowdung. However, leaf colour of the plots having cowdung has faded due to low level of total nitrogen, content of dry matter of tested cowdung as only 1.37%. Therefore, time to time, ammonium sulfate was applied for these plots to compensate the deficiency of chemical properties of tested soil.

The tested plants were planted in black coloured polyethylene film pot as volume 500 ml (size 9 cm x 9 cm squre), then, tested soil of each combination was filled up in the Wagner's pot (scale is 1/2,000 are) with two replications.

The watering has been carried out time to time for two weeks after the setting of pots. Then, 10 samples of each treatment were collected. These sampled soil were tested to measure on three phase distribution using by actual volumenometer under the moisture condition at pF 1.5.

Result and Discussion:

The growth condition of seedling was shown in Table 15.

Table 15 The correlation between soil composition and growth of seedling

Treatments			Non shading plot				Shading plot			
Soil	Cowdung	Sand	Plant height	No. of leaves	Length of leaf	Dry matter weight of aerial part	Plant height	No. of Leaves	Length of leaf	Dry matter weight of aerial part
1	0	0	14^{cm}	7.4	10.3^{cm}	2.1^{g}	18.9^{cm}	7.7	15.3	2.4^{g}
3	1	0	15	7.9	13.4	2.6	15.7	7.4	18.5	3.0
1	1	0	13	7.7	13.0	2.6	16.0	7.3	18.7	3.0
1	3	0	14	7.9	13.6	2.3	16.3	7.4	14.8	2.6
0	1	0	16	8.0	13.6	2.6	17.1	7.9	16.8	3.1
3	0	1	14	6.6	10.6	2.3	18.5	7.3	16.1	2.6
1	0	1	15	7.1	10.6	2.4	15.3	7.1	14.2	2.2
1	0	3	13	7.5	10.0	2.0	18.9	7.1	13.9	2.1
0	0	1	14	7.0	9.5	2.0	18.2	6.9	14.8	2.0
1	1	1	14	7.7	12.4	2.8	18.0	7.2	18.6	3.0

Regarding dry matter weight in case of non-shading plot, the best result was obtained from the plot having soil, cowdung and sand in the ratio 1: 1: 1. The growth with the ratios 1: 0: 3 and 1: 0: 0 was poor.

In case of shading plots, the soil composition ratios such as 0: 1: 0, 3: 1: 0, 1: 1: 0 and 1: 1: 1 were good. However, the plots such as 0: 0: 1 and 1: 0: 3 and 1: 0: 1 gave poor growth.

In comparison between non shading and shading, in generally, the shading plots have shown rather good growth, however, as regards ratio of dry matter, the shading plots were 13 % against 18 % of non-shading plots. From this result,it can be said that the shading can give feeble and succulent growth of plots.

The physical properties of nursing soil were presented in Table 16.

Table 16 The physiological properties of nursing soil (%)

Soil	Cowdung	Sand	Solid phose	Liquid phase	Gaseous phase	Pore space
1	0	0	48	29	23	52
3	1	0	40	29	31	60
1	1	0	39	37	24	61
1	3	0	25	37	38	75
0	1	0	21	48	30	78
3	0	1	47	30	23	53
1	0	1	45	32	24	56
1	0	3	40	34	26	60
0	0	1	37	33	30	63
1	1	1	38	36	25	61
Original soil			52	43	5	47
Original sand			43	41	16	57

The gaseous phase of original soil and sand collected from site were tremendously low status. However, when it was mixed with higher ratio of cowdung and sand the liquid phase and gaseous phase were very effective.

Especially, it was very effective when the soil was mixed with cowdung.

Conclusion:

As seen in the results of experiment No. 1, the all tested 12 varieties grown vigourusly in the higher does plot, the content of nitrogen and potassium also were higher in the higher does plots. In view of the result of experiment No. 3, it can be said that the best growth was obtained from the plot which applied 20 mg of nitrogen to 100 g of soil. On the assumption that the same does applied into field having 10 ares with 10 cm deep, it bulk density come to 1.58, it means as good as has applied 32 Kg of nitrogen into 10 ares.

According to the conclusion of S. Razia and M.S. Islam[13], it has reported that amount of nitrogen application should be examined higher than dose as 15 Kg/10 ares which of their the highest designed dose when they had examined on 6 different doses of nitrogen level ranged between 0 - 15 Kg/10 ares, and applied two equal installment at 20 days and 60 days after setting of plants.

However, as the results of experiment No. 1 and No. 3, it has been

fairly recognized that the growth was declined on 10 days after of setting in plots of low nitrogen level in experiment No. 1 and also checked on 14 days after setting in 0 level in experiment No. 3.

Therefore, these facts indicated that nitrogen need supply as basal application with rather higher dose.

Furthermore, as seen in the result of experiment No. 1 very high iron content was found in the upper leaves sample in low fertilizer level plots, and plant growth became extraordinarily poor as compared with that in high fertilizer level ones at the later stage. Generally, it was known that if root has been lost its activity by the reason of less fertilizer and/or excess moisture in the soil, the iron has been absorbted by root and accumlated at the upper leaves. It is, therefore, considered that low fertilizer reduced not only nutrient level in the plant but also root tolerance against wet damage derived from excess irrigation. Special care is ineviatable for avoiding excess irrigation in low fertilizer cultivation which is quite common in Bangladesh. So long as apply high fertilizer, both of growth and root activity can be maintained vigourously and longer period.

As mentioned as above, it come to the conclusion that the adequate basal application of nitrogen is 30 Kg per 10 ares (in Urea equivalent, either 267 Kg/acre or 667 Kg/ha).

With regard to the top dressing of nitrogen, it can be said through the results of experiment No. 1 that first top dressing should be carried out on 30 days after setting with the interval of 30 days from the last at rate of 10 Kg/10 ares of nitrogen seems to be most effectual measures, because of, EC level of lower soil layer in high dose plot has fallen upto 0.16 mυ/cm.

However, it is still necessary to further study on amount of top dressing and interval of implementation for final conclusion.

By results of experiment No. 2, it was revealed that the effect of non phosphorus application had the most severe effect upon the eggplant growth. On the other hand, the content of phosphorus in upland soil of Joydebpur has been found remarkably low figure as value of 3 mg/100 g of soil as shown in Table 11. It is, therefore, considered that the application of phosphorus especially in this area is the most essential matter for sound and vigour growth of eggplant. The adequate application amount of phosphorus which usually does not leach, can be though at rate of 10 Kg/10 ares (in TSP equivalent 267 Kg/acre) as it fit amount.

Also potassium needs to examine furthermore henceforth, however, it can

be considered that its absorptive quantity might be higher than nitrogen, because of, the content of potassium was much higher than that of nitrogen. Therefore, the application amount of potassium is considered as good as that of nitrogen, accordingly, potassium has been known that as absorbed lavish-lavishly. In regard to calcium, magnesium and sulphur, it could not be recognized their effect upon growth of seedlings, by reason of rather high content of them in soil and/or irrigation water in Joydebpur area. However, the content of calcium in leaf has been found to decline in non-calcium plot according to the leaf analysis test. And, in case of non-magnesium plot, it also was found that was not only low content of magnesium but also content of calcium have reduced. Generally, it was well known that calcium is hardly ever move at inside of plant body once it had been absorbed.

Therefore, the deficiency symptom of calcium occurs either on fruit or at growing point usually. On the other hand, the deficiency symptom of magnesium make it a rule to find at lower leaves, because, magnesium moves easily to growing point from lower leaves when it can't be supplied constantly or efficiently, especially in case of eggplant. By means of these matters, the effects of less application of calcium and magnesium will be conjected that will be occured at after the climax growth stage.

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