STUDIES ON THE GENETICAL ASPECTS FOR IMPROVEMENT OF POINTED GOURD

(*Trichosanthes dioica* **Roxb.**)

A Thesis
Submitted to the
Bidhan Chandra Krishi Viswavidyalaya
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in
HORTICULTURE

BY

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Dedicated to

Whom I dare to dedicate

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CERTIFICATE

This is to certify that the work recorded in the thesis entitled **"Studies on the genetical aspects for improvement of pointed gourd (*Trichosanthes dioica* Roxb.)"** submitted by Sri Anupam Pariari for the award of the Degree of Doctor of Philosophy in Horticulture of the Bidhan Chandra Krishi Viswavidyalaya, is a faithful and bonafide research work carried out under my personal supervision and guidance. The result of the investigation reported in the thesis have not so far been submitted for any other Degree or Diploma. The assistance and help received during the course of investigation have been duly acknowledged.

(T. K. MAITY)

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Despite of constraints, in the last four decades of post-independance era Indian Agricultural Scientists have achieved a glorious development in the field of Agricultural Research, but surprisingly the minimum dietary needs of a common Indian still not been met due to low production of the 'protective supplementary food' i.e., vegetable. Though a number of varieties with high yielding ability have been evolved in some major vegetable crops to cope up with the increasing demand of the market, a few nutritive vegetable crops with higher yield potential is still in dark in the field of research. This unfortunate situation led me to do some basic research leading to the improvement of such a common vegetables like pointed gourd.

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CHAPTER-I

Introduction

INTRODUCTION

Pointed gourd or Parwal (*Trichosanthes dioica* Roxb.;2n=22) a dioecious semi-perennial creeper of Cucurbitaceae family grown extensively in the Eastern part of India, is one of the most nutritive, wholesome and highly accepted vegetable. The fruit (botanically known as pepo') is used in different vegetable preparations and the leaves with tender shoots for preparation of soups for convalescents. The vegetable is easily digestible, diuretic and laxative; envigorates heart and brain and is useful in disorder of the circulatory system (Yawalkar, 1985). The decoction of the stalk is a good expectorant. According to Choudhuri (1967), each 100 gm of fruit contains protein (2g),Potassium (83 mg), Phosphorus (40 mg), Calcium (30 mg), Vitamin A (255 I.U.) and Vitamin C (29 mg).

The crop is commonly cultivated in Bihar, Uttar Pradesh, Assam and West Bengal (Nath & Subramanyam, 1972). In Uttar Pradesh it is regarded as the 'King of vegetables'. The area under cultivation is about 10,000 ha in Uttar Pradesh and 14,000 ha in North Bihar (Singh, 1989). At present, the farmers of Orissa, Madhya Pradesh, Maharastra and Gujarat are gradually adopting its cultivation due to some special advantages:-

1) Unlike most other cucurbits the crop is propagated asexually (i.e. through vine or root-cutting). So varietal purity can easily be maintained.

ii) Once planted, the crop may be kept in the field profitably for 2-3 years. The fruiting starts in the very first year, if vegetatively propagated and the economic yield can be obtained upto 6-7 months at a stretch in each year.

iii) Crop protection is easier due to comparatively less incidence of disease and pest.

iv) Weed management is also easier as the overlapped vines itself cover the ground rapidly and smother the weeds.

Pointed gourd is considered to be the native of India, specially Assam-Bengal area is assumed to be the primary centre of Origin (Choudhury, 1967). De Candolle wrote that the species of *Trichosanthes* are all of the Old World and considered Indian origin as the most probable one, especially in case of pointed gourd (Seshadri,1986).

In pointed gourd there is no recognised standard variety. Due to continued vegetative propagation and judicious selection a large number of cultivars and forms having restricted local distribution have been accumulated in different growing areas. Extensive variation in this crop have been observed in Assam-Bengal region, North India and Bihar. The fruits of these cultivars are available in the market under different local names without any uniformity and standardisation in nomenclature. Based on morphological variations (Shape, size and striation) of fruits Seshadri (1986) grouped the plants into 4 major types:

i) those that bear 10-13 cm long, dark green fruits with white stripes.

ii) 10-16 cm long, thick, dark green fruits with very faint stripes and pale green in colour.

iii) small 5-8 cm long roundish dark green and striped fruit.

iv) small fruit tapering towards end, green and striped.

Sometimes these clones give very poor yield and commercial acceptability of those types are also low leading to poor income of the farmer. So varietal improvement of the crop is very much essential in the present context.

The usual vegetative propagation provides unique advantages and opportunities in the breeding of this crop. A single outstanding plant selected from a population may form a basis of new variety where genotype of the plant is not important; since there would be no further sexual reproduction. Selection may be exercised among the assembled germplasms for the created variability (Som *et al.*, 1993). The extent of genetic variability in a crop is of paramount importance for its improvement. The assessment of variability present in the crop helps for successful utilization of plant characters in suitable varieties for yield and stability. Characters with high degree of positive correlation to yield should be given due weightage.

Therefore, a survey or knowledge of available variability for desired traits enables a breeder to determine the best one.

Pointed gourd is commonly propagated through root and vine-cuttings. To evolve a new variety by breeding, seed propagation is essential. But, the sexual method of propagation i.e. through seed has some limitations (Seshadri,1986) mainly because of :

i) seed germination is poor and also seeds lose viability soon.

ii) about 50 per cent plants become male i.e. non-bearing.

iii) seedlings generally take 2-3 years for flowering and fruiting.

iv) varietal purity can never be maintained as it is a highly cross- pollinated crop .

As the crop is cross-pollinated the seedlings show a wide variation in different growth and yield attributes. Most of the seedlings will be inferior or *at par* with mother plant except a few which will be better in some respect. The type i.e., better one over mother plant may be identified from the population of seedling segregates to be considered as a variety. For perpetuation of the variety, the plant should be propagated vegetatively in the successive years. By this way the improvement of the crop can be done.

One of the limitations of the seed propagated crop is the late flowering and fruiting. Earliness in flowering and fruiting can be obtained by application of different growth regulating chemicals as observed by several workers in a number of vegetable crops. In cucurbitaceous crops, these chemicals can also modify the sex of a crop. Information on the application of growth regulating chemicals in this regard in pointed gourd are very much limited. It is, therefore, suggested to undertake a study on the induction of flowering and fruiting by application of those chemicals in the seedling segregates of this crop so that selection work can be enhanced to a great extent.

With the above objectives in view, it is considered worthwhile to undertake the following experiments in pointed gourd for the genetical improvement of the crop:

i) Evaluation of germplasms.

ii) Selection of seedling segregates for better plant type with high yielding ability.

iii) Studies on flowering and fruiting behaviour in seedling segregates by growth regulator applications.

CHAPTER-II

Review of Literature

REVIEW OF LITERATURE

Available literatures on the genetical aspects for improvement of pointed gourd were not so much, as the crop was neglected in the field of research even in the last decade. Asexual propagation provides unique advantages and opportunities in the breeding of this crop. A single outstanding plant selected from a population may form the basis of a new variety where genotype of the plant is not important since there would be no further sexual reproduction. Selection may be exercised among the assembled germplasms or among the created variability.

The assessment of variability present in the crop helps for successful utilization of plant characters in developing suitable varieties for yield and stability. Shadque *et al.* (1986) studied the genetic variability in pointed gourd cultivar collected from different parts of Eastern India and observed significant variation existed for yield and yield contributing characters.Among those main creeper length, leaf number per plant, days from bud initiation to edible fruit maturity, fruit yield per plant, fruit volume and seed number per fruit exhibited high genotypic co-efficient of variation. They opined that selection would be effective for fruit number per plant and fruit volume as well. High heritability coupled with high genetic advance was revealed for fruit length, fruit volume, fruit yield per plant, shoot number per plant, primary branches per plant, fruit number per plant and skin thickness suggesting the conditioning of these characters by additive gene action, hence, proved their reliability for effective selection (Singh *et al.* 1985).

Direct phenotypic selection for yield in any crop may not be very effective and involves genotypic differences as yield is generally associated with other components. Singh *et al.*(1986) opined that fruit yield is positively and significantly correlated with fruits per plant and vine length, whereas Singh *et al.*(1987) recorded strong positive correlation with fruit yield per plant to length, diameter and weight of fruit.A significant positive correlation between yield per plant and fruit number per plant was observed by Singh and Prasad (1989) indicating their possibility for selection in an effective selection programme in order to improve yield of the respective crop. Sarkar *et al.* (1990) concluded fruit weight as the most important fruit yield component followed by fruit diameter, fruit volume and primary branches per plant.Prasad and Singh (1990) reported that higher yield was correlated with late flowering and seed number per fruit and had direct correlation with fruit weight.

From the above discussions, different fruit characters namely weight, length , volume and number of fruits per plant emerged as most important yield attributing characters. Hence, due weightage should be given on these characters in the breeding programme for improvement of pointed gourd. Revelation of positive correlation between yield and late flowering is not desirable from a plant breeder's point of view and a compromise between these character becomes thus evident to strike a proper balance. Similarly, direct correlation between seed number in a fruit and fruit weight needs to be altered so as to get proper fruit weight without having higher number of seed in it.

The existing clones of pointed gourd are obviously heterozygous; so the seeds would invariably produce segregated seedlings. Selection of an outstanding plant from the segregated seedling population may fix the desirable variant.Information relating to this aspect of the crop is very meagre. Only a preliminary information was first reported by Sarkar (1989). He initiated the work with 476 seedlings during 1986-87 and observed no flowering in any seedling segregate during the first year; while recorded 12.91 per cent in the second year and 98.51 per cent in the third year of his experimentation. Out of the seedling segregates flowered, the sex ratio was observed 1:1.15 (Female : Male). Though few types were found to be better over mother plant, their yield potentiality was not systematically evaluated.

The question of sex expression and sex ratio is of great interest in most of the cucurbitaceous crops having the monoecious sex-form, which bear male and female flowers separately on the same plant. The flowering behaviour and mode of sex expression in those plants are mostly hereditary and controlled by genetic factors. So, the principle of sex modification in cucurbit through application of growth regulator lies only in altering the sequence of flowering and sex-ratio as well.Appearance of flower in the plant though depends largely on environmental conditions, application of certain plant growth substances can modify it alongwith their sex expression to some extent.

But in a dioecious crop the sex is fixed and cannot be modified by any means. Hence the only interest here is to induce flower early by plant growth substances. Information relating to the early flower induction in dioecious cucurbits is very much limited, more particularly in seedling segregates of pointed gourd. The releavant literatures relating to the effects of plant growth regulators on different cucurbits were reviewed and presented below:

Pointed Gourd:

Dubey and Nair (1972) observed that NAA (100-500 ppm) induced parthenocarpic fruit set in pointed gourd (*Trichosanthes dioica* Roxb.) cv. White Oval. The maximum set of 80 per cent occured in response to treatments at 200 and 300 ppm; but at the higher rates it declined to 70 per cent, which was similar to the result of fruit set by hand pollination. Fruit size and weight increased progressively with NAA concentration to a maximum weight of 10.76 g at 500 ppm in comparison to 16.0 g for hand pollinated fruit. Treatments with 2, 4, 5-T and IAA at rates of

25-100 ppm were also effective.

Sarkar *et al.*(1989) studied the effect of GA_3, IAA, Ethrel and CCC on induction of flowering in seedling segregates of pointed gourd. The longest vines and internodes were obtained with GA_3 (200 ppm), whereas IAA (100 ppm) produced the highest number of branches per plant. Application of GA_3(50 ppm) and IAA (25 ppm) resulted flowering in 40.0 and 31.66 per cent plant against no flowering in control during the first year of experimentation. The per cent of total population which flowered in the second year were 58.33, 55.0 and 13.33 for the same treatments respectively. Plants in control had a sex ratio (Female:Male) of 1:1 , while sex ratio was increased upto 1:0.33 by both the Ethrel (50 and 100 ppm) tretments. Treatment with GA_3 (50 ppm) resulted emergence of first flower at lower node during both the years. The highest yield per plant, however, was obtained when the seedlings were treated with IAA (25 ppm) .

The transition from vegetative to reproductive phase of pointed gourd was accompanied by a significant increase in the level of GA_3 (Sarkar and Dutta, 1990). The increase in GA_3 in androecious individuals and branches was higher than that in gynoecious ones.

Kakrol:

Ali *et al.*(1991) in a trial on another dioecious cucurbit kakrol (*Momordica dioica* Roxb.) found that seed originated plants had a ratio of 1:1 (Male : Female). The use of ethephon on the male plant was not effective in converting the sex. Application of $AgNO_3$ (300-600 mg/l) to the female plant was effective in inducing bisexual flowers.

Cucumber:

In cucumber (*Cucumis sativus* L.), Verma (1969) reported MH (200 ppm) applied at 1 to 2-leaf stage and again at 3-to 4-leaf stage increased the number of female flowers, number of fruits and total weight of fruits per plant over other growth substance treatments including control. Rodriquex and Lambeth (1972) observed MH and ethephon inhibited growth and induced femaleness when applied to foliage at 500, 200 and 100 ppm, respectively. Foliar sprays of GA_3 (1500 ppm) stimulated growth and increased maleness.

In a trial with cucumber cv. selection 9307, Ethrel (upto 500 ppm) delayed male flowering by a maximum of 14 days while advanced the induction of female flowers upto 9 days in comparison to the untreated one i.e. control.Number of male flowers was also reduced and in contrary, number of female flowers increased by the same treatment. Though yield differences was less due to greater fruit drop,higher Ethrel concentrations were found to be more detrimental (Bhandary *et al.*, 1974). From a study on the effect of Ethrel application to the formation of female and male flowers and productivity of cucumber Ejsmond (1974) observed increased number of female and significantly reduced number of male flowers by Ethrel application. The treatments, however, had no effect on earliness or yield, but shortening of the internodes was marked .

In another experiment Santos and Lopes (1981) reported that NAA reduced the number of male flowers and increased the female flowers of cucumber, whereas, GA_3 showed the opposite effect. Again, the number and weight of fruit with vine length as well increased by NAA , but GA_3 decreased those . Patil *et al.* (1983) also studied the modification of sex expression in cucumber. Young plants of cucumber cv. Khira were sprayed with GA (5-25 ppm), MH (100-400 ppm) or Ethrel (100-400 ppm) at 2 to 3 true leaf stage and the highest percentage of female flowers was found on plants treated with ethephon (400 ppm) and the lowest on those treated with GA(25 ppm).In another experiment Patil *et al.* (1984) used different plant growth regulators in changing the position of male and female flowers in cucumber and found GA (25 ppm) enhancing male flower to appear on first node, while Ascorbic Acid and MH (100 ppm) had no effect on position of male flower. GA caused female flower to appear on higher nodes whereas ethephon had the opposite effect. But Ascorbic Acid or MH produced no significant effect in this regard. GA also increased the number of male flowers whereas ethephon increased the number of female flowers. Singh and Singh (1984) observed earlier appearance of female flower in respect to number of days and node number with more female flower than male when seedlings of cucumber were sprayed with NAA (25-100 ppm), ethephon (50-150 ppm), though ethephon(100 ppm) gave the best result. Again

Talalova (1984) found in cucumber that ethephon (200, 300 and 400 mg/l) shortened stem, reduced lateral branching, increased female flower and yield as well. The best result relating to suppression and delay in the production of male flowers and, advanced and increased production of female flowers per plant resulting more yield in cucumber with the spraying of ethephon(100 ppm) was reported by Ratnapala and Silva (1989).

Melons:

The seedlings of muskmelon (*Cucumis melo* L.) was treated with Ethrel (25, 50, 100, 250 or 500 ppm) and it was found that increasing concentrations reduced vine length, increased the number of internodes, delayed the appearance of staminate flowers by upto 14 days and hastened pistillate flowers by upto 4 days . Ethrel(250 ppm) treatment induced the greatest number of pistillate flowers and altered the male:female ratio from 59.58:1 in untreated plants to 22.25 :1 (Sulikeri and Bhandary, 1973).

Pumpkin and Squashes:

Arora *et al*. (1982) conducted a two years field trial to study the effect of various plant growth regulators on vegetative growth, sex expression and fruit yield in summer squash (*Cucurbita pepo* L.)cv. Hissar Selection 1. The plants were treated with several growth regulators at 2- and again at 4-true leaf stages. The greatest stimulation of growth was obtained with GA (10 and 25 ppm) whereas Ethrel (100 and 250 ppm). inhibited the growth. Ethrel,however, especially at the higher rate, induced the formation of female flowers and increased the average yield from 1.112 kg in the control to 2.434 kg per plant. Treatments with MH, NAA and GA gave intermediate results.

Krishnamurthy and Sandooja (1982) noticed that the number of female flowers in *Cucurbita pepo* L. markedly decreased at all NAA (125-500 mg/l) concentrations. The number of female flowers was highest in the control plants. Matlob and Basher (1983) observed that application of Ethrel (150-600 ppm) and MH (100-400 ppm) were applied to summer squash cv. Mullah Ahmed suppressed staminate flowers, enhanced pistillate flower development, lowered the node position of first pistillate flowers, increased the number of pistillate flowers and increased the pistillate to staminate flower ratio. From a green house trial on summer squash cv. Vegetable Spaghetti Edelstein *et al.* (1984) found that staminate flowers were markedly delayed by ethephon particularly at higher concentrations (300 and 600 ppm). In general, ethephon also reduced length of internode and plant height, but the number of internode remained unaffected.

From a two-year study on the effect of growth retardants and Ethrel on fruiting and yield in pumpkin (*Cucurbita maxima* Duch.) Verma *et al.* (1987) reported that Ethrel (100 ppm) was most effective in inducing flower at lower nodes compared to all growth retardants as well as control. Arora and Partap (1988) and Arora *et al* (1989) recorded maximum vine length, earliest male flower at lowest node number and highest number of seed per fruit in pumpkin when the plants were sprayed with GA_3 (25 ppm).On the contrary, ethephon (250 mg) treated plants produced the highest number of secondary branches, the earliest occurrence and highest number of female flowers, the lowest sex ratio (male: female) with a maximum yield.

Bottle gourd:

Choudhury and Babel (1969) conducted an experiment on the growth and sex expression of bottle gourd [*Lagenaria siceraria* (Mol) Standf.] using growth regulators GA, MH and NAA. The treatments GA (50 ppm) , MH (10, 25, 50 and 100 ppm) , NAA (50 ppm) significantly increased the number of female flowers over control. There was a significant suppression of male flowers was marked in plants sprayed with MH (50 and 100 ppm) , NAA (50, 150 and 200 ppm), whereas significant increase was observed with GA (50 ppm) and MH (10 ppm). All the treatments gave increased fruitset with the exception of NAA (200 ppm). The weight of the individual fruit was found to be highest with the treatment MH (100 ppm). All the treatments except GA (50 ppm) produced longer fruits than control, the treatments which significantly increased the girth of individual fruit were GA (50 ppm), MH (10, 25, 50 and 100 ppm) and NAA (150 and 200 ppm).

A study on the effect of MH on vegetative growth, flowering and yield of bottle gourd was conducted during the rainy and summer seasons of 1979 and 1980, respectively by Arora *et al.*(1982). MH (150 mg/l) had a profound effect on the earliest appearance of pistillate flowers at the lowest node number. The male : female ratio was lowered with MH (50 mg/l) and was found to be most effective in producing the maximum number of fruits and fruit weight per plant and ultimately the yield, whereas GA_3, NAA and Ethrel did not influence yield.

Arora *et al.*(1985)studied the influence of some chemicals on bottle gourd cv. Pusa Summer Prolific Long and reported earlier flowering by MH (150 mg/l) over control, whereas NAA (50 mg/l) delayed flowering. Mandal *et al.* (1990) also studied the response of bottle gourd to some growth regulator and found Ethrel (10 or 20 ppm) to be most effective to increase different yield attributes as well as yield.

Bitter gourd:

Spraying bitter gourd (*Momordica charantia* L.) cv. Karala plants with Ethrel, Ghosh and Basu (1983) observed inhibition of flowering with the number of male bud decreasing progressively as the concentration increased from 25 to 100 mg/l. Ethrel (25 mg /l) increased female flowers, but at 100 mg/l the number was decreased. Application of GA (20 to 40 mg/l) increased only the female flowers . GA application at all concentration reduced the ratio of male:female flowers.

In a two years field trial it was observed that application of NAA (10 or 20 ppm), 2,4-D (5 or 10 ppm), MH (100 or 200 ppm), Ethrel (100 or 200 ppm) or CCC (250 or 500 ppm) at 2 or 4 leaf stage of bitter gourd cv. Pusa Do Mausmi decreased vine length, leaf area and number of male flowers. But on the other hand, those treatments increased number of female flowers and reduced the male: female ratio resulting and increased total yield (Kabir *et al.* 1989).

Snake gourd:

Suppression of male flowers in snake gourd (*Trichosanthes anguina* L.) by the application of CCC (500 and 1000 ppm) was evidenced by Ghosh and Bose, (1970), but higher concentration (2000 ppm) of this chemical increased femaleness. Pistillate flower production, fruit per plant,fruit size and yield of this crop were increased and time taken for induction of the first flower was reduced by Ethrel (Ramaswamy *et al.*, 1976). The best result ,however, was obtained at Ethrel (150 ppm.)

Sponge gourd and Ridge gourd:

Dubey (1983) studied the efficacy of MH (100-400 ppm), Ethrel (125-500 ppm) or NAA (50-200 ppm) to sponge gourd (*Luffa cylindrica* Roxb.) cv. Pusa Chikni applied at 2-4 true leaf stage. Vine length was stimulated by NAA, whereas MH and Ethrel inhibited it . All the treatments except MH (400 ppm) stimulated branching. Ethrel (250 ppm) enhanced the production of pistillate flowers resulting in the highest yield of 10.16 kg per 12 sq. m. plot compared to 7.8 kg in the next best treatment (NAA 200 ppm) and 2.68 kg in the control. In a two-years trial with Sponge gourd cv. Pusa chikni Arora *et al.* (1989) reported that application of cycocel (250 or 500 mg/l) to the foliage 30 and 45 days after sowing or soaking of seeds for 24 hours before sowing reduced the main vine length, length of internode and sex ratio (M:F) as well in comparison to the control. The highest average yield of 1.171 kg per plant was obtained with seed soaking alone at 250 mg/l.

In another experiment on ridge gourd (*Luffa acutangula* Roxb.) during rainy and summer seasons Arora *et al.* (1987) found that GA (25 mg/l) stimulated elongation of main shoot while Ethrel (100 mg/l) induced branching. Staminate flowers at lower nodes appeared early in plants treated with GA (25 mg/l), MH (150 mg/l) or TIBA (100 mg/l). Ethrel (100 mg/l) markedly advanced the appearance of pistillate flowers at the lower nodes but only during the rainy season. Male:Female ratio was lowered by Ethrel (100 mg /l) and it was most effective in producing the maximum number of fruits fruit weight, early and total yield of plant , though GA, MH, NAA and TIBA did not influence the yield.

CHAPTER–III

Materials and Methods

MATERIALS AND METHODS

The experiments were conducted during 1990-91, 1991-92 and 1992-93 at Horticultural Research Station, Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal to study the genetical aspects for improvement of pointed gourd. The location of the farm is 23.5°N latitude and 80°E longitude with an average altitude of 9.75 m above mean sea level.

CLIMATIC CONDITIONS:

The locality, where the experiments were carried out had a tropical and humid climate. The climatic conditions during the period of experimentation were presented in Table I. The temperature began to fall down from the end of November with the minimum in January and began to rise again from the end of February with the maximum in April in each year. Rainfall was rare during winter-months, though not so uncommon. Maximum rainfall was observed in June-July and minimum during summer and winter months. Relative Humidity ranged between 34 to 98 per cent.

SOIL:

The soil of the experimental site was fertile, sandy loam with good water holding capacity. For analysis, composite soil samples were taken from a depth of 30 cm before final land

TABLE I: METEOROLOGICAL DATA OF THE EXPERIMENTAL SITE DURING THE PERIOD OF EXPERIMENTATION.

Month	AVERAGE TEMPERATURE(°C)								AVERAGE RELATIVE HUMIDITY (%)								TOTAL RAIN FALL (mm)			
	Maximum				Minimum				Maximum				Minimum							
	1990	1991	1992	1993	1990	1991	1992	1993	1990	1991	1992	1993	1990	1991	1992	1993	1990	1991	1992	1993
January	-	24.4	24.6	24.4	-	11.9	11.6	11.7	-	88.0	88.4	89.1	-	47.0	49.9	41.0	-	44.0	08.4	Nil
February	-	30.3	27.0	28.9	-	16.8	14.4	16.9	-	87.0	87.1	85.7	-	42.0	39.3	50.2	-	18.4	103.2	Nil
March	-	34.1	34.5	30.9	-	20.3	20.9	18.6	-	85.0	85.5	80.7	-	47.0	31.6	36.9	-	43.2	Nil	76.6
April	-	36.5	38.1	34.4	-	23.5	23.6	23.1	-	81.1	82.7	83.7	-	42.9	31.8	50.9	-	09.6	07.8	47.4
May	-	36.1	35.1	33.3	-	26.0	24.1	24.6	-	84.3	86.9	83.9	-	54.4	59.2	59.9	-	99.2	141.2	148.5
June	-	33.8	34.3	32.2	-	25.9	25.6	25.4	-	87.0	87.5	89.4	-	68.0	67.8	72.0	-	37.0	174.4	341.0
July	-	33.2	32.1	31.4	-	26.1	25.1	25.8	-	86.0	88.7	91.6	-	74.0	74.8	76.2	-	506.6	303.7	344.8
August	-	33.2	32.1	31.9	-	25.8	25.9	25.7	-	89.7	91.8	92.7	-	73.1	74.5	78.4	-	579.6	169.4	312.0
September	-	33.0	31.7	31.4	-	25.4	24.6	24.8	-	90.8	87.9	93.1	-	66.8	70.8	76.9	-	177.0	197.8	373.8
October	33.2	31.2	32.0	-	17.0	23.7	23.1	-	95.0	88.8	89.9	-	34.0	66.9	65.3	-	176.6	100.0	38.4	-
November	32.0	28.1	29.4	-	12.8	17.2	18.9	-	95.0	82.5	85.9	-	39.0	39.8	47.3	-	20.2	Nil	5.2	-
December	27.3	25.9	24.3	-	12.7	16.8	10.9	-	88.0	90.9	87.5	-	41.0	50.4	45.2	-	05.0	28.2	Nil	-

preparation. The result of the analysis of soil sample was presented in Table II.

TABLE II. SOIL-ANALYSIS OF THE EXPERIMENTAL SITE

Sl.No.	Particulars	Value
1	Organic carbon (%)	0.39
2	Total Nitrogen (%)	0.04
3	Available Phosphorus(kg/ha)	32.00
4	Available Potassium (kg/ha)	46.00
5	pH of the Soil	6.00

EXPERIMENT NO.1: EVALUATION OF GERMPLASMS

Twenty-one widely divergent germplasms of Pointed gourd collected from different parts of West Bengal, Bihar and Uttar Pradesh were taken for this study. The details about them were presented in Table III. The experiment was laid out in a Randomised Block Design with three replications. Root-cuttings of both female and male plants at the ratio of 9:1 were planted in each bed on 11th October, 1990. The plants were kept in the same plot for three consecutive years and after each fruiting season the vines were prunned leaving 12 cm from the base to enhance new growth in the succeeding year. Other cultural practices scheduled for cultivation of pointed gourd were done in time which will be described in the following paragraphs.

TABLE III. SELECTED GERMPLASMS OF POINTED GOURD.*

Sl.No.	Code No.	Source
1	BC-1	Kulpi, 24-Parganas (S), West Bengal
2	BC-2	Birsa Agricultural University, Ranchi
3	BC-3	Rakhalmari, Coochbehar, West Bengal
4	BC-4	Sheali, Burdwan, West Bengal
5	BC-5	Dariapur, Midnapur, West Bengal
6	BC-6	Beldanga, Murshidabad, West Bengal
7	BC-7	Dadanpatrabarh, Midnapur, West Bengal
8	BC-13	Ranimararkuthi, Coochbehar, West Bengal
9	BC-15	Debnagar, 24-Parganas, West Bengal
10	BC-19	Madanpur, Nadia, West Bengal
11	BC-22	Birsa Agricultural University, Ranchi,Bihar
12	BC-23	Daulatpur, Midnapur, West Bengal
13	BC-24	Kaksa, Burdwan, West Bengal
14	BC-34	Faizabad, Uttar Pradesh
15	BC-53	Nagardanga, 24-Parganas(N),West Bengal
16	BC-59	Dumka, Bihar
17	BC-60	Faizabad, Uttar Pradesh
18	BC-62	Sabour, Bihar
19	BC-63	Faizabad, Uttar Pradesh
20	BC-64	Sheoraphuli,Hooghly, West Bengal
21	BC-65	Birsa Agricultural University, Ranchi,Bihar

*In the graphical representation (Fig.I,II and III), the germplasms were presented serially with the notations like G1,G2,G3.. G20 and G21.

EXPERIMENT NO.2: SELECTION OF SEEDLING SEGREGATES FOR BETTER PLANT TYPE WITH HIGH YIELDING ABILITY

For raising seedlings, seeds were collected from ripe and healthy fruits of pointed gourd cv. Kajli Bombai, a local one. Three to four seeds were sown in each polythene packet filled up with well rotten cowdung-manure on 18th August, 1990. After a month, 3-4 leaved healthy seedlings were transplanted in the beds. Ten seedlings were accomodated in each bed. A sum total of 600 seedlings were planted in the field for this experiment, though 585 seedlings of those survived ultimately. For comparison, root-cuttings of mother plant were also planted simultaneously in three beds. The plants were kept in the same field for all the three years of experimentation. General cultural practices for raising of the crop were followed in this experiment too.

EXPERIMENT NO.3: STUDIES ON FLOWERING AND FRUITING BEHAVIOUR IN SEEDLING SEGREGATES BY GROWTH REGULATOR APPLICATIONS.

The experiment was laid out in a Randomised Block Design replicated thrice with application of different growth regulating chemicals to the seedlings of pointed gourd raised by the same way. Eight growth regulating chemicals namely IAA (Indole Acetic Acid), NAA (Napthalene Acetic Acid), Ethrel, GA (Gibberellic Acid), IBA (Indole Butyric Acid), Kinetin, CCC (cycocel) and MH (Maleic Hvdrazide) were applied to the seedlings each with two concentrations. In control, only distilled water was sprayed.

Thus there were altogether seventeen treatments in each replication which were presented below:

Treatment No.	Growth regulating chemicals	Concentrations
1	IAA	100 ppm.
2	IAA	200 ppm
3	NAA	25 ppm
4	NAA	50 ppm
5	Ethrel	100 ppm
6	Ethrel	200 ppm.
7	GA	50 ppm
8	GA	100 ppm
9	IBA	25 ppm
10	IBA	50 ppm
11	Kinetin	5 ppm
12	Kinetin	10 ppm
13	CCC	100 ppm
14	CCC	200 ppm
15	MH	50 ppm
16	MH	100 ppm
17	Control(Water spray)	

In the graphical representations (Fig. VIII to XIII, notations like T1, T2, T3....... T16 and T17 were used for the above mentioned treatments.

Required quantity of the chemicals were dissolved in Ethyl Alcohol (95%) separately. The young seedlings were sprayed twice; first at 2-leaf stage and another at one month after the first spray. There were altogether 30 seedlings in each treatment with 10 seedlings in each bed. The plants were kept in the same field for all the 3 years of experimentation and same cultural practices were followed like the earlier experiments.

GENERAL CULTURAL PRACTICES:

A land with good water holding capacity and drainage system in a sunny situation was selected for the experiments. After thorough preparation of land, it was left for seven days for sun-drying to kill harmful soil micro-organisms, if any. During land preparation well rotten cowdung manure @ 20 tonnes per hectare was incorporated to the soil. Raised beds (3m x 3m) of 15 cm high from soil surface were prepared. A space of 75 cm was kept between two beds which served as irrigation cum drainage channel. Ten hills (five hills in each side) were made along the sides of irrigation channel at a spacing of 60 cm between the hills.

A fertilizer dose of 90 kg Nitrogen, 60 kg Phosphorus and 40 kg Potassium per hectare scheduled for pointed gourd cultivation was practised. Full amount of P and K in the form of single super phosphate and Muriate of Potash respectively along with the half dose of Nitrogen in the form of urea was applied at the time of planting of root cuttings or transplanting of seedlings. Rest amount of N was applied in two equal splits at 90 and 120 days after planting. In the subsequent years of experiment, the same schedule was followed. But the fertilizer was applied in three splits. Full dose of P and K alongwith half dose of N was applied as first split during middle of November and the rest amount of N was given in two equal splits 90 and 120 days after first split respectively.

Irrigation was given as and when necessary. In general, plants were irrigated at 10-12 days interval during summer and winter months, but in rainy season it was applied as and when required. To check weed growth water hyacynth as mulching material was used in all beds in the first year of experiment. Subsequent weeding was done manually when needed.

Though there was no serious incidence of pests and diseases, Blitox @ 4g per litre was sprayed at 15 days interval as preventive measures against the incidence of any fungal disease, particularly at rainy season. Harvesting of green and tender fruits started from middle of March and continued upto mid-September in each year. Generally pickings were made at an interval of 6-7 days.

OBSERVATIONS RECORDED:

Experiment No.1: Mean performance of the germplasms during three years of experiment were studied separately.

Observation was recorded on the following characters:

1. Vine Length (m)
2. Length of internode (cm)
3. Number of primary branches per plant.
4. Number of fruits per plant.
5. Fruit length (cm)
6. Fruit diameter (cm)
7. Core diameter (cm)
8. Core diameter : Fruit diameter ratio
9. Fruit volume (c.c.)
10. Number of seeds per fruit
11. Pulp weight (g)
12. Fruit weight (g)
13. Pulp weight : Fruit weight ratio
14. Early yield per plant (kg)
15. Total yield per plant (kg)

Average performances of five female plants of each replication at the end of fruiting season were considered for vegetative growth characters, but for different fruit characters observations were taken from 20 randomly selected fruits at the middle of fruting season from each replication.

Core refers to the inner part of the fruit containing seed and pulp encircled by the flesh.

Early yield is the fruit yield obtained during the first half of the harvesting period.

EXPERIMENT NO.2: In addition to the characters considered for Experiment No.1 (except early yield), observations were also recorded on Number of plants (seedling segregate) flowered in different years and Sex Ratio .

EXPERIMENT NO.3: The data were recorded on :

1) Vine length(m)
2) Length of internode (cm)
3) Number of primary branches per plant
4) Node-number for the appearance of first male and female flower.
5) Percentage of plants flowered
6) Percentage of male and female plants.(i.e. sex-ratio).
7) Total number of female flowers per plant.
8) Number of fruits per plant.
9) Fruit weight (g)
10) Yield per plant (Kg)

STATISTICAL METHODS:

For Experiment No. I general analysis of variance was done with the mean of three years' pooled data for all the characters of the germplams along with their correlations. Individual year was analysed as per usual method for analysis of variance for Randomised Block Design (Panse and Sukhatme, 1978). The combined analysis has been made like a split plot experiment considering year as main plot (Verma et al. ,1987). The ANOVA for pooled analysis is presented below :

Source	Degrees of Freedom (d.f.)	Mean Sum of Squares (MSS)	Error mean sum of squares (EMS)
Year	y-1	MS_Y	$\sigma_e^2 + r.g.\ \sigma_e^2$
Replication within year	y(r-1)	MS_R	--
Genotype	g-1	MS_G	$\sigma_e^2 + r\ \sigma_{ge}^2 + ry \left[\Sigma ig i^2 /(g-1) \right]$
Genotype X Year	(g-1)(y-1)	MS_{GY}	$\sigma_e^2 + r.\sigma_e^2.ge$
Error	y(r-1)(g-1)	MS_E	σ_e^2

Where σ_e^2 and σ_g^2 represent environmental and genotypic variances respectively.

Genotype X Year interaction has been tested against pooled error. If the interaction was absent the interaction sum of square was combined with pooled error to get a fresh estimate of the pooled error. If the interaction was found significant, the genotype was tested against the interaction and interaction mean sum of square has been estimated as pooled error.

Genotypic variance, Phenotypic variance and percentage of heritability were calculated as per formula suggested by Hanson *et al*. 1956:

$$\text{Genotypic variance } (\sigma_g^2) = \frac{MS_G - MS_{GY}}{r.y}$$

$$\text{Phenotypic variance } (\sigma_p^2) = \sigma_g^2 + \sigma_e^2$$

$$\text{Percentage of Heritability (in broad sense)} = \frac{\sigma_g^2}{\sigma_p^2} \times 100$$

For Experiment No.3, individual year was analysed with the usual method for analysis of variance for Randomised Block Design suggested by Panse and Sukhatme, 1978. Data on percentage of flowering and sex expression was calculated with their angular values (Fisher and Yates, 1963).

CHAPTER–IV

Results and Discussion

RESULTS AND DISCUSSION

The results obtained in three experiments are presented below with discussions:

EXPERIMENT NO.I: EVALUATION OF GERMPLASMS

The experiment was conducted for three consecutive years i.e. 1990-91, 1991-92 and 1992-93 at the Horticultural Research Station, Mondouri, Nadia (West Bengal) to evaluate the performances of germplasms collected from different regions of the country. The results obtained in the experiment are presented below:

VEGETATIVE GROWTH CHARACTERS

Observations on vegetative growth characters like vine length, length of internode and number of primary branches per plant are represented in Table IV and Figure I (Ia,Ib and Ic). Analysis of variances of yield and other morphological characters are shown in Table V. The correlation studies among all the characters are presented in Table VI. Observations on phenotypic variance, genotypic variance and percentage of heritability are shown in Table VII.

TABLE IV: PERFORMANCES OF GERMPLASMS OF POINTED GOURD ON VEGETATIVE GROWTH CHARACTERS

Sl No.	Germplasms	Vine length (m)				Length of internode (cm)				No. of Primary branches per plant			
		A	B	C	Mean	A	B	C	Mean	A	B	C	Mean
1	BC-1	4.41	4.89	5.77	5.02	6.23	6.21	6.24	6.23	2.66	5.13	5.34	4.38
2	BC-2	2.58	3.00	3.50	3.02	5.27	5.28	5.25	5.27	2.45	4.41	4.86	3.91
3	BC-3	2.80	3.40	3.81	3.33	5.44	5.39	5.43	5.42	4.62	6 54	6.73	5 96
4	BC-4	3.63	5.03	5.82	4.82	7.34	7.36	7.36	7.35	3.06	5.06	5.26	4.46
5	BC-5	3.81	4.83	5.02	4.55	7.86	7.90	7.88	7.88	5.03	6 13	6.66	5.94
6	BC-6	3.64	4.74	5.52	4.63	5.41	5.44	5.43	5.43	5 36	6.34	6 59	6.10
7	BC-7	3.31	5.63	6.16	5.03	6.10	6.13	6.11	6.11	3.16	6.23	6.38	5.26
8	BC-13	2.73	4.00	4.46	3.73	5.16	5.17	5.17	5.17	4.62	6.34	6.46	5.81
9	BC-15	4 73	5.14	5 45	5.10	8.14	8.11	8.13	8.13	2 84	5.16	6.18	4.73
10	BC-19	4.53	6.24	7.13	5.96	5.63	5.63	5.60	5.62	4 33	5.85	6 00	5 39
11	BC-22	2.31	3.33	3.76	3.13	5.30	5.33	5.29	5.31	3 13	4.46	5 00	4.20
12	BC-23	4 05	5.92	6.42	5 46	5.13	5.16	5.13	5 14	6.19	7.06	7 13	6.79
13	BC-24	4 55	6.53	7.22	6.10	4.76	4.80	4 78	4 78	5 89	7 83	7 86	7.19
14	BC-34	3.23	3 51	3.76	3 50	3.96	4.00	3.96	3.97	3 86	4.16	4 23	4.08
15	BC-53	4.91	5 94	6 66	5.83	5.38	5.40	5.39	5 39	4.23	6.00	6.12	5 45
16	BC-59	3 42	4 20	4.77	4 13	6.03	6 06	6 00	6.03	2 33	4 16	5 13	3.87
17	BC-60	2.14	2.72	3.00	2.62	7.16	7.13	7.16	7.15	3.54	4.26	5.13	4.31
18	BC-62	3 21	3 87	4.02	3.70	5 30	5.33	5.31	5.31	3.03	3.76	4.73	3 84
19	BC-63	2.33	2.81	2.86	2 66	6.84	7.00	6.88	6.91	2.19	3.26	3.53	2.99
20	BC-64	3.61	5 50	5.82	4.97	5 16	5.14	5.16	5.15	3.77	4.52	4 81	4.36
21	BC-65	2.72	3.43	3.75	3.30	8 23	8.20	8.19	8.21	2.11	3.43	4.12	3.22
		I	II	III	IV	I	II	III	IV	I	II	III	IV
S.Em ±		0.023	0.11	0.054	0 04	0.045	0.007	0.11	0.078	0.75	0.28	1.84	1 306
CD at 5%		0.064	0.38	0.153	0.112	0.125	0.024	0.383	0.218	2.09	0.97	5.17	3.65

I : Germplasms (Genotypes)
II : Year (Environment)
III: Two genotypes within same year
IV : Two genotypes not in the same year (Genotype x Environment)

A: 1990-91
B: 1991-92
C: 1992-93

Vine Length:

It revealed from Table IV that the germplasms varied significantly in each year in relation to vine length and the maximum vine length of each germplasm was recorded in the third year of experimentation (Fig.Ia). Interestingly, the germplasms collected from different parts of West Bengal produced longer vines than the types collected from other states. Probable reason behind the poor growth of those germplasms in the first year was their slow adaptation to the changed situation. In the first year, BC-53 produced the maximum vine length of 4.91 m which was closely followed by BC-15 (4.73 m). However, there was no significant variation between these two types. The performance of BC-60 was very poor in this regard and it was only 2.14 m. This was also true for the types collected from other states. In the second year, the picture was slightly different from the first year and the increased values were recorded in BC-24 (6.53 m) and BC-19 (6.24 m) which were statistically better over BC-53 (5.94m) and BC-15 (5.14 m). Similar to the first year, the shortest vine length (2.72 m) was recorded in BC-60 which was closely followed by BC-63(2.81 m).The vine growth in the third year of experiment was quite higher than the previous years and all the germplasms produced their highest vine length in this year. Among those, BC-24 and BC-19 recorded the maximum vine length over others. Though the former showed the highest value (7.22 m), it was not statistically varied with BC-19 (7.13 m). The germplasms collected from other states were found to be inferior in this

TABLE V: ANALYSIS OF VARIANCES FOR YIELD AND OTHER MORPHOLOGICAL ATTRIBUTES OF 21 GENOTYPES OF POINTED GOURD.

Source	Degrees of Freedom (d.f.)	MEAN SQUARES												
		Vine length	Length of internode	No.of primary branch/plant	No.of fruits/ plant	Fruit length	Fruit diameter	Core diameter	No.of seeds/ fruit	Fruit volume	Pulp weight	Fruit weight	Early yield	Total yield
Year	2	38.185**	0.004	80.676**	1174.51**	0.042	0.003	0.091**	31.443**	0.460**	5.109**	1.309**	0.947**	1 974**
Replication within year (Error)	6	0.008	0.003	4.94	0.089	0.023	0.017	0.001	2.176	0.012	0.003	0.024	0.002	0.002
Genotypes	20	10.833**	12.283**	15.230**	250.244**	14.568**	1.621**	1.988**	331.942**	1533.594*	30.335**	630.839**	0.462**	1.12**
Genotypes X Environment	40	0.479**	0.002	5.332	17.76**	0.023	0.024**	0.011**	2.771	1.419**	0.177**	0.229**	0.029**	0.067**
Pooled Error	120	0.005	0.018	5.120	0.134	0 019	0.01	0.001	2.113	0.009	0.002	0.026	0.002	0.001

** Significant at 1% level

Fig.I: Performances of germplasms on vegetative growth characters

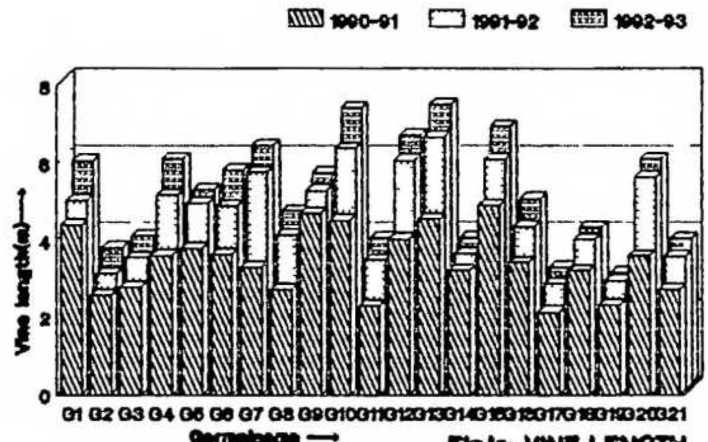

Fig.Ia: VINE LENGTH

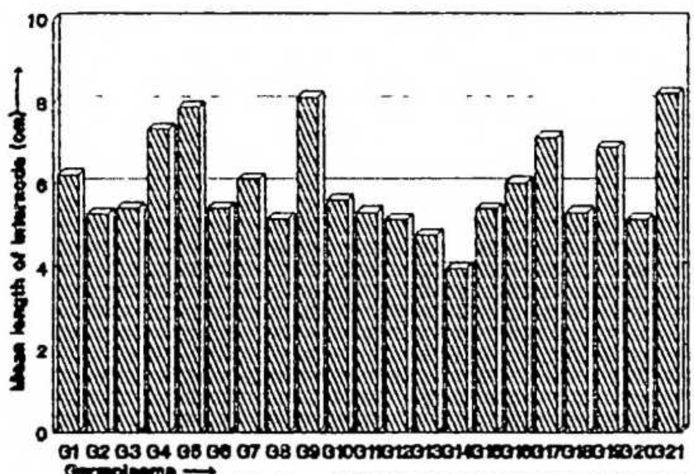

Fig.Ib- MEAN LENGTH OF INTERNODE

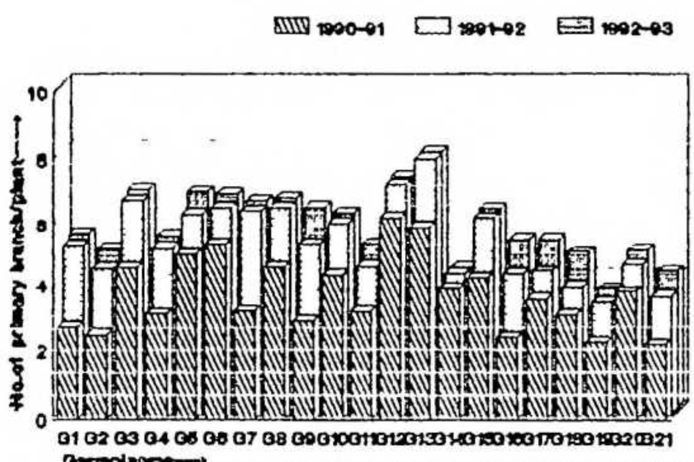

Fig.Ic: NO.OF PRIMARY BRANCH/PLANT

regard in comparison to the germplasms of West Bengal in this year also.

The variation in vine length in the germplasms was due to the genetic make-ups of the concerned germplasms. Besides, environment had a positive role in this regard which reflected on the vine length of the germplasms (Table V) and it was also highly correlated with yield (Table VI). The observation of Singh *et al.*(1986)was in the suppport of these findings.

Length of internode:

From a three years' observation, it was noticed that mean length of internode of the selected germplasms ranged from 3.97 to 8.21 cm (Table IV) . Though length of internode varied significantly among the germplasms in individual year, the year had no significant influence on this attribute. BC-65, a germplasm collected from Bihar recorded the highest length in each year followed by BC-15, whereas a germplasm collected from Uttar Pradesh namely BC-34 had the lowest value in this relation for all the three years (Fig.Ib). The other types recorded the moderate values. From the result it was apparent that length of internode was a genetical character of the plant which could not be influenced by environment in a greater way(Table V). It was also found that the germplasms collected from outside the state had the moderate (even the highest also) length of internode, though their vine lengths were less. It was also observed from Table VI that vine length as well as yield had no direct

TABLE VI: CORRELATION COEFFICIENTS OF YIELD AND YIELD ATTRIBUTES IN POINTED GOURD
(POOLED OVER THREE YEARS)

	Vine length	Length of internode	No.of primary branch/plant	No.of fruit/plant	Fruit length	Fruit diameter	Core diameter	Fruit volume	Pulp weight	No.of seeds/fruit	Fruit weight	Early yield
Length of internode	-0.072											
NO. of primary branch/plant	0.625**	-0.260										
No. of fruit per plant	0.879**	-0.100	0.560**									
Fruit length	0.392	-0.268	0.457*	0.245								
Fruit diameter	0.476*	0.214	0.397	0.343	-0.018							
Core diameter	0.319	0.215	0.439*	0.273	0.047	0.866**						
No. of seeds/fruit	0.671**	-0.166	0.651**	0.571**	0.658**	0.284	0.311					
Fruit volume	0.239	-0.149	0.161	0.230	0.175	0.433*	0.432	0.598**				
Pulp weight	0.277	-0.061	0.330	0.192	0.310	0.590**	0.682**	0.582**	0.801**			
Fruit weight	0.478*	-0.193	0.309	0.210	0.696**	0.287	0.279	0.642**	0.503*	0.535*		
Early yield/plant	0.897**	-0.039	0.537*	0.807**	0.553**	0.418	0.321	0.814**	0.481*	0.460*	0.683**	
Total yield/plant	0.866**	-0.093	0.577**	0.796**	0.563**	0.451*	0.394	0.855**	0.575**	0.535*	0.694**	0.983**

* Significant at 5% level
** Significant at 1% level.

relationship with the length of internode .

Moreover, vines with longer internode as observed in the germplasms collected outside the state, produced less number of internodes. This situation was not at all desirable, as less the internode number, there might be less flowering and consequently low yield also.

Number of primary branches per plant:

It is one of the important criterion for yield, because branching improves the number of nodes i.e. possibility for more flowering and also signifies the vigour and adaptability of the germplasms to the new environment. From Table V it was observed that the number of primary branches per plant varied significantly in both the ways. i.e. among the germplasms and year to year. In most of the cases number of branches increased in the following years because of their gradual adaptation to the changed environment. Maximum number of primary branches per plant in the first year was observed in BC-23(6.19) followed by BC-24 (5.89), while the lowest number of branches was observed in BC-65 (2.11) followed by BC-63 (2.19) and BC-59 (2.33) etc. Due to poor growth of these types, which was reflected by less vine length as well as less number of branches, there would be less fruiting. From Table IV it was also observed that the germplasms from Bihar and Uttar Pradesh produced less number of branches, but in the second year and third year they produced more branches probably due to their gradual adaptability. In the second and

TABLE VII : PHENOTYPIC VARIANCE, GENOTYPIC VARIANCE AND PERCENTAGE OF HERITABILITY OF DIFFERENT CHARACTERS.

Sl No.	Characters	Phenotypic Variance	Genotypic Variance	Percentage of Heritabiity (in broad sense)
1	Vine length	1.63	1.15	70.38
2	Length of internode	1.38	1.36	98.55
3	NO. of primary branch/plant	11.55	1.10	9.51
4	No. of fruit per plant	43.60	25.83	59.26
5	Fruit length	1.66	1.62	97.47
6	Fruit diameter	0.21	0.17	83.89
7	Core diameter	0.23	0.22	94.81
8	No. of seeds/fruit	41.46	36.574	88.22
9	Fruit volume	171.67	170.24	99.17
10	Pulp weight	3.53	3.35	94.93
11	Fruit weight	71.02	70.76	99.64
12	Early yield/plant	0.08	0.05	68.66
13	Total yield/plant	0.19	0.12	63.24

third year, all the types had more number of primary branches than the first year. However, in the third year the numbers were found to be the highest, more specifically in the germplasms collected from outside of West Bengal. From the average of three years, it was found that BC-24 had the highest number of primary branches per plant (7.19) followed by BC-24 (6.79). The least number was recorded in BC-63 (2.99) followed by BC-65(3.22). In the second year of experimentation, the rate of increment in the number of branches was quite higher for the local types, as they became well adapted to the environment. While the higher rate of increment for the outside ones was recorded in the third year because of their gradual adaptability to the new environment. Number of primary branches per plant was found to be correlated with yield, which may be supported with the observation of Sarkar *et al.* (1990). Though Singh *et al.* (1985) recorded high heritability in this attribute, a lower per cent of heritability was observed in this experiment due to greater influence of environment resulting higher value of phenotypic variance.

YIELD ATTRIBUTES

The data recorded on yield attributes like number of fruit per plant,fruit length, fruit diameter, core diameter, core diameter : fruit diameter ratio , fruit volume, pulp weight, fruit weight, pulp weight: fruit weight ratio and seed per fruit were represented in Table VIII and Fig.II (IIa, IIb, IIc, IId and IIe).

TABLE VIII: PERFORMANCES OF GERMPLASMS OF POINTED GOURD ON YIELD ATTRIBUTES.

Sl No.	Germplasms	Number of fruits per plant				Fruit length (cm)				Fruit diameter (cm)				Core diameter (cm)				Ratio of mean Core diameter: Fruit diameter
		A	B	C	Mean	A	B	C	Mean	A	B	C	Mean	A	B	C	Mean	
1	BC-1	22.7	36.5	32.8	30.69	7.25	7.21	7.19	7.22	3.61	3.56	3.63	3.60	2.25	2.23	2.30	2.26	1:1.59
2	BC-2	12.3	20.3	21.3	17.96	8.66	8.64	8.61	8.64	2.83	2.77	2.76	2.78	1.61	1.63	1.76	1.66	1:1.67
3	BC-3	19.5	29.7	20.3	23.16	7.17	7.20	7.13	7.17	3.39	3.46	3.4	3.42	2.40	2.46	2.51	2.46	1:1.39
4	BC-4	28.4	35.7	30.3	31.46	6.10	6.04	6.06	6.07	3.58	3.49	3.56	3.54	2.43	2.41	2.43	2.42	1:1.46
5	BC-5	23.6	36.4	30.4	30.13	6.79	6.81	6.78	6.79	3.89	3.87	3.77	3.84	2.71	2.67	2.73	2.70	1:1.42
6	BC-6	28.3	30.3	30.3	29.63	8.47	8.53	8.54	8.51	2.73	2.75	2.83	2.77	1.86	1.67	1.76	1.76	1:1.57
7	BC-7	21.5	38.2	31.3	30.33	7.78	7.84	7.82	7.81	3.66	3.77	3.64	3.69	2.69	2.81	2.70	2.73	1:1.35
8	BC-13	22.3	33.7	28.5	28.16	7.79	7.81	7.82	7.81	2.41	2.54	2.53	2.49	1.16	1.21	1.26	1.21	1:2.06
9	BC-15	27.7	38.5	30.0	32.06	8.61	8.63	8.58	8.61	3.16	3.21	3.13	3.16	2.13	2.10	2.13	2.12	1:1.49
10	BC-19	30.7	36.1	35.1	33.90	8.24	8.22	8.18	8.21	3.26	3.11	3.18	3.18	1.43	1.56	1.62	1.54	1:2.06
11	BC-22	20.3	28.7	25.3	24.76	8.48	8.44	8.42	8.45	2.83	3.0	2.93	2.92	2.23	2.16	2.33	2.24	1:1.30
12	BC-23	30.9	37.5	33.4	33.93	6.90	6.84	6.86	6.86	3.53	3.43	3.33	3.43	2.43	2.45	2.56	2.48	1:1.38
13	BC-24	32.3	44.7	38.6	38.33	8.71	8.66	8.67	8.68	3.8	3.73	3.76	3.76	2.61	2.53	2.63	2.59	1:1.45
14	BC-34	26.3	32.4	31.4	30.03	6.52	6.48	6.44	6.48	2.53	2.5	2.46	2.49	1.16	1.32	1.46	1.31	1:1.90
15	BC-53	28.7	39.4	30.3	32.80	7.75	7.86	7.91	7.84	2.92	3.01	3.12	3.02	1.90	1.87	1.81	1.86	1:1.62
16	BC-59	22.4	29.0	24.5	25.30	4.82	4.81	4.83	4.82	3.26	3.23	3.26	3.25	1.63	1.54	1.66	1.61	1:2.02
17	BC-60	15.5	17.0	17.3	16.60	6.36	6.43	6.47	6.42	3.13	3.16	3.21	3.16	1.86	1.82	1.86	1.85	1:1.70
18	BC-62	25.4	31.7	30.9	29.33	4.69	4.76	4.81	4.75	2.93	3.0	3.06	2.99	1.76	1.83	1.94	1.84	1:1.62
19	BC-63	18.4	25.4	27.3	23.70	5.49	5.56	5.58	5.54	3.23	3.26	3.28	3.26	2.03	2.08	2.06	2.06	1:1.58
20	BC-64	27.4	35.6	30.6	31.20	8 71	8.74	8.72	8.72	3.25	3.23	3.27	3.25	1.63	1.72	1.73	1.69	1:1.92
21	BC-65	19.5	27.8	29.6	25.60	6.48	6.52	6.50	6.5	2.31	2.32	2.38	2.34	1.23	1.34	1.36	1.31	1:1.79
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
S.Em ±		0.122	0.037	0.298	0.211	0.046	0.019	1.16	0.079	0.034	0.016	0.081	0.058	0.011	0.004	0.025	0.018	
CD at 5%		0.341	0.128	0.836	0.590	0.128	0.066	3.24	0.221	0.095	0.055	0.023	0.162	0.031	0.014	0.072	0.050	

A : 1990-91
B : 1991-92
C : 1992-93

I : Germplasms (Genotypes)
II : Year (Environment)
III : Two genotypes in the same year
IV : Two genotypes not in the same year (Genotypes x Environment)

Continued next page

Table continued

TABLE VIII: PERFORMANCE OF GERMPLASMS OF POINTED GOURD ON YIELD ATTRIBUTES.

Sl No.	Germplasms	NO. of seeds/ fruit				Fruit volume (cc)				Pulp weight (g)				Fruit weight (g)				Ratio of mean Pulp weight: Fruit weight
		A	B	C	Mean	A	B	C	Mean	A	B	C	Mean	A	B	C	Mean	
1	BC-1	28.53	27.62	30 15	28.8	40.26	38.86	39.25	39.46	8.6	8.54	8.85	8.66	40.30	40.86	40.47	40.54	1:4.69
2	BC-2	16.26	16.16	18.06	16.83	27.86	26.44	25.83	26.71	5.83	6.0	6.56	6.13	32.47	32.26	32.00	32.24	1:5.26
3	BC-3	28.64	28.16	30.23	29.24	42.53	44.16	43.45	43.38	8.63	8.78	8.93	8.78	30.10	30.50	29.96	30.19	1:3.44
4	BC-4	16 56	15.16	17.34	16.35	27.13	26.72	26.86	26.9	4.86	4.76	4.95	4.85	23.81	24.13	23.84	23.93	1:4.83
5	BC-5	23.26	23.86	26.18	24.43	36.13	35.64	35.93	35.9	7.34	7.36	8.23	7.64	31.97	32.02	32.00	31.99	1:4.22
6	BC-6	11.06	10.52	12.43	11.34	38.24	38.61	37.76	38.2	4.43	4.16	4.93	4.51	27.63	27.23	27.10	27.32	1:6.43
7	BC-7	26.13	27.19	29.63	27.65	55.86	56.17	54.84	55.62	9.23	9.83	10.26	9.77	40.83	40.86	40.69	40.79	1:4.28
8	BC-13	15.24	14.36	14.98	14.86	45.06	45.86	45.11	45.34	6.48	6.23	6.36	6.36	26.95	27.03	26.73	26.90	1:4.45
9	BC-15	19.64	20.73	21.84	20.74	52.66	53.06	51.9	52.54	6.16	6.85	7.05	6.69	44.87	44.76	45.00	44.88	1:6.81
10	BC-19	13.23	12.85	14.38	13.49	39.34	38.52	38.86	38.91	5.23	5.06	5.45	5.25	34.13	34.76	32.89	33.93	1:6.44
11	BC-22	27.76	25.39	27.40	26.85	35.03	37.43	36.82	36.43	7.81	7.49	7.97	7.76	29.63	30.03	30.07	29.91	1:3.89
12	BC-23	20.16	21.42	20.76	20.78	54.86	54.82	53.74	54.47	6.93	7.03	7.19	7.05	32.91	33.16	33.01	33.02	1:4.66
13	BC-24	25.83	26.50	26.86	26.40	60.47	60.19	60.36	60.34	10.03	10.16	10.46	10.22	46.56	46.53	46.54	46.54	1:4.57
14	BC-34	13.76	14.46	16.13	14.78	32.03	31.53	30.44	31.33	5.13	5.72	6.51	5.79	22.70	22.48	22.90	22.69	1:3.89
15	BC-53	26.46	26.98	28.12	27.19	62.94	64.15	65.46	64.18	10.16	10.41	10.97	10.51	49.80	50.13	50.02	49.98	1:4.76
16	BC-59	12.73	13.76	16.04	14.18	22.53	21.98	22.76	22.42	5.13	5.96	6.23	5.77	21.73	22.23	21.83	21.93	1:3.51
17	BC-60	19.05	19.13	20.16	19.45	32.37	32.76	32.94	32.69	6.16	6.43	7.16	6.58	28.84	28.90	28.58	28.77	1:4.59
18	BC-62	17.93	18.16	18.53	18.31	20.92	21.18	21.93	21.34	7.83	8.44	8.75	8.34	23.38	23.86	23.73	23.66	1:3.04
19	BC-63	14.73	15.00	15.63	15.12	26.75	26.85	25.91	26.5	8.34	8.53	8.86	8.58	25.58	25.93	25.58	25.69	1:3.14
20	BC-64	24.38	24.45	24.53	24.45	58.21	57.73	58.81	58.25	10.16	10.24	10.46	10.29	39.84	39.86	39.13	39.61	1:3.86
21	BC-65	13.87	13.18	14.12	13.72	31.13	31.76	32.34	31.74	6.46	6.03	6.41	6.3	23.87	24.06	24.14	24.02	1:3.83
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
S.Em.±		0.485	0.186	1.180	0.839	0.032	0.014	0.077	0.055	0.014	0.007	0.036	0.025	0.054	0.019	0.132	0.094	
CD at 5%		1.36	0.64	3.32	2.34	0.089	0.049	0.216	0.154	0.039	0.024	0.10	0.07	0.151	0.066	0.36	0.263	

A : 1990-91
B : 1991-92
C : 1992-93

I : Germplasms (Genotypes)
II : Year (Environment)
III : Two genotypes in the same year
IV : Two genotypes not in the same year (Genotypes X Environment)

Number of fruits per plant:

There was a significant variation in the number of fruits per plant in each year and among the germplasms as well (Table VIII). In the first year of experimentation, all the germplasms produced lesser number of fruits in comparison to the following years. However, the second year cropping produced maximum number of fruits specially in the germplasms collected from different parts of the state (Fig.IIa), while in the germplasms collected from outside of West Bengal, the third year cropping recorded the highest number of fruits. From the average of three years of experimentation, it was found that BC-24 recorded maximum number of fruits per plant (38.33), however, its second year cropping produced the highest value(44.70) and BC-24 was statistically superseded other germplasms also. Though BC-23 closely followed BC-24 in the first year, the trend was not same for all the years. In the second year and third year, BC-53 and BC-19 proved their superiority over BC-24 . In the first year of experimentation, BC-2 had the lowest number of fruits per plant (12.3) followed by BC-60 (15.5). In the subsequent years, the number of fruits per plant was increased in the germplasms collected outside the state, but their values in no case were at par with the local types.From the average of three years observations, BC-60, a germplasm collected from Faizabad, Uttar Pradeh was found to be very much inferior in this relation.

The higher number of fruits in the germplasms of West

Fig.II:Performances of germplasms on yield attributes

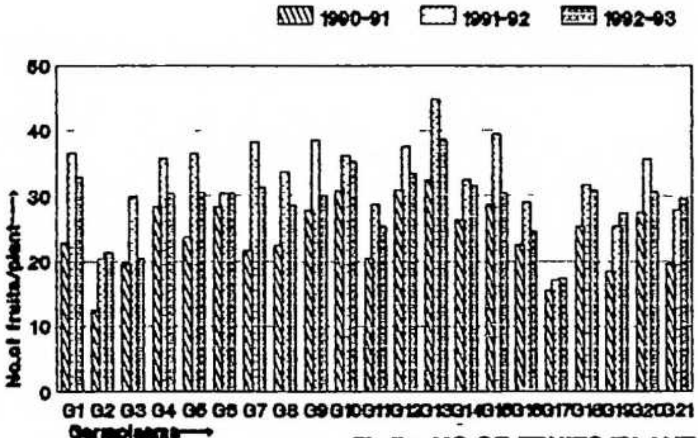

Fig.IIa: NO.OF FRUITS/PLANT

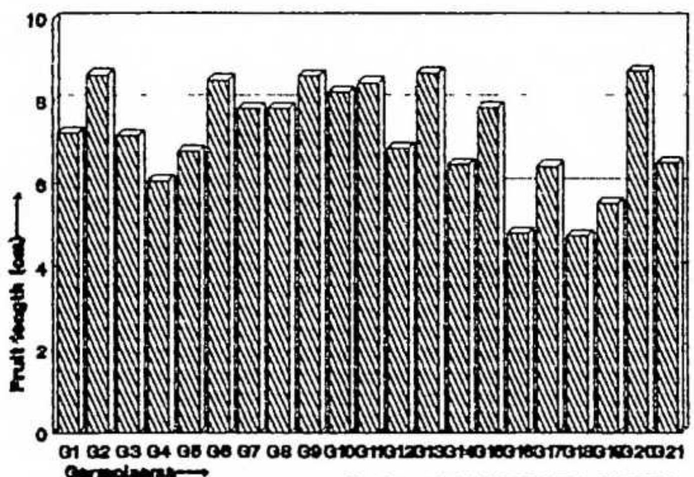

Fig.IIb· MEAN FRUIT LENGTH

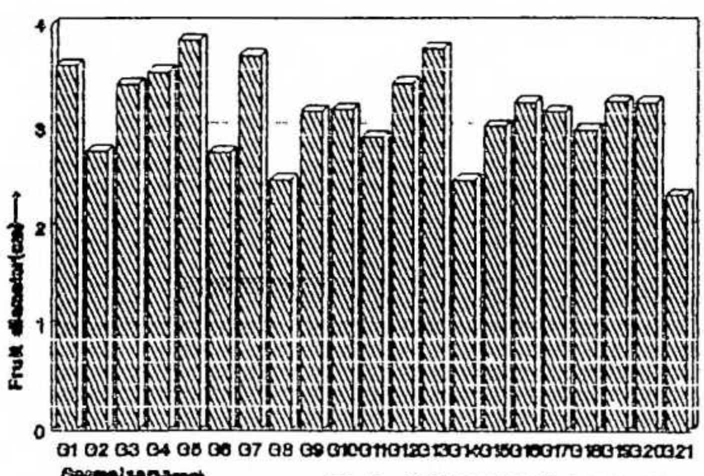

Fig.IIc· MEAN FRUIT DIAMETER

Bengal were due to their increased growth it terms of vine length, number of primary branches per plant and comparatively lesser internodal length. Less number of fruits in the first year for all the types was due to less vigour and growth of those germplasms. In the subsequent years, the growth of all the germplasms was markedly enhanced producing more number of fruits per plant.Though increased growth was also recorded in the types collected outside the state, it was quite lower than the local ones resulting less number of fruits per plant. Shadque *et al.* (1986) came to the same conclusion that fruit number per plant in addition to the some other characters proved their reliability for effective selection. Hence in the present evaluation programme number of fruits per plant is one of the most important criteria for effective selection as it has not only a direct relationship (r = 0.796) with the total yield of the crop (Table VI), but also a higher genotypic variance and heritability as well (Table VII). The obervation of Singh *et al.* (1985), Singh *et al.*, (1986) and Singh and Prasad (1989) supported the present opinion.

Fruit length:

A significant wide variation in fruit length was found among the germplasms in each individual year. But the variation within the year was not significant. In the first year of experimentation fruit length was comparatively lesser than second and third year cropping of all the germplasms and it ranged from 4.69 cm to 8.71 cm. Though in second and third year fruit length was more over first year, the trend of variation was not so consistent within the years. Among the germplasms, BC-64 produced the maximum fruit length (8.74 cm) in the second year followed by BC-24 (8.66 cm). From the average of three years of growing(Fig.IIb) it was found that the same germplasms (BC-64) proved its superiority (8.72 cm) over others in this regard followed by BC-24 (8.68 cm) and BC-2 (8.64 cm). The lowest length (4.75 cm) was recorded in BC-62 collected from Sabour, Bihar. Other germplasms except BC-2 and BC-22 , collected outside the state were of moderate values in relation to fruit length. The probable reason for better performance of most of the germplasms in the second year was better establishment of the crop, though not significantly varied with other years. Thus, fruit length may be considered to be an inherited character of the germplasms and showed higher per cent of (97.47) heritability (Table VII). The opinion of Singh *et al.* (1985) was in conformity with the present observation. They opined that for effective selection,fruit length should be considered as it proved its reliability on such programme. They also suggested that fruit length is an important character for an evaluation programme and the result obtained in the present study supported their view , as fruit length was directly correlated with yield (Table VI) . Therefore, more emphasis should be given on fruit length in an evaluation programme of this crop.

Fruit diameter:

Similar to fruit length, fruit diameter of the germplasms also did not vary markedly among individual years, but significant variation was marked among the germplasms (Table V).The highest value (3.84 cm), however , was recorded in BC-5 in all the three years of the experiment (Fig.IIc) followed by BC-24 (3.76 cm) and BC-7 (3.69 cm) . The germplasms collected from outside state, were found comparatively inferior to the local ones and BC-65 collected from Bihar was of the lowest value (2.34 cm) in this regard. In the present experiment fruit diameter was found to have a significant relationship with yield of the crop. Moreover, it showed a higher percentage (83.89) of heritability. Therefore fruit diameter should be given due weightage in a selection programme. Sarkar *et al.* (1990)in another evaluation programme considered fruit diameter as an important criterion for selection of good genotypes for improvement of yield. The present findings are in a line with their opinion. The fruit and leaf shape variation of each germplasms observed in this experiment were shown in Plate I to XXI.

Core diameter:

Core is the inner part of fruit encircled with the flesh and full of seed and pulp. So better quality of fruit of pointed gourd should have thicker flesh and low core diameter. Similar to other characters, core diameter of the germplasms also

PLATE NO. I

PLATE NO. II

PLATE NO. III

PLATE NO. IV

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

PLATE NO. V

PLATE NO. VI

PLATE NO. VII

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

PLATE NO. VIII

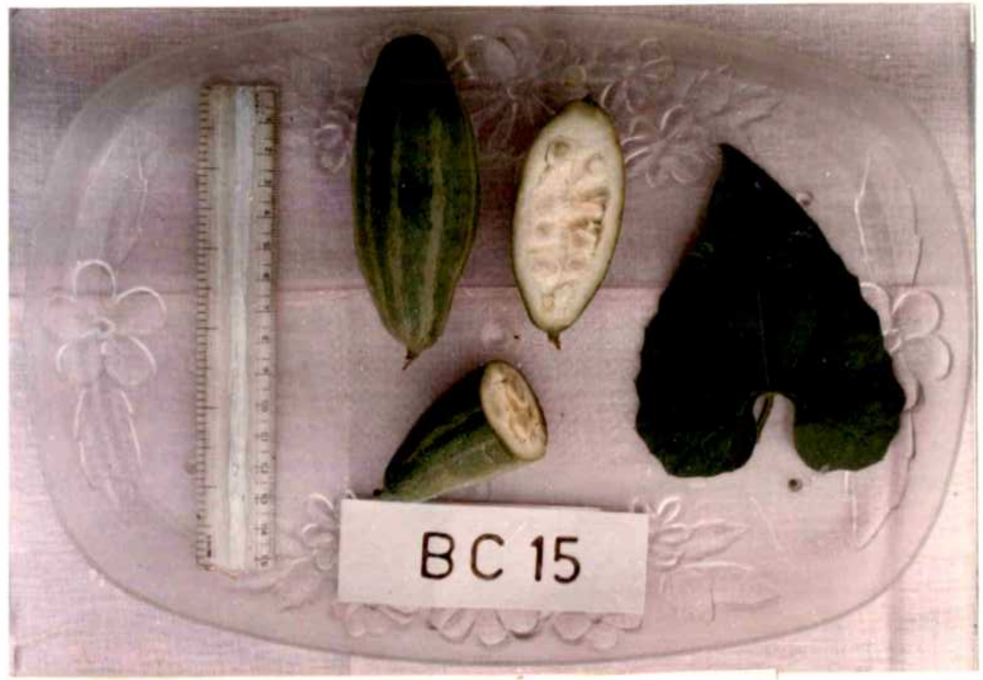

PLATE NO. IX

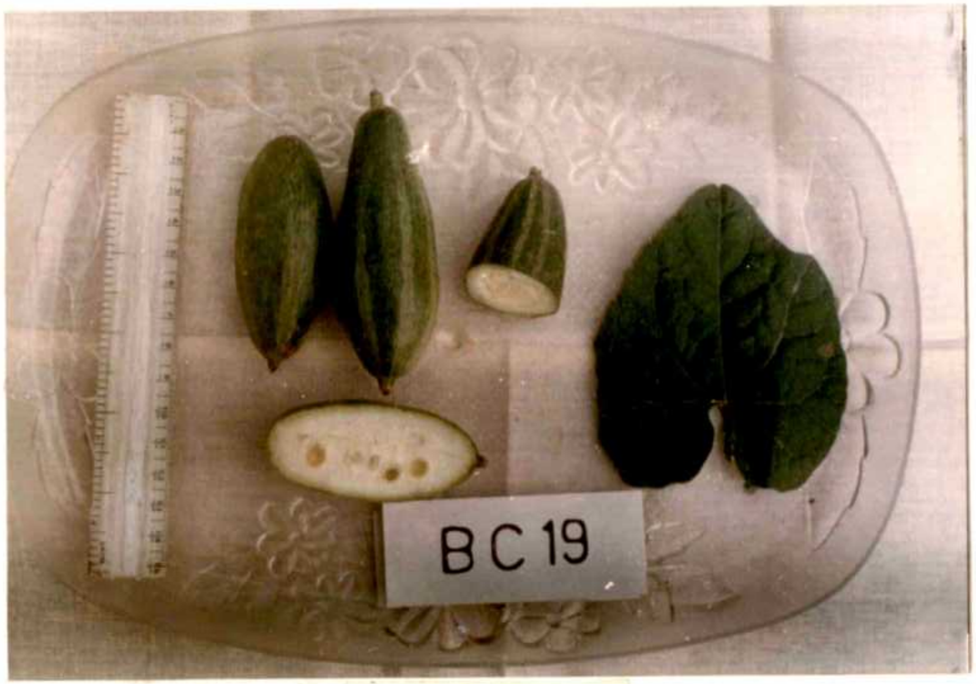

PLATE NO. X

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

PLATE NO. XI

PLATE NO. XII

PLATE NO. XIII

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

PLATE NO. XIV

PLATE NO. XV

PLATE NO. XVI

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

PLATE NO. XVII

PLATE NO. XVIII

PLATE NO. XIX

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

PLATE NO. XX

PLATE NO. XXI

FRUIT AND LEAF SHAPE VARIATION OF THE GERMPLASMS OF POINTED GOURD.

significantly varied with each other among the three years of experimentation (Table V). In the first year the lowest core diameter (1.16 cm) was recorded in BC-13 and BC-34, but the trend remained same only in BC-13 for the subsequent years. On the other hand, the highest core diameter in the first and third year was obtained in BC-5 while in the second year, it was observed in BC-7. However, from the average of three years of experiment it was found that BC-7 proved its superiority over germplasms. From the present findings the fruit with larger diameter but lower core diameter may be considered in a selection programme as it contains less pulp.

Core diameter: Fruit diameter ratio:

It was also revealed from Table VIII that BC-13 and BC-19 had the highest ratio (1:2.06) while BC-22 had the lowest one (1:1.3) . This suggested that fruit with more diameter and less core diameter was more advantageous as it contained less pulp in comparison to flesh. The reverse situation was not at all desirable because of more pulp content indicated the possibility for more number of seeds in fruits as in BC-22.Thus for selection of a good type one should consider higher ratio of core diameter to fruit diameter .From the present investigation BC-13, BC-19 and BC-59 may be considered as better types.

Number of seed per fruit:

There was a significant variation in the number of seeds per fruit of the germplasms in different years (Table V). From the average of three years it revealed that BC-3 contained the highest number of seeds (29.24) in a fruit followed by BC-1 (28.8) and BC-53 (27.19), while the least number was found in BC-6 (11.34) (Table VIII). Interestingly, the germplasms collected from outside the state except BC-22 had lower seeds per fruit. Though lower number of seeds in those germplasms was mainly due to their small sized fruits, this was not applicable for all the types as less number of seeds might also be present in large fruit. This situation was always desirable because more pulp with less number of seeds in a fruit and thicker flesh was needed. From Table VI it was observed that number of seeds per fruit had a direct relationship with fruit weight, total yield of the crop as well and, it had a genotypic variance with high heritability (Table V). Prasad and Singh (1990) was also of the same view that seed number in a fruit had a direct correlation with fruit weight. Moreover, Shadque *et al.* (1986) recorded higher genotypic coefficient of variation for number of seeds per fruit which was observed in the study also. Yet, this character was not considered in the selection programme as our desired end should be targeted on fruit with more weight, but not in exchange of more number of seeds per fruit.

Pulp weight:

It revealed from Table VIII that BC-53 always produced fruits of more pulp content followed by BC-54 and BC-24. However, in the third year the pulp weight was maximum in most of the germplasms.On the other hand, BC-6 had the lowest pulp weight for all the three years of experimentation. The types collected from outside the State and most of the local ones had the moderate values in this regard. Significant variation was also observed for pulp weight in the germplasms in each year of experimentation(Table V). From the results presented earlier, it was found that seed numbers increased in the subsequent years over first year which influenced the pulp weight of fruit accordingly. Thus, pulp weight had a direct relationship with fruit weight and yield of the crop as well, probably because of number of seed per fruit was directly correlated with pulp weight of the fruit also (Table VI) . The fruit with lower pulp was considered good as it contained less number of seeds.

Fruit volume:

It revealed from Table V that the variation in fruit volume of the germplasms was significant in individual years. The highest fruit volume (65.46 cc) was recorded from BC-53 in the third year of experimentation and this germplasm also showed its superiority over other germplasms in first and second years as well (Fig.IId). From the overall performance of three years, though BC-24 (60.34 cc) and BC-64 (58.25 cc) followed closely to BC-53 (64.18 cc), there was a significant variation between them within the individual years. Lower fruit volume was recorded in BC-62(21.34 cc), BC-59 (22.42 cc) and BC-63 (26.5 cc).

Fig.II:Performances of germplasms on yield attributes

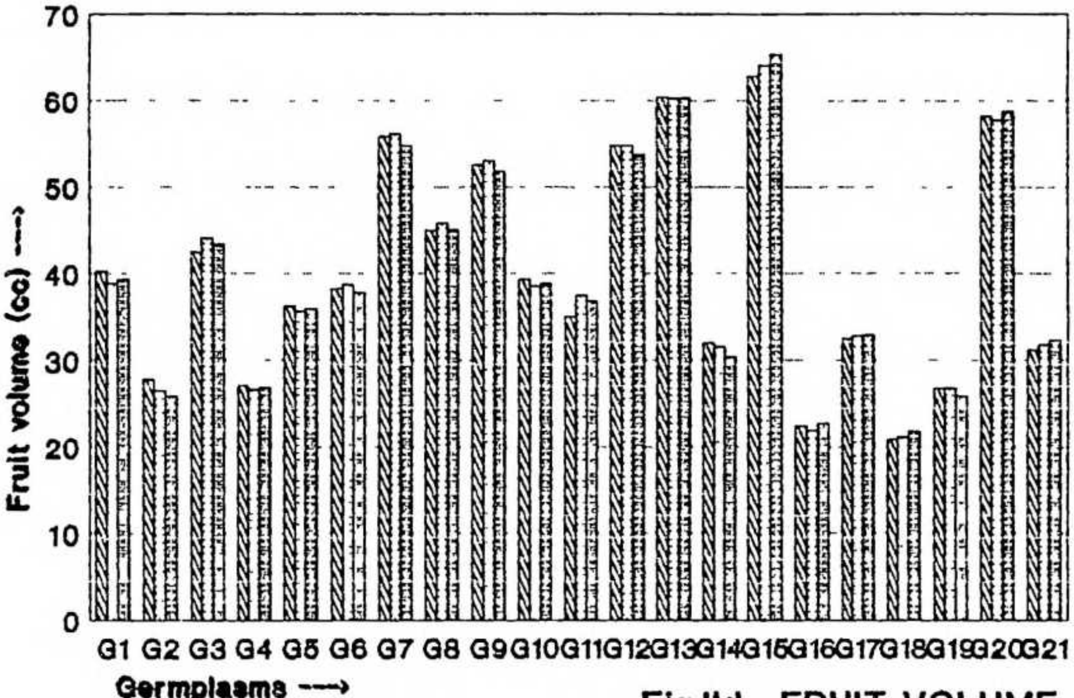

Fig.IId: FRUIT VOLUME

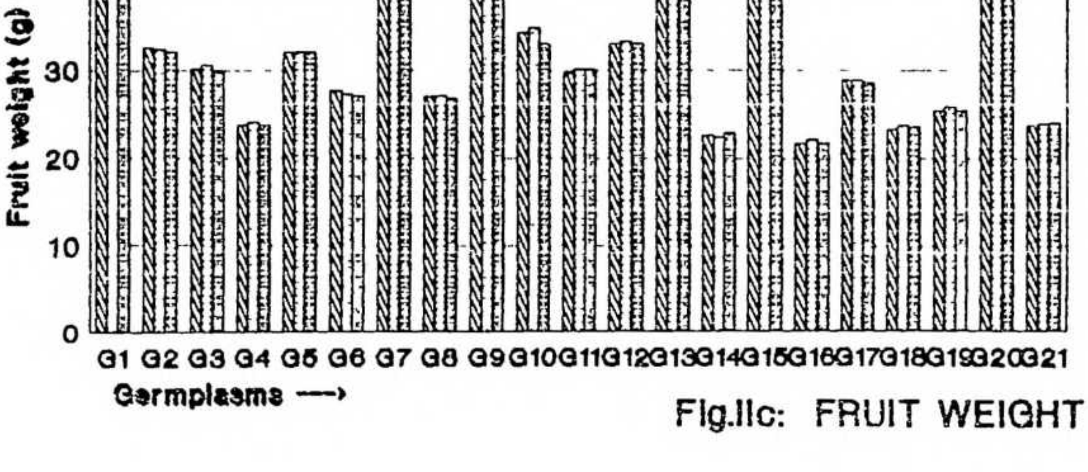

Fig.IIc: FRUIT WEIGHT

It was clear from Table VI that fruit volume was highly correlated with fruit weight and yield also. If fruit volume increased, the fruit weight would be more and ultimately there would be better yield of the crop. The genotypic variance was also found to be higher (99.17) for this attribute. The result of the present study was in conformity with the findings of Singh *et al.*(1985) and Shadque *et al.*(1986), who suggested fruit volume should be given due emphasis in a selection programme. In this context, the report of Sarkar *et al.* (1990) was also in a line with the present finding, who concluded from a two year study that fruit volume was one of the most important yield component. The present investigation indicated that fruit volume should be given a vital emphasis because of its highest genotypic variance along with the higher percentage of heritability in a selection programme for further improvement of this crop.

Fruit weight:

There was a significant variation in the fruit weight of different germplasms in different years of experiment. It was found from Table VIII that fruit weight increased in the second and third year over first year. In most of the germplasms, it was found to be highest in the second year. From the average of three years, it was quite evident that BC-53 had the highest fruit weight (49.98 g). The same type proved its superiority for all the three years of experimentation (Fig.IIe). Next to BC-53, the other types which had comparatively higher values in this regard were BC-24 (46.54 g), BC-15 (44.88 g), BC-7 (40.79 g) and BC-1(40.54). The performances of the outside ones including some local types were not so promising. In this context, the record of BC-59 was very meagre and the fruit weight of only 21.93 g was observed in this type. The increased yield of second and third year in the germplasms was due to their better establishment in those years. Though the types collected outside the state gradually adapted to this situation, their performance in relation to fruit weight were not so encouraging over local types indicating fruit weight as a genetical factor. Besides, the increased fruit size influenced the fruit weight in a positive way. As yield of the crop was highly correlated with weight of fruit (Table VI), fruit weight should be given a prime importance in the selection and evaluation programme. The genotypic variance was also found higher in fruit weight (Table VII). The present findings can be supported with the observation of Singh *et al.* (1987) who recorded strong positive correlation with fruit yield per plant to weight of fruit. Sarkar *et al.* (1990) were also of the same view that fruit weight was the most important fruit yield component.

Pulp weight : Fruit weight ratio:

From the earlier discussion it was evident that bigger fruit had more pulp and fruit weight in most of the cases. The ratio of pulp and fruit weight was considered as it signified the pulp content in respect to fruit weight. Therefore, fruits with higher ratio of pulp and fruit weight should be regarded as better one, as it contained less pulp.

From Table VIII it was clear that BC-15 had the highest ratio (1:6.81) followed by BC-19 (1:6.44) and the least value of 1:3.04 was obtained in BC-62 proving its inferiority in a selection programme.

YIELD

Observations recorded on yield i.e. , Early yield and Total yield was presented in Table IX and Fig. III(IIIa, IIIb and IIIc).

Early yield:

Early yield in the germplasms significantly varied with each other in each individual year (Table V). In the second and third year early yield was comparatively more than the first year. However, in most of the cases it was more in the second year. From the average value a great variation in early yield ranging from 0.25 to 0.99 kg per plant was observed. BC-24 was comparatively high yielder than other types, while BC-60 produced the lowest yield.

The increased early yield in the types namely BC-24 and BC-15 were due to production of more flowers and fruits in the first half of the harvesting period.The reverse situation occured in the .low early yielders. The low early yield in third

TABLE IX: PERFORMANCES OF GERMPLASMS OF POINTED GOURD ON YIELD.

Sl No.	Germplasms	Early yield per plant (kg)				Total yield per plant (kg)			
		A	B	C	Mean	A	B	C	Mean
1	BC-1	0.42	1.03	0.91	0.79	0.84	1.46	1.33	1.21
2	BC-2	0.13	0.47	0.41	0.34	0.40	0.65	0.68	0.58
3	BC-3	0.31	0.45	0.35	0.37	0.59	0.80	0.65	0.68
4	BC-4	0.32	0.55	0.45	0.44	0.68	0.83	0.74	0.75
5	BC-5	0.40	0.72	0.65	0.59	0.75	1.19	0.98	0.97
6	BC-6	0.36	0.60	0.62	0.53	0.78	0.89	0.91	0.86
7	BC-7	0.46	0.91	0.75	0.71	0.88	1.64	1.30	1.27
8	BC-13	0.35	0.52	0.55	0.47	0.60	0.95	0.84	0.80
9	BC-15	0.80	1.15	0.84	0.93	0.98	1.80	1.36	1.38
10	BC-19	0.45	0.93	0.90	0.76	1.05	1.22	1.15	1.14
11	BC-22	0.22	0.51	0.44	0.39	0.60	0.87	0.78	0.75
12	BC-23	0.70	0.73	0.63	0.69	1.03	1.24	1.10	1.12
13	BC-24	0.82	1.13	1.01	0.99	1.22	2.16	1.78	1.72
14	BC-34	0.37	0.43	0.41	0.40	0.68	0.76	0.70	0.71
15	BC-53	0.73	1.11	0.95	0.93	1.09	1.98	1.53	1.53
16	BC-59	0.30	0.40	0.31	0.34	0.49	0.56	0.49	0.51
17	BC-60	0.21	0.28	0.26	0.25	0.45	0.53	0.54	0.51
18	BC-62	0.33	0.47	0.48	0.43	0.59	0.82	0.83	0.75
19	BC-63	0.30	0.34	0.38	0.34	0.47	0.69	0.76	0.64
20	BC-64	0.65	0.98	0.72	0.78	1.09	1.39	1.28	1.25
21	BC-65	0.27	0.41	0.45	0.38	0.47	0.68	0.79	0.62
		I	II	III	IV	I	II	III	IV
S.Em.±		0.014	0.006	0.037	0.025	0.009	0.005	0.025	0.016
CD at 5%		0.039	0.021	0.102	0.069	0.025	0.017	0.072	0.044

A : 1990-91
B : 1991-92
C : 1992-93

I: Germplasms (Genotypes)
II: Year (Environment)
III: Two genotypes in the same year
IV: Two genotypes not in the same year (Genotypes X Environment)

year in comparison to second year was probably due to less number of effective nodes.

Total yield:

Similar to the early yield, total yield of the germplasms varied significantly in the individual years (Table V). The yield increased upto second year. In the second year, BC-24 produced a total yield of 2.16 kg per plant which was superior to all other types and this type maintained its supremacy all along. From the average value it was found that BC-53 (1.53 kg) and BC-15 (1.38 kg) closely followed to BC-24 (1.72 kg). The outside ones were very much low yielder and not a single type can supersede any local one except BC-3. The performance of BC-59 and BC-60 were very poor and an average yield of only 0.51 kg was obtained from these types signifying their inferiority for selection.

The increased yield obtained in BC-24 was due to production of more number of fruits with moderate fruit weight. On the contrary, though maximum fruit weight was obtained in BC-53, the yield in this type was comparatively lesser than BC-24 due to less number of fruits per plant. The poor performance of the germplasms from outside was due to less number of fruits coupled with low fruit weight. A slight decrease of yield in the third year in comparison to the second year in most of the types was probably due to the presence of less number of effective nodes. From the correlation studies it was observed that yield of

Fig.III.Comparison between early yield and total yield of germplasms in different years.

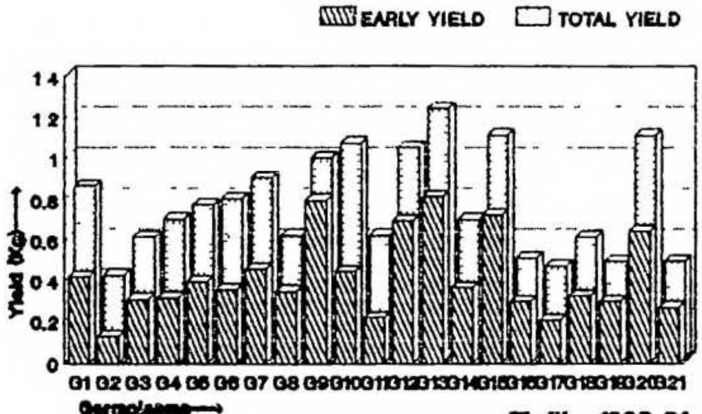

Fig.IIIa: 1990-91

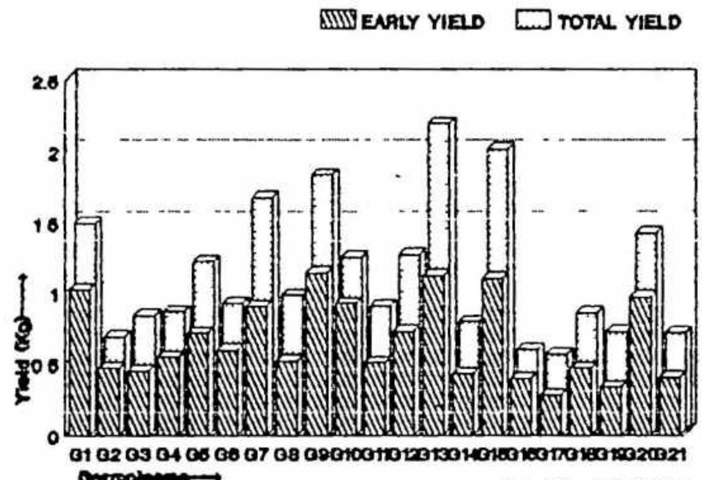

Fig.IIIb: 1991-92

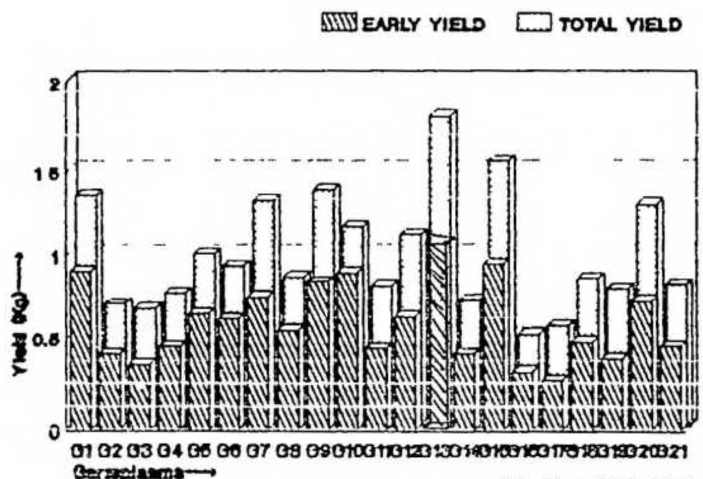

Fig.IIIc: 1992-93

pointed gourd had a positive and significant correlation with several yield attributing characters like early yield (r = 0.983), vine length (r = 0.866), fruit volume (r = 0.855), number of fruits per plant (r = 0.796) , fruit weight (r = 0.694), number of primary branches per plant (r = 0.577) , pulp weight (r = 0.575) , fruit length (r = 0.563) and, as well as number of seeds per fruit (r = 0.535) and fruit diameter (r = 0.451). Several workers also observed strong and positive correlations between yield and these characters. (Singh *et al.*1986,1987; Singh and Prasad ,1989; Prasad and Singh, 1990 and Sarkar *et al.*,1990).

In the present study the outside ones are low-yielder compared to the local ones. Thus growing of those types are not at all profitable under this region. The local types particularly BC-24, BC-53, BC-15 are high yielder and may be grown for commercial cultivation. The flowering a well as fruiting stage of BC-24 and BC-53 are sown in Plate XXII and Plate XXIII.

From the results obtained in the study , it can therefore be concluded that for selection of a better germplasms emphasis should be given on total yield as well as on the yield attributing characters like fruit weight and fruit volume having not only higher correlation with yield , but also the higher value of genotypic variance and percentage of heritability. In addition to these characters fruit length, fruit diameter and number of fruits per plant may be considered as those either have higher genotypic variance or heritability. Though number of seeds

PLATE NO. XXII

PLATE NO. XXIII

FLOWERING AND FRUITING STAGE OF TWO LEADING GERMPLASMS.

per fruit , core diameter and pulp weight have higher percentage of heritability , are not considered as important criterion in a selection programme. Because these characters signified the increased fruit weight by increasing the number of seeds within a fruit. Our target is to get higher yield with higher fruit weight, but not in exchange of more number of seeds in a fruit. Similarly length of internode having higher percentage of heritability and no significant interaction with environment was also discarded as it has no significant correlation with yield.

From these points of view for selection, besides the high yielder types like BC-24, BC-53 , BC-15 , the germplasms with lower yield namely BC-1, BC-5, BC-7, BC-19, BC-23 and BC-64 were also taken into consideration because of their better performance regarding various characters which would be considered in a selection programme for further improvement of the crop.

EXPERIMENT NO.2: SELECTION OF SEEDLING SEGREGATE FOR BETTER PLANT TYPE WITH HIGH YIELDING ABILITY.

The present experiment was aimed to select a single or more seedling segregate(s) better over mother plant in relation to yield attributes as well as yield from the created variabilities of 585 seedling population.The results obtained in the experiment have been presented below:

FLOWERING BEHAVIOUR AND SEX-EXPRESSION:-

From Table X it was observed that in 1990-91 i.e.the first year of experimentation, flowering was recorded only in 86 plants, representing 14.7 per cent of total plant population. The flowering and fruiting of a seedling segregate was presented in Plate XXIV. The sex ratio (M:F) in the flowered seedling segregates was appeared to be 1:1.15. Being a vegetatively propagated one, all the mother plants bore flowers and fruits within the very first year of its planting. In the second year (1991-92) of experimentation number of plants flowered was quite higher than the first year. In addition to 86 plants (those flowered in the first year), flowering was occured in another 328 new plants which was collectively 70.77 per cent of the total plant population. Amongst them a number of 219 plants were found to be male (52.89 per cent) and number of female plants was 195 which was 47.11 per cent of total plants flowered. In this year the Male:Female ratio was found to be 1:0.89. In the third year (1992-93) more or less all the plants (577) flowered except a few ones. The total number of plants flowered in that year was inclusion of the earlier flowered plants also. The number of non-flowering plants remained 8 only, which represented 1.37 per cent of the total plant population. Sex ratio (M:F) of 1:0.94 was observed in this year which was almost same to the ratio of 1:1. The percentage of flowering and sex expression in the seedling segregates in different years of experimentation was depicted in Fig. IV.

TABLE X: FLOWERING BEHAVIOUR AND SEX EXPRESSION IN SEEDLING SEGREGATES.

	FLOWERING BEHAVIOUR				SEX EXPRESSION				
Year	Number of total plants flowered	Percentage of flowering plants to total population (%)	Number of total non-flowering plants	Percentage of non-flowering plants to total population (%)	Number of male plants flowered	Percentage of male to total plants flowered (%)	Number of female plants flowered	Percentage of female to total plants flowered (%)	Sex-ratio (Male:female)
1990-91	86	14.7	499	85.3	40	46.51	46	53.49	1:1.15
1991-92	414	70.77	171	29.23	219	52.89	195	47.11	1:0.89
1992-93	577	98.63	8	1.37	298	51.64	279	48.35	1:0.94

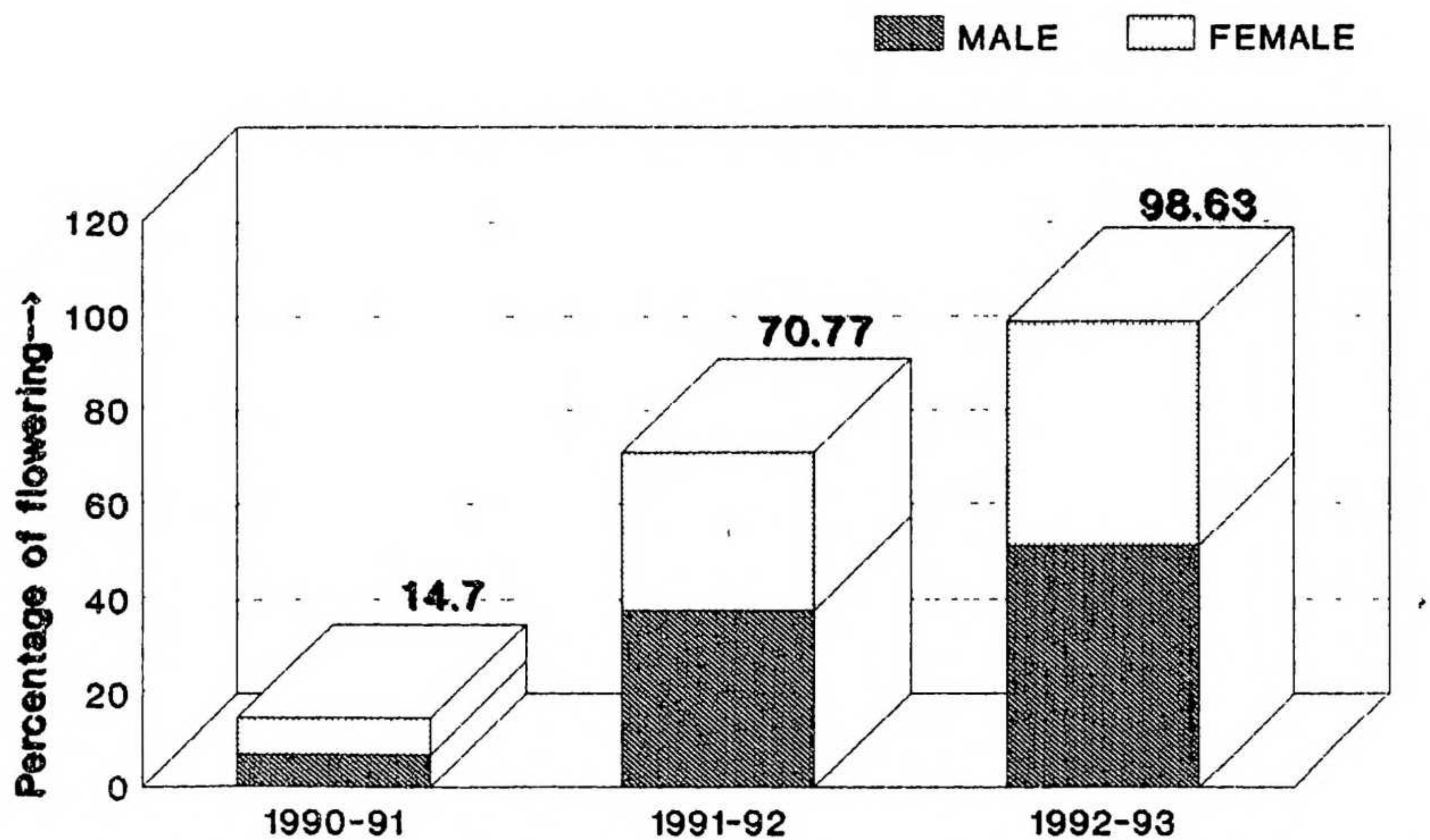

Fig.IV:% OF FLOWERING & SEX EXPRESSION IN SEEDLING SEGREGATE

From the result, it was quite clear that initially the number of plants bearing female flowers was more, but in the subsequent years the number of male plants was in increasing trend. However, finally the ratio of male and female plants became almost 1:1. This result was in conformity with the report of Seshadri(1986), who opined the sex ratio for seedling plants was 1:1. He also reported that it took 2-3 years for flowering and fruiting in seed propagated crops. In this experiment also the maximum flowering and fruiting was observed in second year and third year. The result of the first year was not in agreement with the findings of Sarkar(1989) who observed no flowering in seedling segregates in the first year of his experiment.

GROWTH CHARACTERS IN SEEDLING SEGREGATES

Growth characters i.e. vine length, length of internode and number of primary branches per plant were presented in Table XI and Fig. V.

Vine length:

The vine length in seedling segregates of male and female plant was grouped in nine classes and the mean value of each class was also presented in Table XI. In seedling segregates, the vine length was quite longer than the mother plant. Interestingly, the vine length of male plants was found to be more than female ones. In male plants vine length ranged from 5.1 to 14.0 m, while in female plants the range was from 5.1 to

12.0 m only. Among the male plants 31.88 per cent plants laid in the class 81-9.0 m. The number of plants beyond this class was on decreasing trend for different classes. In case of female plants, the highest number (93) of plants was found to be in the class ranged from 7.1 to 8.0 m, which represented 33.34 per cent of total female population and only 2 plants belonged to the class 11.1-12.0 m.

It is quite obvious that vegetatively propagated plant is less vigorous than seed propagated plants. That is why the vine length of mother plant was less in this experiment, as it was propagated asexually. It was a general observation that male plants showed more growth than female ones. In this experiment it was also found true for the seedling segregates.

Length of Internode:

Similarly the length of internode found in different male and female seedling segregates were grouped in six classes, where length varied from 4.1 cm to 10.0 cm. In a large number of population either male or female, the length of internode was better over mother plant (5.38cm). In case of male seedling segregates, the highest number of 83 plants was in the class 5.1-6.0 cm, which represented 27.85 per cent of total male population. On the other hand, the highest percentage (30.47) of female plants belonged to the class 4.1-5.0 cm. The lowest percentage of both male and female plant population belonged to the class 9.1-10.0 cm.

TABLE XI: GROWTH CHARACTERS IN SEEDLING SEGREGATES OF POINTED GOURD

Class	Class Value	MALE*			FEMALE+			Mean value of Mother plant
		Number of plants	Mean of class	Percentage of total Male population	Number of plants	Mean of Class	Percentage of total Female population	
Vine -length (m):								
5.1-6.0	5.55	12	5.97	4.02	25	5.83	8.97	
6.1-7.0	6.55	31	6.23	10.40	62	6.62	22.21	6.70
7.1-8.0	7.55	59	7.72	19.80	93	7.29	33.34	
8.1-9.0	8.55	95	8.48	31.88	35	8.41	12.55	
9.1-10.0	9.55	41	9.39	13.77	49	9.66	17.57	
10.1-11.0	10.55	26	10.83	8.73	13	10.34	4.65	
11.1-12.0	11.55	17	11.61	5.70	2	11.84	0.71	
12.1-13.0	12.55	15	12.73	5.03	-	-	-	
13.1-14.0	13.55	2	13.51	0.67	-	-	-	
Length of Internode (cm):								
4.1-5.0	4.55	49	4.45	16.44	85	4.87	30.47	
5.1-6.0	5.55	83	5.89	27.85	63	5.44	22.58	5.38
6.1-7.0	6.55	57	6.67	19.13	46	6.73	16.49	
7.1-8.0	7.55	56	7.38	18.79	38	7.89	13.62	
8.1-9.0	8.55	40	8.63	13.43	27	8.45	9.67	
9.1-10.0	9.55	13	9.88	4.36	20	9.61	7.17	

Number of primary branches per plant:

Category	MALE		FEMALE		Mean value of Mother plant
	Number of plants	Percentage of total Male population	Number of plants	Percentage of total Female population	
2.0	27	9.06	32	11.47	
3.0	35	11.74	80	28.67	
4.0	66	22.15	53	19.00	
5.0	75	25.17	78	27.96	
6.0	56	18.79	20	7.17	5.45
7.0	14	4.70	7	2.51	
8.0	12	4.03	9	3.22	
9.0	8	2.68	-	-	
10.0	5	1.68	-	-	

* Total Male population : 298 + Total Female population :279

The result obtained in the present study was in conformity with the general observation where male plants of pointed gourd had more length of internode than female one propagated either through stem or root cuttings. The main consideration for length of internode in a plant particularly the female one was to asses the number of nodes in a vine .There is a possibility for more number of nodes if the vine is longer with shorter length of internode. The situation of more node number in a plant is very much desirable, as flowers are born in nodes. So more number of node may lead ultimately to better yield of crop.

Number of Primary branches per plant:

The number of primary branches in each seedling segregate varied from 2 to 10 , whereas, the mean number for mother plant was 5.45. In male seedling segregates 75 plants, which represented 25.17 per cent of total male population, had 5 primary branches per plant. Beyond this category the number of male plants were on decreasing trend though a maximum of 10 branches were recorded only in 5 plants. On the other hand, the variation in the number of primary branches per plant was from 2 to 8 in female seedling segregates. A maximum of 80 plants (28.67 per cent of total female population) had 3 branches per plant. The main differences in the number of primary branches per plant of seedling segregates irrespective of sex type was due to variation of growth in the plants. In case of female plant, the main emphasis should be given on the type,

Fig. V: Percentage of seedling segregates in different classes on growth characters

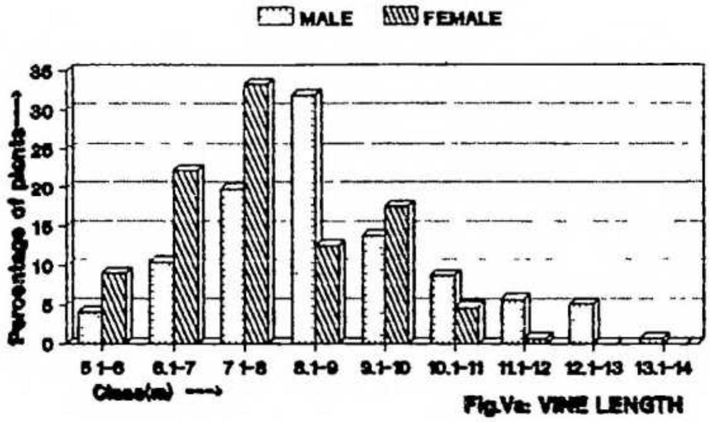

Fig.Va: VINE LENGTH

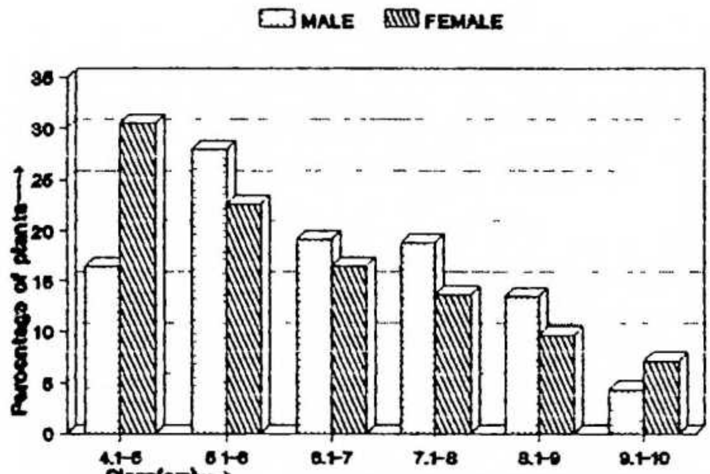

Fig.Vb: LENGTH OF INTERNODE

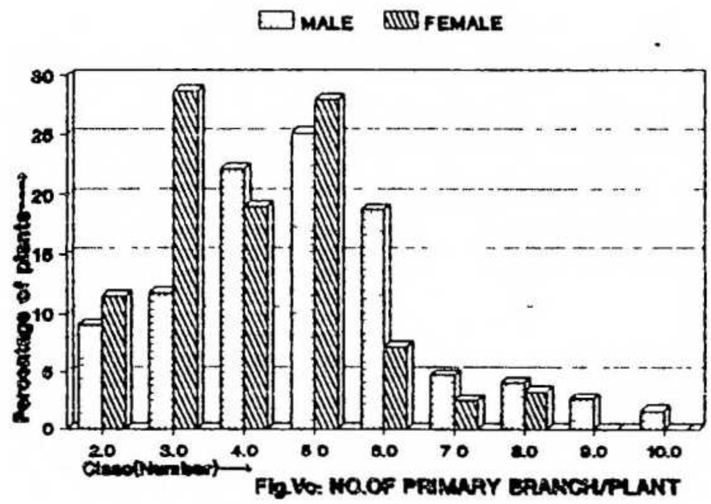

Fig.Vc: NO.OF PRIMARY BRANCH/PLANT

which had more number of primary branches as it had possibility to bear more number of flowers and fruits.

Leaf shape:

A great variation was observed in the leaf shape of seedling segregates of pointed gourd. This was presented in Plate XXV.

FRUIT CHARACTERS OF SEEDLING SEGREGATES (FEMALE):

Observations on different fruit characters like fruit length, fruit diameter, core diameter, number of seeds per fruit, pulp weight, fruit volume and fruit weight were represented through Table XII and Fig. VI (VIa, VIb, VIc and VId). The variation in fruit shape of seedling segregates was shown in Plate XXVI.

Fruit length:

The fruit length of all the female seedling segregates were grouped in four classes ranging from 4.1 to 8.0 cm. The highest number of 92 plants belonged to the class 6.1-7.0 cm followed by 84 number in the class 5.1-6.0 cm. Though the class 7.1-8.0 cm had 77 number of plants the mean value of their fruit length (7.32 cm) did not exceed the fruit length of mother plant (7.84 cm).Thus regarding fruit length, not a single seedling segregate showed outstanding potentialities.

TABLE XII: FRUIT CHARACTERS IN SEEDLING SEGREGATES (FEMALE) OF POINTED GOURD.

Class	Class values	Number of plants	Percentage of total plants* (female)	Mean value of fruit belonging to the class	Mean value of Mother plant
Fruit length (cm):					
4.1-5.0	4.55	26	9.32	4.87	
5.1-6.0	5.55	84	30.11	5.63	
6.1-7.0	6.55	92	32.97	6.49	
7.1-8.0	7.55	77	27.60	7.32	7.84
Fruit diameter (cm):					
2.61-2.8	2.705	47	16.85	2.64	
2.81-3.0	2.905	97	34.77	2.89	
3.01-3.2	3.105	99	35.48	3.13	3.02
3.21-3.4	3.305	36	12.90	3.34	
Core diameter (cm):					
1.51-1.7	1.61	43	15.41	1.58	
1.71-1.9	1.81	108	38.71	1.86	1.86
1.91-2.1	2.01	79	28.31	1.93	
2.11-2.3	2.21	28	10.04	2.21	
2.31-2.5	2.41	13	4.66	2.43	
2.51-2.7	2.61	8	2.87	2.58	
No.of seeds/fruit:					
5-10	7.5	37	13.26	7.61	
10-15	12.5	57	20.43	12.30	
15-20	17.5	64	22.94	18.71	
20-25	22.5	61	21.86	23.93	
25-30	27.5	45	16.13	28.40	27.19
30-35	32.5	15	5.38	33.42	
Pulp weight (g):					
4.1-6.0	5.05	32	11.46	5.42	
6.1-8.0	7.05	63	22.58	7.24	
8.1-10.0	9.05	71	25.45	8.53	
10.1-12.0	11.05	77	27.60	11.01	10.45
12.1-14.0	13.05	36	12.91	12.98	
Fruit- volume (cc):					
20.1-30.0	25.05	19	6.81	27.72	
30.1-40.0	35.05	32	11.47	39.57	
40.1-50.0	45.05	98	35.13	48.64	
50 1-60.0	55.05	61	21.86	59.69	
60.1-70.0	65.05	69	24.73	63.08	64.18
Fruit weight (g):					
15.1-20.0	17.55	7	2.51	18.54	
20.1-25.0	22.55	12	4.30	23.73	
25.1-30.0	27.55	19	6.81	26 17	
30.1-35.0	32.55	50 32	17.92	34.59	
35.1-40.0	37.55	35	12.54	36.98	
40.1-45.0	42.55	71	25.45	44 62	
45.1-50.0	47.55	85	30.47	49.45	49 70

* Total female population : 279

Fruit diameter:

Similar to the fruit length, fruit diameter of different values found in seedling segregates were classified into four classes ranging from 2.61 to 3.4 cm. The highest number of plants (99) belonged to the class 3.01-3.2 cm, and minimum number of plants (36) was observed in the class ranging from 3.21 to 3.4 cm. Most of the plants belonging to the last two classes (3.01-3.2 cm and 3.21- 3.4 cm) had more fruit diameter over mother plant. From the result it was quite evident that a few segregates had more fruit diameter, which signified for further consideration in an improvement programme.

Core diameter:

A great variation in core diameter was observed among the fruits of seedling segregates.These were grouped in six classes ranging from 1.51 to 2.7 cm (Table XII). A maximum number of 108 plants belonged to the class 1.71-1.90 cm , which had the class value of 1.81 cm.But the mean value of core diameter belonging to this class was slightly better (1.86 cm) .Next to this class, a large number of plants (79) belonged to the class of 1.91 to 2.1 cm. But their mean value (1.93 cm) was slightly lower than the class value (2.01 cm). A few number of plants belonging to the first 2 classes had the core diameter at par with mother plant. It was evident from the result that some seedling segregates having lower core diameter than mother plant had the potentiality to be selected in a selection programme.

Fig.VI:Percentage of female seedling segregates in different classes on fruit characters

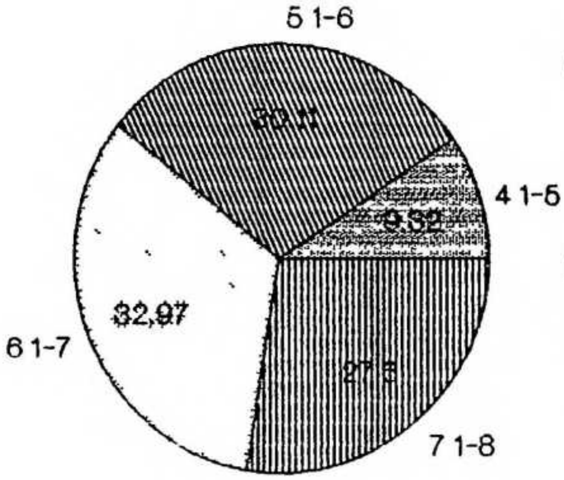

Fig.VIa: FRUIT LENGTH (cm)

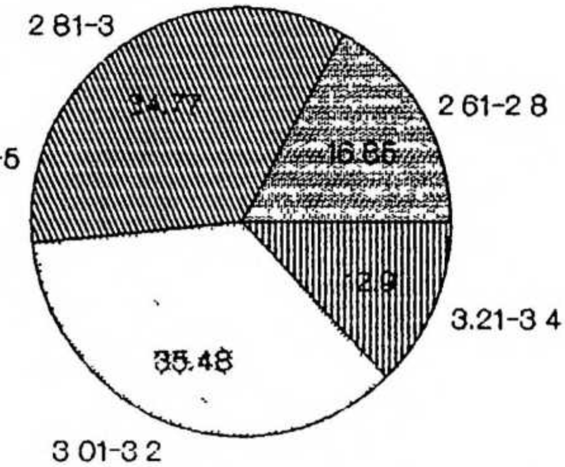

Fig.VIb: FRUIT DIAMETER (cm)

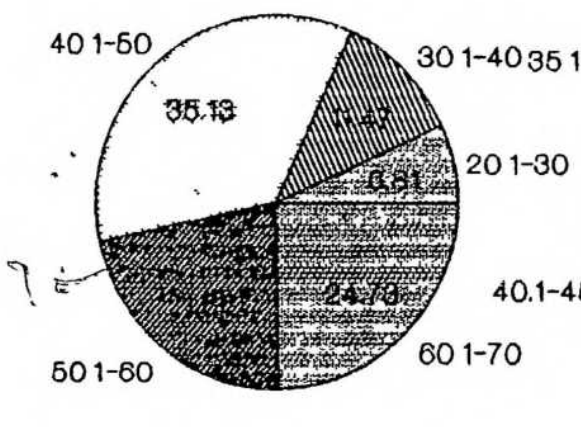

Fig.VIc: FRUIT VOLUME (cc)

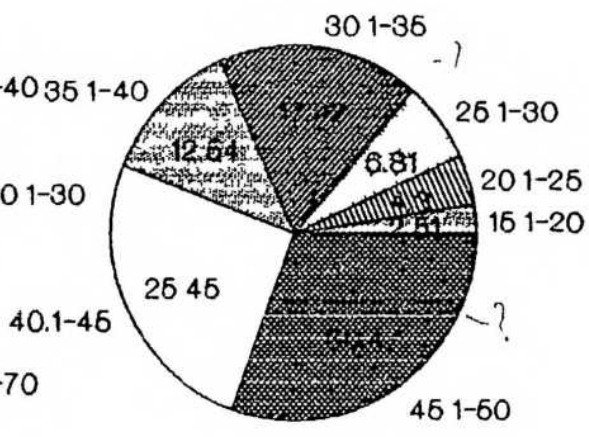

Fig.VIc: FRUIT WEIGHT (g)

Number of Seeds per fruit:

Number of seeds per fruit varied widely ranging from 5 to 35 and those were grouped in six classes. A number of 15 plants (5.38 per cent of female population) belonging to the class ranging from 30 to 35 had more number of seeds per fruit. In addition to that most of the plants belonging to the class 25 to 30 also contained more seeds having higher mean value in comparison to the mother plant (27.19). The highest number of plants (64) was observed in the class having number of seeds 15 to 20, which represented 22.94 per cent of total female population. The plant which had more seed content in fruit not at all desirable.

Pulp weight:

Five classes in relation to the pulp weight obtained from fruits of different seedling segregates were presented in Table XII. A maximum number of 166 plants belonging to the first three classes had lesser pulp weight than mother plant.But in the plants of remaining two classes the pulp weight of fruits was quite more than mother plant . The highest number of plants (77) was observed in the class of 10.1 to 12.0 g having the mean value of 11.01 g which was higher than mother plant. It is obvious that fruit with more weight and less pulp is desirable. Hence in the present study the plants having fruits with less pulp may be considered for selection of seedling segregates.

Fruit volume:

Fruit volume varied widely from 20.1 to 70.0 cc and presented in five classes (Table XII). The highest number of plants(98) belonged to the class of 40.1 to 50.0 cc, with a mean value of 48.64 cc. In all the cases the mean values of fruits belonging to different classes were better than the class values except the last class, where mean values of fruit belonging to this group was slightly lesser (63.08 cc) to class values (65.05 cc). However, the mean values of mother plant (64.18 cc) in this relation was always superior to the seedling segregates. Thus it suggested that fruit-size of seedling segregates obtained in this study had no positive impact over mother plant.

Fruit weight:

A wide variation in fruit weight was observed among the seedling segregates and those were grouped in seven classes ranging from 15.1 to 50.0 g. A number of 85 plants which was 30.46 per cent of total female plant population belonged to the class ranging from 45.1 to 50.0g. In most of the cases mean value of fruits belonging to the different classes were higher than the class values, but in no case it was better than the mother plant (49.70 g). In the last group also (highest range 50.0g) no single fruit was obtained to supersede the mother plant. Thus on the basis of fruit weight, no single segregate was found to be selected for further improvement of pointed gourd.

NUMBER OF FRUITS PER PLANT:

The flowering pattern of seedling segregates was presented earlier (Table X and Fig.IV). Although flowering was observed only in 46 female seedling segregates in the first year (1990-91) the number of fruits even in no seedling segregate exceeded the number of fruits in mother plant (28.7). The highest number of plants (20) producing fruit in the range of 21 to 25 number of fruits per plant representing 43.48 per cent of total female plant population, with a mean value of 23.63. Percentage of female seedling segregates in different classes regarding number of fruits per plant was represented in Table XIII and Fig.VIIa. In the second year (1991-92) flowering was observed in 149 plants for the first time and the number of fruits in a seedling segregate ranged from 16 to 35 in number.Though a few plants of last two classes (26-30 and 31-35) bore more fruits than the mean value of mother plant in the first year, but in comparison to the performance of mother plant in the second year (39.4) these two groups were found to be inferior in this relation. However, the seedling segregates, which flowered successivey in the second year had a wider range of fruits per plant. Only 4 plants belonging to the last group (41 to 45) bore more number of fruits than the mother plant and those plants were identified because of their potentiality to bear more number of fruits. The number of fruits obtained from the identified plants were 47,45,43 and 42. Among those, two promising seedling segregates with their leaf and fruit shape were presented in

TABLE XIII: NUMBER OF FRUITS PER PLANT IN SEEDLING SEGREGATE (FEMALE) OF POINTED GOURD.

Sl. No.	Category of Seedling Segregates*	Class	Class values	Number of plants	Percentage of total plants in the group	Mean value of fruit belonging to the class	Mean value of Mother plants
	Those plants	11-15	13.00	10.00	21.74	14.61	
1	flowered first	16-20	18.00	14.00	30.43	18.00	
	time in first year	21-25	23.00	20.00	43.48	23.63	
	(1990-91)	26-30	28.00	2.00	4.35	27.82	28.70
	Total			46	100.0		
	Those plants	16-20	18.00	25.00	16.78	17.31	
2	flowered first	21-25	23.00	35.00	23.49	24.55	
	time in second year	26-30	28.00	63.00	42.28	27.81	-
	(1991-92)	31-35	33.00	26.00	17.45	33.00	
	Total			149	100.0		
	Those plants	21-25	23.00	3.00	6.52	24.66	
3	flowered successively	26-30	28.00	8.00	17.39	28.15	
	for second time	31-35	33.00	12.00	26.09	34.73	
	in second year	36-40	38.00	19.00	41.30	38.71	39.40
	(1991-92)	41-45	43.00	4.00	8.70	43.00	
	Total			46	100.0		
	Those plants	21-25	23.00	14.00	16.67	24.73	
4	flowered first	26-30	28.00	26.00	30.95	26.37	
	time in third year	31-35	33.00	30.00	35.71	34.65	
	(1992-93)	36-40	38.00	14.00	16.67	38.54	-
	Total			84	100.0		
	Those plants	21-25	23.00	10.00	6.71	24.32	
5	flowered successively	26-30	28.00	22.00	14.77	28.41	
	for second time in	31-35	33.00	48.00	32.21	32 00	-
	third year (1992-93)	36-40	38.00	65.00	43.62	37.84	
		41-45	43.00	4.00	2.69	43.75	
	Total			149	100.0		
	Those plants	16-20	18.00	7.00	15.22	18.92	
6	flowered successively	21-25	23.00	20.00	43.48	24.21	
	for third time in	26-30	28.00	14.00	30.43	27.71	30.30
	third year (1992-93)	31-35	33.00	5.00	10.87	33.40	
	Total			46	100.0		

*In graphical representation (Fig.VIIa) the category of seedling segregates were reprented serially as Category-I,II,III,IV,V and Category VI.

Plate XXVII and XXVIII alongwith their mother plant (Plate XXIX). In the third year (1992-93) of experimentation 84 plants flowered for the first time and the number of fruits ranged from 21 to 40 in number, but no seedling segregate out- yielded the performance of mother plant in the second year of fruiting. Among 149 plants, which flowered successively for second time in third year,only 5 plants from the last two classes (36 - 40 and 41 - 45 in number) outyielded the mother plant. The number of fruits obtained form those plants were 40,42,42,44 and 47. A number of 46 plants flowered successively for third time in this year. Among those,in addition to the 4 plants which yielded more fruits than mother plant in the second year, one more plant also produced higher number of fruits than mother plant in the third year. In the successive third fruiting mother plant produced 30.3 fruits in number whereas the number of fruits produced by those 5 plants belonging to the last group(31 - 35 in number) were 32,32,34,34 and 35 having a mean value of 33.4. On the basis of their potentiality to bear more fruits than the mother plant in the second and third fruiting as well, those seedling segregates were identified and may be considered for further improvement programme of this crop.

YIELD PER PLANT:

Yield obtained from female seedling segregates in the three years of experimentation were arranged in different classes (Table XIV and Fig.VIIb). In the first year yield varied from 0.31 to 1.1 kg, but no seedling segregate outyielded the mother plant which produced a yield of 1.09 kg per plant in its first fruiting during the first year of experimentation.Among 46 plants, the highest (22) number of plants was observed in the class ranging from 0.71 to 0.9 kg, which was actually the 47.83 per cent of total female plants flowered in the first year(1990-91) with a mean value of 0.79 kg. The same trend was marked in case of 149 plants flowered first time in second year (1991-92). A maximum number of 55 plants was observed in the class 0.51 to 0.7 kg with a mean value of 0.67 kg. Though 46 number of plants which flowered successively for second time in this year showed more yield (1.11 to 2.1 kg), the mean value of any class could not exceed the yield of mother plant in second year(1.98 kg). In the third year (1992-93) the yield of 84 plants which flowered for the first time were grouped in 5 classes ranging from 0.31 to 1.3 kg. The result showed that though few plants were found to be better in comparison to the yield of mother plant in first fruiting, they failed to supersede the performance of mother plant in second fruiting in second year. The yield of all the seedling segregates was compared with the performance of mother plant in second year, as because of the fact that mother plant showed its highest value in this experiment.

The yield of 149 seedling segregates, those flowered successively for the second time in third year were categorised in classes with a range of 1.11 to 1.9 kg. Though the plants produced more yield than their first fruiting in first year,they

TABLE XIV: YIELD PER PLANT IN SEEDLING SEGREGATES (FEMALE) OF POINTED GOURD.

Sl. No.	Category of seedling segregates*	Class (kg)	Class values (kg)	Number of plants	Percentage of total plants of the group	Mean value of fruit belonging to the class (kg)	Mean value of Mother plants (kg)
	Those plants	0.31-0.5	0.405	6	13.04	0.48	
	flowered first	0.51-0.7	0.605	15	32.61	0.66	
1	time in first year	0.71-0.9	0.805	22	47.83	0.79	
	(1990-91)	0.91-1.1	1.005	3	6.52	0.98	1.09
	Total			46	100.0		
	Those plants	0.31-0.5	0.405	21	14.10	0.56	
	flowered first	0.51-0.7	0.605	55	36.91	0.67	—
2	time in second year	0.71-0.9	0.805	46	30.87	0.96	
	(1991-92)	0.91-1.1	1.005	27	18.12	1.07	
	Total			149	100.0		
	Those plants	1.11-1.3	1.205	9	19.56	1.27	
	flowered successively	1.31-1.5	1.405	12	26.09	1.49	
3	for second time	1.51-1.7	1.605	12	26.09	1 57	
	in second year	1.71-1.9	1.805	8	17.39	1.87	
	(1991-92)	1.91-2.1	2.005	5	10 87	1.93	1.98
	Total			46	100.0		
	Those plants	0.31-0.5	0.405	4	4.76	0.57	
	flowered first	0.51-0.7	0.605	10	11.9	0.73	
4	time in third year	0.71-0.9	0 805	29	34.53	0.88	—
	(1991-92)	0.91-1.1	1.005	24	28.56	1.17	
		1.11-1.3	1.205	17	20.24	1.29	
	Total			84	100.0		
	Those plants	1.11-1.3	1.205	33	22.15	1 26	
	flowered successively	1.31-1.5	1.405	53	35.57	1.44	—
5	for second time in	1.51-1.7	1.605	41	27.52	1.57	
	third year (1992-93)	1.71-1.91	1.805	22	14 76	1.79	
	Total			149	100.0		
	Those plants	0.71-0.9	0.805	4	8.67	0.84	
	flowered successively for	0.91-1.1	1.005	14	30.43	0.98	
6	third time in third year	1.11-1 3	1.205	15	32.61	1.24	
	(1992-93)	1.31-1.5	1.405	13	28.26	1.39	1.53
	Total			46	100.0		

* In graphical representation (Fig.VIIb.) the category of plants were represented serially as Category I, II, III, IV, V and VI.

could not supersede the performance of mother plant in the second year. Similarly, in case of 46 plants, which flowered successively for the third time in third year, the yield of all the seedling segregates was found to be lower than the yield of mother plant in the third year(1.53 kg),in its third fruiting. From the overall result, it is quite clear that no seedling segregate proved its superiority over the performances of mother plant regarding yield. However, a few plants were identified on the basis of more number of fruits but their yield were not at par with the mother plant. Similarly, though a few plants showed more fruit diameter, they did not contribute positively to the increament of total yield.

Hence, seedling segregates showing better performance over mother plant particularly in relation to the number of fruits per plant, and fruit diameter may be utilised for further improvement of the crop. Besides, there may be a possibility to obtain better types, if more number of seedlings are included in such a programme to create wider variability.

Fig. VII: Percentage of female seedling segregates in different classes regarding yield attributes

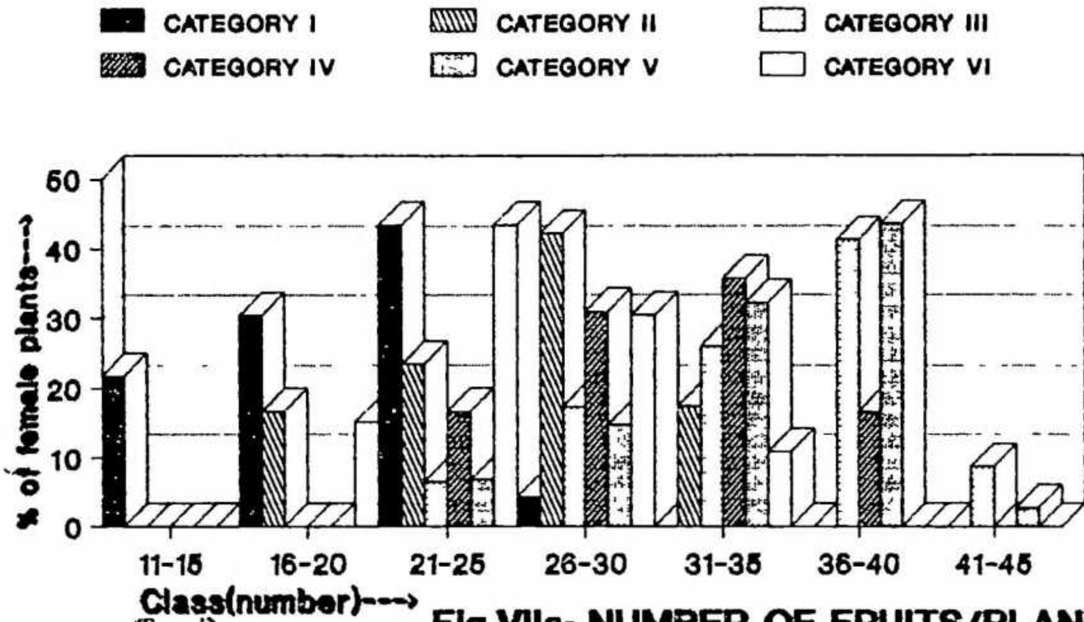

Fig. VIIa: NUMBER OF FRUITS/PLANT

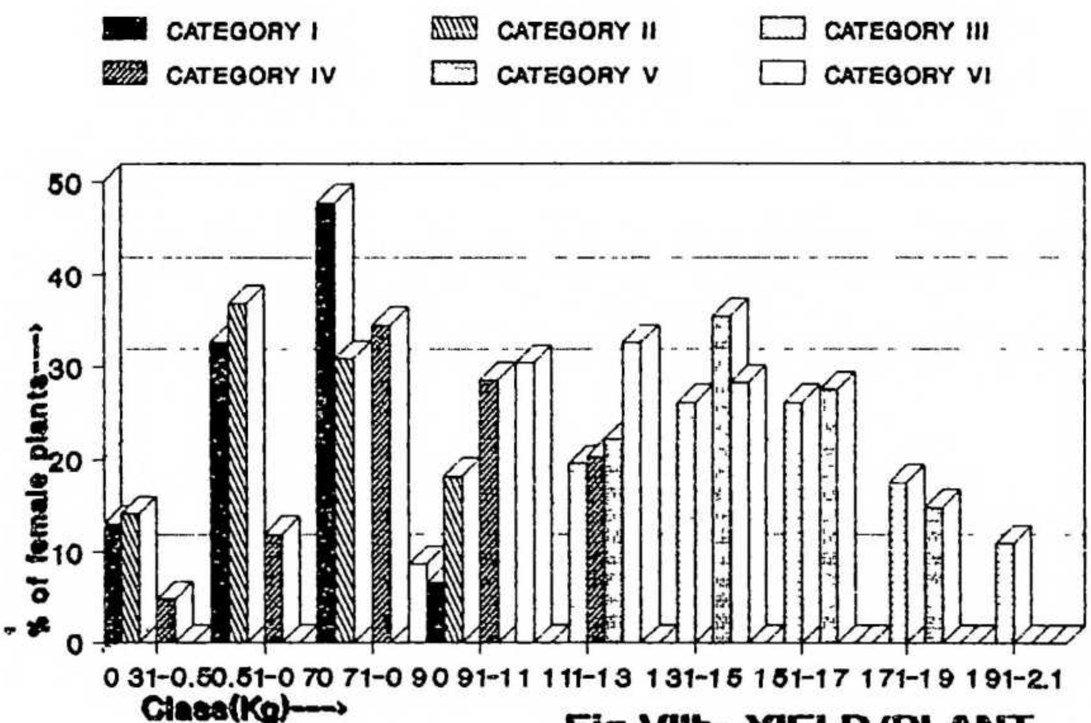

Fig. VIIb: YIELD/PLANT

EXPERIMENT NO.3:EFFECT OF PLANT GROWTH REGULATORS ON INDUCTION OF FLOWERING AND SEX EXPRESSION IN SEED PROPAGATED PLANTS.

The results obtained on different characters during experimentation have been presented below:

GROWTH CHARACTERS:

The data recorded on variation in growth characters of seedling segregates like vine length, length of internode and number of primary branches per plant in different years by the application of growth regulators were presented in Table XV and Fig. VIII (VIIIa, VIIIb, VIIIc).

Vine Length:

It revealed from Table XV and Fig. VIIIa that vine length of seedling segregates varied significantly for all the three years of experiment. GA (100 ppm) produced the longest vine in each year followed by IBA (50 ppm) and GA (50 ppm). In the third year GA (100 ppm) produced the maximum vine length of 8.48m followed by IBA (50 ppm) and GA (50 ppm) with the values of 8.16 m and 7.96 m respectively. The length in control plant was 6.24m. It was also observed that MH and CCC at all concentrations and, NAA and Ethrel at higher concentration suppressed the growth of the vine for all the three years and they were found even inferior to control. The minimum average vine length of 2.28 m was however observed in MH (100 ppm) followed by CCC (200 ppm)

TABLE XV: EFFECT OF GROWTH REGULATORS ON GROWTH OF SEEDLING SEGREGATES OF POINTED GOURD*.

Tr. No	Treatment	Vine length (m)				Length of internode (cm)				No. of Primary branches/plant			
		A	B	C	Mean	A	B	C	Mean	A	B	C	Mean
1	IAA 100 ppm	5.87	6.84	7.24	6.65	7.43	7.45	7.51	7.46	5.14	5.86	6.61	5.87
2	IAA 200 ppm	5.4	5.81	6.0	5.74	7.12	7.01	7.13	7.09	4.83	5.26	6.04	5.38
3	NAA 25 ppm	5.21	6.46	6.88	6.18	7.2	7.21	7.22	7.21	4.71	5.53	5.87	5.37
4	NAA 50 ppm	3.98	5.0	5.44	4.81	7.47	7.53	7.51	7.5	5.73	5.84	7.02	6.2
5	Ethrel 100 ppm	4.98	6.17	6.73	5.96	5.87	5.89	6.0	5.92	4.83	6.36	6.87	6.02
6	Ethrel 200 ppm	3.97	5.65	5.85	5.16	5.48	5.5	5.56	5.51	6.43	7 22	7.81	7.15
7	GA 50 ppm	5.84	6.98	7.96	6.92	7.71	7.75	7.8	7 75	4.51	5.82	6.17	5.48
8	GA 100 ppm	6.73	7.87	8.48	7.69	8.31	8.36	8.34	8.34	4.15	5.43	5.67	5.08
9	IBA 25 ppm	5.33	6.84	7 27	6.4	7.14	7.18	7 2	7.17	4.78	5.62	5.86	5.42
10	IBA 50 ppm	6.0	7.55	8.16	7.23	7.56	7.58	7 54	7.56	4 46	5.26	5 48	5.06
11	Kinetin 5 ppm	5.21	6 49	6.64	6 11	6.85	6.83	6.81	6 83	5 81	6.34	6.87	6.34
12	Kinetin 10 ppm	5 85	6 98	7.25	6 69	7 69	7.72	7.75	7.72	6 23	7.4	7 81	7.q15
13	CCC 100 ppm	2 5	3.26	3.84	3.21	4 41	4.52	4.53	4.49	4.92	7.33	7 68	6 64
14	CCC 200 ppm	1.98	2.78	2.99	2.58	3.72	3.83	3 74	3.76	6.13	8.19	8.41	7 58
15	MH 50 ppm	2.28	3.15	3.45	2.96	4.34	4 43	5 0	4.59	5.19	7.34	8.25	6.93
16	MH100 ppm	1.75	2 43	2.67	2 28	4 0	4.12	4.87	4 33	6 83	8 36	9.01	8 07
17	Control	4.95	5 84	6.24	5.51	6.82	6.78	6.79	6.79	4.64	5.12	5.81	5.19
S.Em ±		0.044	0 289	0.246		0.09	0.103	0.153		0.023	0.057	0.07	
CD at 5%		0.09	0.583	0.498		0.18	0.209	0.309		0.046	0.117	0.143	

A: 1990-91
B: 1991-92
C: 1992-93

* In graphical representation (Fig VIIIa, VIIIb and VIIIc) the treatments were represented serially as T1, T2 . T16 and T17.

and MH (50 ppm) with a value of 2.58 m and 2.96 m respectively whereas in control, the vine length was found to be moderate (5.51 m).

The increased vine length in GA treated seedling segregates might be due to more cell elongation. The growth stimulation by GA in plants was evidenced by several workers. Hillyer (1958) and Audus (1972) opined that the growth stimulation was the result of cell elongation and increased number of nodes; while Stowe and Yamaki (1959) observed that stems of GA sprayed plants usually become much longer than normal due to striking effect of GA on stimulation of growth. Sachs *et al*.(1960) advocated the striking effect of GA was due to pronounced increase in cell division in sub-apical meristem. The result obtained in the present study can be supported by several workers who observed increased vine length with GA application in a number of cucurbits. [Rodriquex and Lambeth (1972), Arora and Partap (1988), Arora *et al*.(1989) and Sarkar *et al*. (1989)].

MH, CCC at all concentrations and, Ethrel and NAA at higher concentration inhibited the growth of vine. Possible explanation of growth inhibition was given by Watson (1952) and Hillyer (1958). According to Watson the growth retardation by MH application was apparently due to inhibition of cell multiplication. Hillyer, however, noted that MH treated plants showed suppressed cell differentiation only in apical meristem and that was how ultimately plant growth was retarded. The growth inhibition of the main axis in NAA treatments, particularly at inhibition of the main axis in NAA treatments, particularly at higher concentration (200 ppm) was reported by Borkowski (1972) in cucumber and this inhibition was possibly due to toxic effect of the chemical on the plant growth.The inhibitory effect of CCC obtained in the study was in conformity with the findings of Sarkar *et al.* (1989) who noted the minimum vine length in pointed gourd with CCC (500 ppm). The reduced growth by CCC, Ethrel, MH, and NAA was also reported by Rodriquex and Lambeth (1972) and Talalova (1984) in cucumber, Sulikeri and Bhandary (1973) in muskmelon, Arora *et al* (1982) in summer squash, Dubey (1983) in sponge gourd and Kabir *et al.* (1989) in bitter gourd. On the contrary, Dubey (1983) observed stimulated vine length in sponge gourd with NAA (50-200 ppm) and Arora *et al.* (1982) reported increased vine growth in bottle gourd with MH (150 mg/l).

However, from the above discussion it was observed that GA and IBA have striking effect on the growth enhancement of the crop.

Length of internode:

From Table XV it was observed that length of internode varied significantly for different treatments. But within the years, no marked variation was recorded in this regard. From the average performance over three years of experiment, GA (100 ppm) was found to be superior to any other treatment followed by GA (50 ppm). The values for GA (100 ppm) were 8.31 , 8.36 and 8.34 cm for 1990-91, 1991-92 and 1992-93 respectively. Similar to the vine length, CCC and MH at all concentrations had no positive influence on the length of internode also. These chemicals always produced the internode with shorter length and in all the years of experimentation, it was found even lesser than the control (6.79 cm). The minimum length of internode (3.76 cm) was observed in CCC (200 ppm) treated plants followed by MH (100 ppm) with a value of 4.33 cm whereas the other treatments showed moderate values in this relation. A similar type of result in pointed gourd was reported by Sarkar *et al.* (1989), who observed the longest internode by GA_3 (200 ppm) and the shortest by CCC (500 ppm) treated plants. The suppression of the length of internode by CCC was also reported earlier by Ejsmond (1974) in cucumber and Edelstein *et al.*(1984) in *Cucurbita pepo* L. Arora *et al.* (1989) also observed reduced length of internode in ridge gourd with application of CCC.

Enhanced cell elongation by application of GA might be the reason for longer internode. The opinion of Weaver (1972) can be put forward in this relation. He inferred that growth was stimulated in the younger internodes and tissues and frequently the length of the individual internode was increased . This obviously increased the length of internode. The shorter length of internode by the application of growth retardant (like CCC), growth inhibitor (like MH) and Ethrel as well at higher concentration was probably because of the inhibition of cell division and cell elongation at subapical meristem (Sirkar, 1971).

Fig. VIII: Effect of growth regulators on growth of seedling segregates

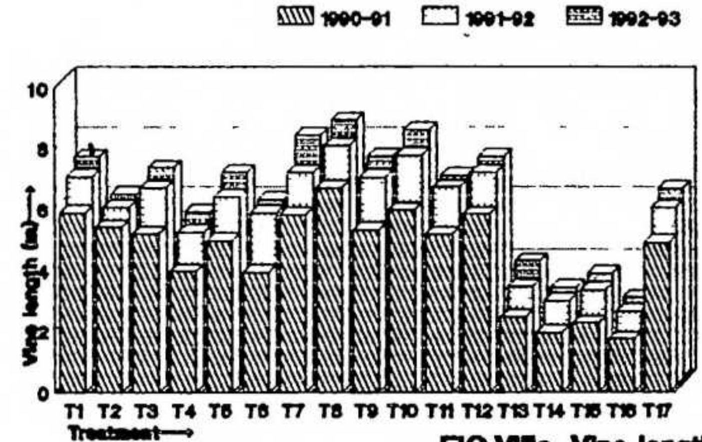

FIG. VIIIa: Vine length

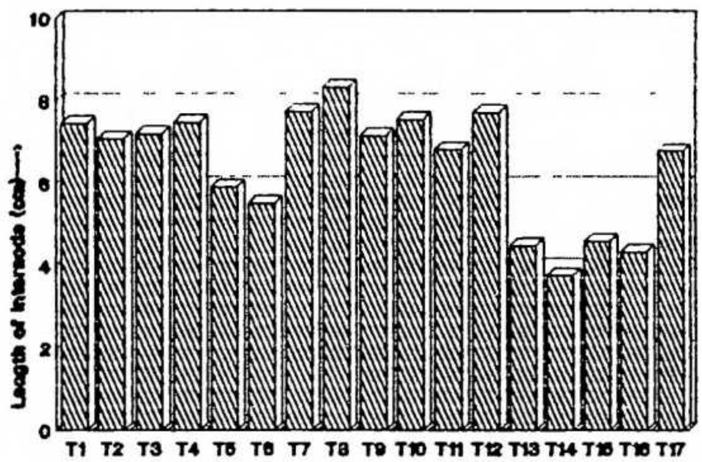

Fig VIIIb: MEAN LENGTH OF INTERNODE

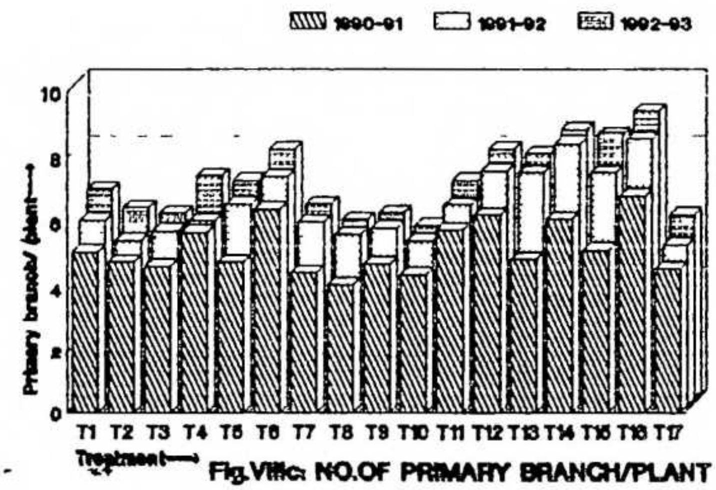

Fig. VIIIc: NO.OF PRIMARY BRANCH/PLANT

Number of primary branches per Plant:

The number of primary branches varied significantly with the various growth regulators treatment and a gradual increase in the number was observed in the succeeding years . A marked variation was also noted for individual years in this relation (Fig. VIIIc). The maximum average number of 8.07 of branches was recorded in MH (100 ppm) followed by CCC (200 ppm) Ethrel (200 ppm) and Kinetin (10 ppm) having a number of 7.15. The lowest number of primary branches (5.04) was observed in IBA (50 ppm) treated plants which was closely followed by GA (100 ppm) and in control the number was 5.19 only.

This result was not in a line with the observation of Sarkar *et al*. (1989) who found highest number of branches in IAA (100 ppm) and lowest in CCC (500 ppm) treated plants. However, the result corroborated the findings of Arora *et al* . (1982), Dubey (1983), Talalova (1984) and Arora *et al*. (1989), who noted increased number of primary branches with the application of MH, Ethrel and NAA in different cucurbits. The increased number of primary branches in these treatments was possibly due to the suppression of apical dominance which induced lateral branching. Sachs *et al*.(1960) opined that MH and CCC due to their inhibitory action to growth, retard stem elongation by preventing cell division in the sub-apical meristem, usually without similarly affecting the apical meristem.

The possible reason for increased number of branches in

Ethrel treatment can be explained by the views of Weaver(1972). The view advocated by him was that ethylene stimulates sprouting and regulates growth by altering the transport or metabolism of auxin. The reason behind increased number of primary branches with Kinetin can be supported with the views of Chvojka *et al* . (1961) and Williams and Stahly (1968).They were of the view that application of Cytokinin overcomes apical dominance and encourages the axillary buds to grow. Axillary buds on actively growing shoots produce lateral branches if treated with Cytokinin. On the otherhand, IBA,and GA produced lesser branches due to their apical dominance which reduced the growth of axillary buds.

FLOWERING, SEX EXPRESSION AND SEX RATIO;

Observations on these aspects were represented in Table XVI and Fig. IX .

Percentage of total plants flowered:

It is apparent from table that a wide variation was observed in the percentage of total plants flowered with the application of growth regulators in different years of experiment.In the first year, though 14.7 percent plants flowered in control, few treatments had no impact on flower induction. But in the subsequent years, all the treatments bore flowers and the percentage of total plants flowered were on increasing trend. In the first year, GA (100 ppm) proved its superiority in inducing flower over any treatment and 42.12 per

TABLE XVI: EFFECT OF GROWTH REGULATORS ON INDUCTION OF FLOWERING, SEX EXPRESSION AND SEX RATIO OF SEEDLING SEGREGATES OF POINTED GOURD.*

Tr. No	Treatment	Percentage of total plants flowered			Sex expression						Sex ratio (Male:Female)		
		A	B	C	A		B		C		A	B	C
					Male	Female	Male	Female	Male	Female			
1	IAA 100 ppm	-	82.47	98.81	-	-	48.34	51.66	50.32	49.68	-	1:1.07	1:1.01
			(65.29)	(83.71)			(44.03)	(45.92)	(45.17)	(44.77)			
2	IAA 200 ppm	-	60.66	94.64	-	-	40.35	59.65	49.45	50.55	-	1:1.48	1:1.06
			(51.12)	(76.56)			(39.41)	(50.53)	(44.66)	(45.29)			
3	NAA 25 ppm	-	75.33	98.45	-	-	46.19	53.81	49.53	50.47	-	1:1.17	1:1.02
			(60.20)	(82.73)			(42.76)	(47.84)	(44.71)	(45.23)			
4	NAA 50 ppm	35.71	80.51	99.62	39.71	60.29	45.64	54.36	50.31	49.69	1:1.52	1:1.19	1:0.98
		(36.69)	(63.79)	(86.37)	(39.06)	(50.89)	(42.48)	(47.47)	(45.17)	(44.77)			
5	Ethrel 100 ppm	27.43	85.17	98.46	23.90	76.10	34.85	65.15	49.84	49.16	1:3.2	1:1.87	1:1.05
		(31.56)	(67.29)	(82.73)	(29.27)	(60.73)	(36.15)	(53.79)	(44.89)	(44.48)			
6	Ethrel 200 ppm	-	69.23	87.65	-	-	28.80	71.20	50.63	50.37	-	1:2.47	1:1.1
			(56.29)	(69.38)			(32.46)	(57.54)	(45.34)	(45.17)			
7	GA 50 ppm	36.84	77.41	98.79	59.43	40.57	54.41	41.59	50.22	49.78	1:0.68	1:0.76	1:0.93
		(37.35)	(61.61)	(83.45)	(50.42)	(39.52)	(47.52)	(40.11)	(45.11)	(44.83)			
8	GA 100 ppm	42.12	83.54	99.47	74.80	35.20	58.73	45.27	50.41	49.59	1:0.47	1:0.70	1:0.98
		(40.45)	(66.03)	(85.56)	(59.87)	(36.39)	(50.01)	(42.25)	(45.23)	(44.71)			
9	IBA 25 ppm	-	68.33	97.46	-	-	44.45	55.55	49.65	50.35	-	1:1.25	1:1.1
			(55.73)	(80.92)			(41.78)	(48.16)	(44.77)	(45.17)			
10	IBA 50 ppm	30.61	79.43	96.35	42.72	57.28	47.81	52.19	49.82	50.18	1:1.34	1:1.09	1:1.05
		(33.58)	(63.01)	(78.91)	(40.22)	(49.14)	(43.74)	(46.20)	(44.89)	(45.06)			
11	Kinetin 5 ppm	20.00	72.18	96.81	34.84	65.16	40.64	59.36	50.11	49.89	1:1.87	1:1.46	1:1.04
		(26.57)	(58.12)	(79.70)	(36.15)	(53.79)	(39.58)	(50.36)	(45.06)	(44.89)			
12	Kinetin 10 ppm	34.63	66.26	92.72	26.72	73.28	31.47	68.53	49.63	50.37	1:2.74	1:2.18	1:1.19
		(36.03)	(54.45)	(74.32)	(31.11)	(58.82)	(34.08)	(55.86)	(44.77)	(45.17)			
13	CCC 100 ppm	23.81	86.45	94.00	37.28	62.72	38.54	61.46	50.39	49.61	1:1.68	1:1.59	1:1.01
		(29.2)	(68.36)	(75.82)	(37.58)	(52.36)	(38.35)	(51.59)	(45.17)	(44.77)			
14	CCC 200 ppm	-	64.57	78.00	-	-	32.44	67.56	45.47	54.53	-	1:2.08	1:1.2
			(53.43)	(62.03)			(34.70)	(55.24)	(42.36)	(47.58)			
15	MH 50 ppm	-	78.34	87.53	-	-	35.73	64.27	47.53	52.47	-	1:1.8	1:1.1
			(62.24)	(69.30)			(36.69)	(53.25)	(43.57)	(46.38)			
16	MH 100 ppm	-	64.21	82.53	-	-	32.44	67.56	45.81	54.19	-	1:2.08	1:1.18
			(53.25)	(65.27)			(34.70)	(55.24)	(42.89)	(47.35)			
17	Control	14.70	70.77	98.63	46.52	53.48	52.82	47.18	50.32	49.68	1:1.15	1:0.89	1:0.98
		(22.54)	(57.23)	(83.20)	(42.99)	(46.95)	(46.61)	(43.34)	(45.17)	(44.77)			
S.Em ±		0.228	0.274	0.387	0.234	0.225	0.219	0.318	0.223	0.292			
CD at 5%		0.461	0.553	0.782	0.473	0.455	0.441	0.642	0.451	0.589			

A: 1990-91
B: 1991-92
C: 1992-93

*Figure in the parenthesis shows the angular value.

cent of total plants flowered. GA (50 ppm) and NAA (50 ppm) closely followed this treatment with a flowering of 36.84 and 35.70 per cent to total plants respectively. Photographs of early flower induction in seedling segregates by some promising treatments in the first year were presented in Plate XXX, XXXI, XXXII, XXXIII, XXXIV and XXXV. In the second year, CCC (100 ppm) superseded all the treatments having 86.45 per cent flowering plants and closely followed by Ethrel (100 ppm) and GA (100 ppm) with a value of 85.17 and 83.54 per cent respectively. The lowest percentage (60.66) in this relation was noted in IAA (200ppm) followed by MH (100 ppm) and CCC (200 ppm). These treatments including Kinetin (10 ppm), IBA (25 ppm) and Ethrel (200 ppm) were even inferior to control. In the third year the percentage of total plants flowered was quite higher than the second year and flowering was observed in most of the plants in the treatments. However, NAA (50 ppm) had the highest value of 99.62 per cent followed by GA (100 ppm) with 99.47 per cent flowering. Few treatments like MH (50 and 100 ppm), CCC (200 ppm), and Ethrel (200 ppm) were even quite inferior to control. In all the three years the treatment variations were found to be significant.

Generally in seed propagated plants of pointed gourd flowering is observed in second and third year of planting (Seshadri, 1986). But in the present study a less per cent of plants flowered in the first year. Probably it was due to the positive influence of environment which favoured early flowering. This result was also found to be contradictory to the report of Sarkar *et al.*(1989), who observed no flowering in the first year of experimentation. The non-flowering in the first year by NAA and IBA at lower concentration and 1AA at both the concentration can be supported with the views of Weaver (1972), who suggested auxin inhibits flowering in some plants, though the role of auxin in flower induction is not clear. Besides, those growth regulators had a positive role on vegetative growth of plant which in turn sometimes delayed flowering.The possible explanation of non-flowering in CCC (200 ppm) and MH at both concentrations was that these chemical suppressed vegetative as well as reproductive phase of the crop. Weaver (1972) also advocated CCC at higher concentration and MH prevent leaf and flower initiation, as well as fruit-set and enlargement. The flowering in other treatments was due to their positive role on flower induction. The gradual increase in the number of total plants flowered in the subsequent years was mainly because of attainment of certain maturity. The probable reason for lower percentage of total plants flowered at CCC and MH was that these chemicals inhibit GA synthesis reflecting less flowering of the crop (Weaver,1972). Thus the result indicated that NAA (50 ppm) and GA (100 ppm) can be used for early induction of flowering in seed propagated plants of pointed gourd.

Sex expression and Sex ratio:

It revealed from table that the mode of sex expression and sex ratio varied greatly with the application of different

Fig.IX: Effect of growth regulators on induction of flowering & sex expression of seedling segregates in different year

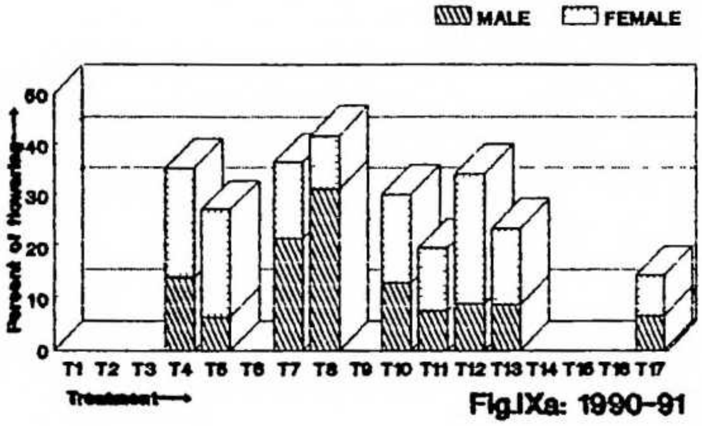

Fig.IXa: 1990-91

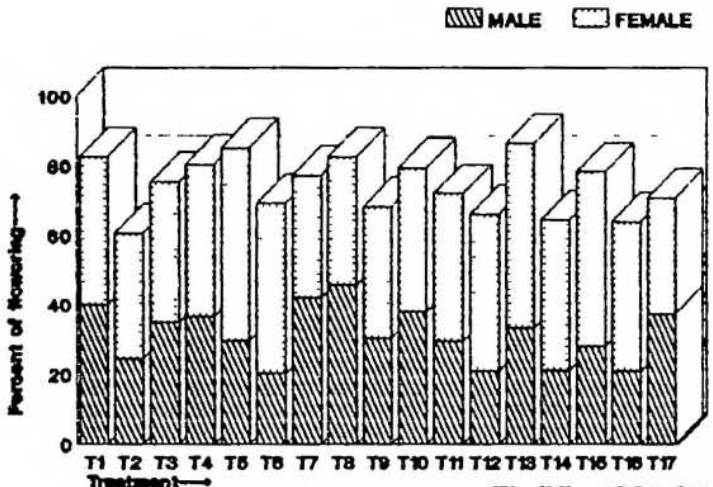

Fig.IXb: 1991-92

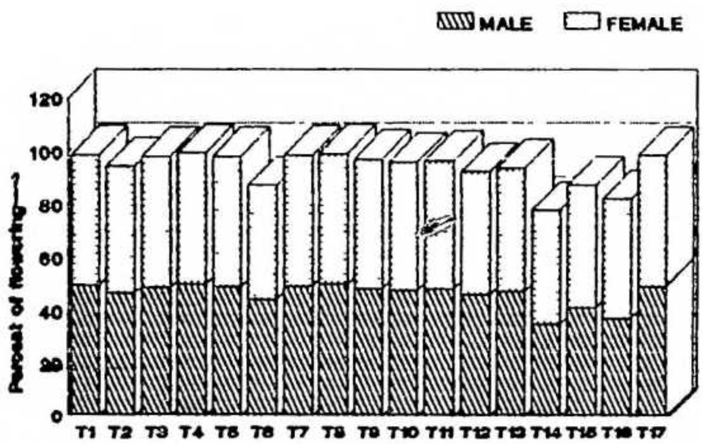

Fig.IXc: 1992-93

growth regulators. In the control plants, the percentage of female population was higher in the first year with a sex ratio of 1:1.15 (M:F).In the second year with the increase of male plant populaltion, the ratio was quite lower i.e 1:0.89. However, in the third year when flowering was almost completed, the ratio was about 1:1 (1:0.98).In other treatments where flowering occured for first time the first year, the highest percentage (76.1) of female population was recorded in Ethrel (100 ppm) followed by Kinetin (10 ppm) and as well as Kinetin (5 ppm). The sex ratio for these treatments were 1:3.2, 1:2.74 and 1:1.87 respectively.The sex ratio for GA treatments was found to be quite low as the percentage of male plant population was more. In the second year flowering was occured in all the treatments and the percentage of female plant population was highest (71.2) in Ethrel (200 ppm) followed by Kinetin (10 ppm), CCC (200 ppm) and MH (100 ppm) with the percentage of 68.53, 67.56 and 67.56 respectively. This situation resulted in a higher sex ratio (M:F). On the contrary, GA treatments had a lower sex ratio as the percentage of male plant was more in these treatments. Other treatments had moderate values in this relation.

In the third year, except a few treatments, almost all the plants in other treatments flowered. Percentage of male and female plant was more or less same resulting a sex ratio of about 1:1. The variation in the sex ratio in different treatments was due to differences in the percentage of total flowering to both the male and female population in the respective treatments.

PLATE NO. XXIV

SEEDLINGS SEGREGATES SHOWING FLOWERING AND FRUITING IN THE FIRST YEAR OF GROWING.

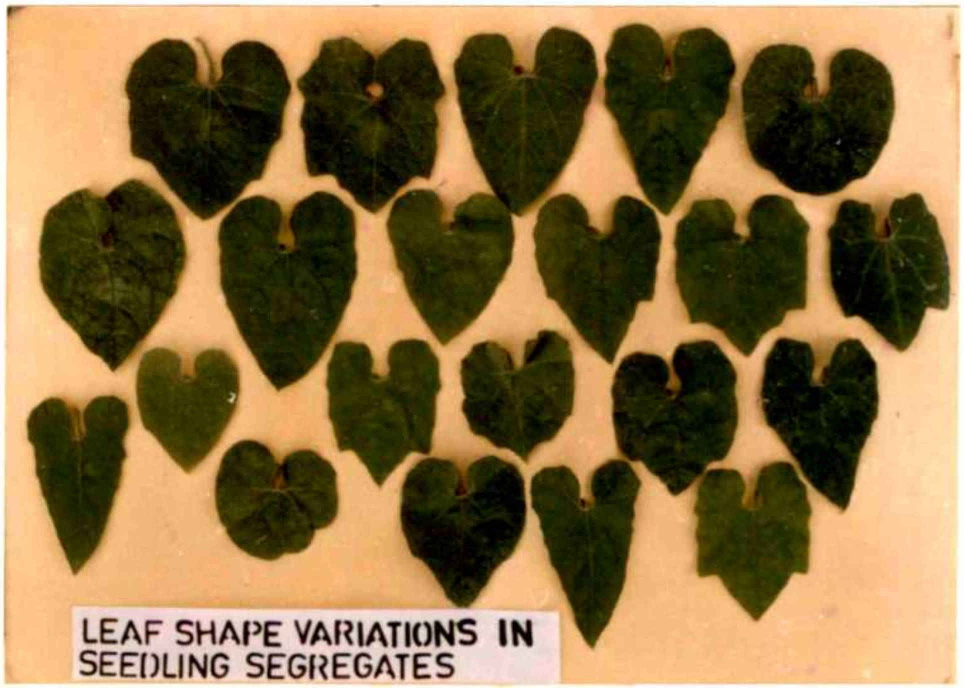

PLATE NO. XXV

LEAF SHAPE VARIATION IN SEEDLING SEGREGATES.

PLATE NO. XXVI

VARIATION OF FRUIT SHAPE IN SEEDLING SEGREGATES.

PLATE NO. XXVII

PLATE NO. XXVIII

PLATE NO. XXIX

LEAF AND FRUIT SHAPE VARIATIONS IN TWO PROMISING SEEDLINGS SEGREGATES WITH THEIR MOTHER PLANT.

PLATE NO. XXX

PLATE NO. XXXI

PLATE NO. XXXII

EARLY FLOWER INDUCTION (FIRST YEAR) IN SEEDLING SEGREGATES WITH SOME GROWTH REGULATORS.

PLATE NO. XXXIII

PLATE NO. XXXIV

PLATE NO. XXXV

EARLY FLOWER INDUCTION (FIRST YEAR) IN SEEDLING SEGREGATES WITH SOME GROWTH REGULATORS.

It is a common feature of the growth regulators to modify sex in monoecious cucurbit as evidenced by the reports of several workers, but for dioecious cucurbit it is quite impracticable. The result obtained in the present study was somehow different from the findings of Sarkar *et al.* (1989) who observed lower sex ratio (1:0.33) by Ethrel (50 and 100 ppm) in seed-propagated plants of pointed gourd.The observation of Ali *et al.* (1991) in Kakrol, another important dioecious cucurbit, was in line with the present result. They reported that ethephon was not effective in converting the sex of male plants of cucurbits.

It can, therefore, be concluded that growth regulator had no impact on altering the sex of a dioecious crop, though they had some influences on flower induction.

FLOWERING BEHAVIOUR

Observations on the effect of different growth regulators mean node number for emergence of first male and female flower and total number of flowers per plant were presented in Table XVII.

Mean node number for emergence of first male flower:

On the basis of flowering in different years of experiment the plants were categorised in six groups (Table XVII). No major change in node number for emergence of first staminate flower by same growth regulator at same concentration was observed within the groups. But a significant variation was marked among the different growth regulators within the group.In the first year, flowering was not observed in all the treatments. It was clearly observed from table that the plants treated with GA (100 ppm) produced first male flower at the lowest (19.6) node followed by GA (50 ppm) with a number of 20.82, while in control it was appeared at the node number of 23.73. Treatment with CCC (100 ppm) produced first male flower at the highest (28.96) node follwed by Ethrel (100 ppm). In the succeeding years, the same trend was followed in their successive flowering during 1991-92 (Group II) and 1992-93 (Group-III) the same trend was followed. Among the plants which flowered in second year for the first time (Group IV) Ethrel (200 ppm) produced flower at highest 32.95 node followed by MH (50 ppm). The same trend was also followed in their successive second flowering in 1992-93 (Group V). In the third year,the plants in which flowering was observed only for the first time (Group VI) Ethrel (200 ppm) bore first male flower at the highest (33.53) node followed by MH (100 ppm). In all the growing seasons GA (100 ppm) produced first male flower at the lowest node followed by GA (50 ppm) in each group of plants.

The earliest male flower at the lowest node by GA was noticed earlier by Arora and Partap (1988) and Arora *et al.* (1989) in pumpkin. Same type of observation in cucumber was recorded by Rodriquex and Lambeth (1972), Patil *et al.* (1984), Singh and Singh (1984), Talalova (1984) and, Ratnapala and Silva

TABLE XVII: EFFECT OF GROWTH REGULATORS ON FLOWERING BEHAVIOUR OF SEEDLINGS & SEGREGATES OF POINTED GOURD.

Tr. No.	Treatment	Mean node number for emergence of first male flower							Mean node number for emergence of first female flower							Total number of female flower per plant						
		GROUP							GROUP							GROUP						
		I	II	III	IV	V	VI	Mean	I	II	III	IV	V	VI	Mean	I	II	III	IV	V	VI	Mean
1	IAA 100 ppm	-	-	-	23.61	22.43	24.32	23.45	-	-	-	27.33	28.45	27.74	27.84	-	-	-	48.73	67.42	56.32	57.49
2	IAA 200 ppm	-	-	-	24.42	23.52	25.53	24.49	-	-	-	30.14	31.51	30.83	30.82	-	-	-	54.62	72.34	61.81	62.92
3	NAA 25 ppm	-	-	-	28.65	27.71	27.64	28.0	-	-	-	24.86	26.33	24.82	25.33	-	-	-	51.31	69.55	56.58	59.14
4	NAA 50 ppm	22.61	21.22	22.4	23.51	23.64	23.83	22.86	23.61	25.62	25.46	22.65	24.64	23.31	24.21	50.24	73.81	62.5	53.65	74.53	67.37	63.68
5	Ethrel 100ppm	26.80	27.34	28.4	28.42	27.33	27.32	27.60	20.82	20.55	20.93	20.73	21.53	21.55	21.02	60.65	82.42	72.4	68.33	86.36	71.95	73.68
6	Ethrel 200ppm	-	-	-	32.95	34.32	33.53	33.60	-	-	-	18.77	18.37	16.49	17.87	-	-	-	61.74	77.56	68.83	69.37
7	GA 50ppm	20.62	18.75	18.50	18.7	18.35	17.82	18.82	28.84	29.44	29.54	29.78	30.88	30.14	29.77	48.16	64.95	58.5	54.77	66.34	54.49	57.87
8	GA 100ppm	19.60	17.43	16.80	17.3	17.8	15.43	17.40	30.54	32.63	31.65	31.49	32.81	33.73	32.14	40.43	48.44	42.3	44.62	52.73	42.92	45.24
9	IBA 25ppm	-	-	-	22.64	24.63	23.52	23.59	-	-	-	24.83	24.72	25.64	25.06	-	-	-	50.75	68.65	57.75	59.05
10	IBA 50ppm	24.53	22.44	25.60	23.97	25.77	25.63	24.65	26.43	27.84	27.62	27.66	28.97	28.42	27.82	49.75	67.73	55.6	52.43	74.36	63.57	60.57
11	Kinetin 5ppm	23.74	23.41	25.40	25.63	24.33	25.34	24.64	23.32	24.52	23.21	23.81	24.58	22.91	23.73	46.62	65.83	54.3	51.94	73.44	60.43	58.76
12	Kinetin 10ppm	26.45	26.82	26.50	28.72	28.31	29.57	27.39	22.61	21.61	20.75	21.46	20.56	19.85	21.14	49.31	72.65	60.60	53.65	72.32	66.99	62.58
13	CCC 100ppm	28.96	28.13	29.40	27.41	28.52	29.63	28.67	24.73	24.67	24.72	24.62	25.44	23.47	24.61	42.34	61.52	51.90	43.63	60.41	48.81	51.43
14	CCC 200ppm	-	-	-	29.63	30.45	29.00	29.69	-	-	-	20.31	23.57	20.81	21.56	-	-	-	40.82	51.59	40.32	44.24
15	MH 50ppm	-	-	-	28.62	29.63	28.53	28.92	-	-	-	22.63	22.93	22.33	22.63	-	-	-	50.51	70.45	54.68	58.54
16	MH100ppm	-	-	-	31.4	31.86	30.73	31.34	-	-	-	19.75	19.55	18.44	19.35	-	-	-	46.44	54.42	45.55	48.80
17	Control	23.73	24.44	24.7	25.55	25.42	25.34	24.91	25.75	28.48	27.83	27.30	29.46	28.56	27.89	45.64	64.73	53.4	48.6	68.54	52.54	55.57
S.Em±		0.053	0.123	0.158	0.096	0.336	0.286		0.128	0.087	0.121	0.209	0.256	0.234		0.133	0.107	0.122	0.294	0.282	0 176	
CD at 5%		0.107	0.249	0.319	0.02	0.68	0.578		0.259	0.176	0.244	0.423	0.516	0.473		0.269	0.216	0.297	0.595	0.569	0.356	

Gr.I: Those flowered in 1990-91 for first time
Gr.II: Those flowered successively in 1991-92 for second time
Gr.III: Those flowered successively in 1992-93 for third time
Gr.IV: Those flowered in 1991-92 for first time
Gr.V: Those flowered successively in 1992-93 for second time
Gr.VI: Those flowered in 1992-93 for first time

(1989).On the other hand, delayed maleness by spraying of Ethephon was marked by Sulikeri and Bhandary (1973), Bhandary *et al.* (1974) and Edelstein *et al.*(1984) in different cucurbits. The result of the present experiment is in a line with their views and also supports the established fact that GA hastens maleness, whereas Ethrel delays.

Mean node number for emergence of first female flower:

Almost opposite trend was marked in the node number for emergence of first pistillate flower in seedlings of pointed gourd. A visible effect was observed by different growth regulators compared to the control.In each year, Ethrel produced female flower at the lowermost node followed by Kinetin or MH and the highest node number was noticed in GA treated plants followed by IAA.

Similar to the node number for appearance of first male flower, in case of female flower also no major variation was marked by same growth regulator applied to different group of plants, but a significant variation was observed among the effects of different growth regulators within the group.Ethrel (100 ppm) produced the first female flower at the lowest node (20.82) in the plants which flowered first time in the first year (Group I). GA (100 ppm) produced female flower at the highest (30.54) node followed by GA (50 ppm) with a node number of 28.84. The other treatments gave the intermediate results.The same trend was followed in their successive flowering in the succeeding years (Group II and III).But in case of the plants , which flowered first time in second year (Group IV) and second time in third year (Group V) Ethrel (200 ppm) produced flower at the lowest node followed by MH (100 ppm) and the highest node number was observed by GA (100 ppm) followed by 1AA (200 ppm). In the rest plants which flowered first time in third year (Group VI) an identical trend was followed.In each year, all the treatments except GA at its both concentrations and 1AA at higher concentration only produced first female flower at lower node in comparison to control. Comparative performances of different growth regulators on mean node number for emergence of first male and female flower were presented in Fig.X. It was clearly observed from the figure that different growth regulators behaved differently in this relation.

Emergence of first pistillate flower at lower node by MH and ethephon (Ethrel) was earlier reported by Rodriquex and Lambeth(1972) in cucumber, Matlob and Basher (1983) in summer squash and Arora *et al*.(1985) in bottle gourd. The result of the present experiment was in conformity with their findings.It appeared from the result that GA, Kinetin and MH had a singificant role on the induction of female flowers at lower nodes which signifies the possibility for more number of fruits per plant.

Total number of female flowers per plant:

It observed from table that average number of female flowers was significantly increased over control in all the treatments except GA and MH at higher concentrations and CCC at all concentrations. In all the years Ethrel (100 ppm) recorded the highest number of female flowers per plant.

In the first year, the maximum (60.65) number of female flowers was observed with Ethrel (100 ppm) followed by NAA (50 ppm) with number of 50.24, whereas GA (100 ppm) produced the minimum number (40.43) followed by CCC (100 ppm). In the succeeding years, the same trend was marked for those plants which flowered first time in the first year (Group I, II and III). But in case of the plants, which flowered first time in the second year (Group IV) Ethrel (100 ppm) produced maximum (68.33) female flowers followed by Ethrel (200 ppm) with 61.74 number of flowers. Minimum (40.82) number was recorded in CCC (200 ppm) followed by GA (100 ppm) In their subsequent flowering in the third year. The trend was identical and number of female flowers in this group was found to be highest in all the treatments than any other group. A similar trend was also noted for the plants which flowered first time in the third year.

From the overall performances of different growth regulators it was found that Ethrel, IAA, NAA, Kinetin, MH and IBA had a significant effect on increasing the number of female flowers per plant over control. The positive responses of these chemicals towards the increased number of female flowers in seedling plants of pointed gourd was supported with the findings of Verma (1969) , Rodriquex and Lambeth (1972), Ejsmond (1974),

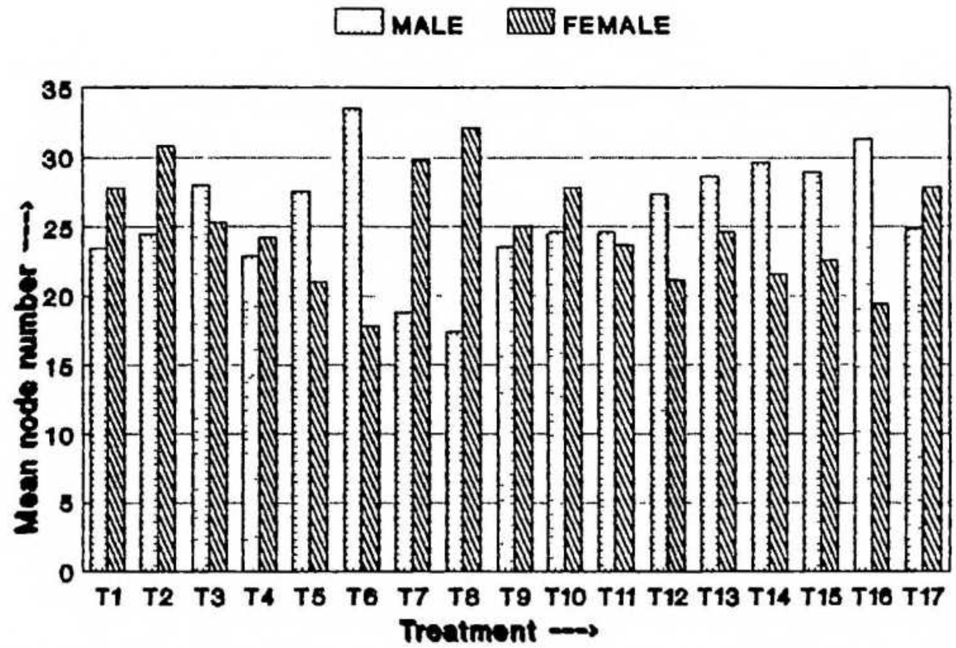

Fig.X: Effect of growth regulators on mean node number for emergence of first male and female flower in seedling segregates

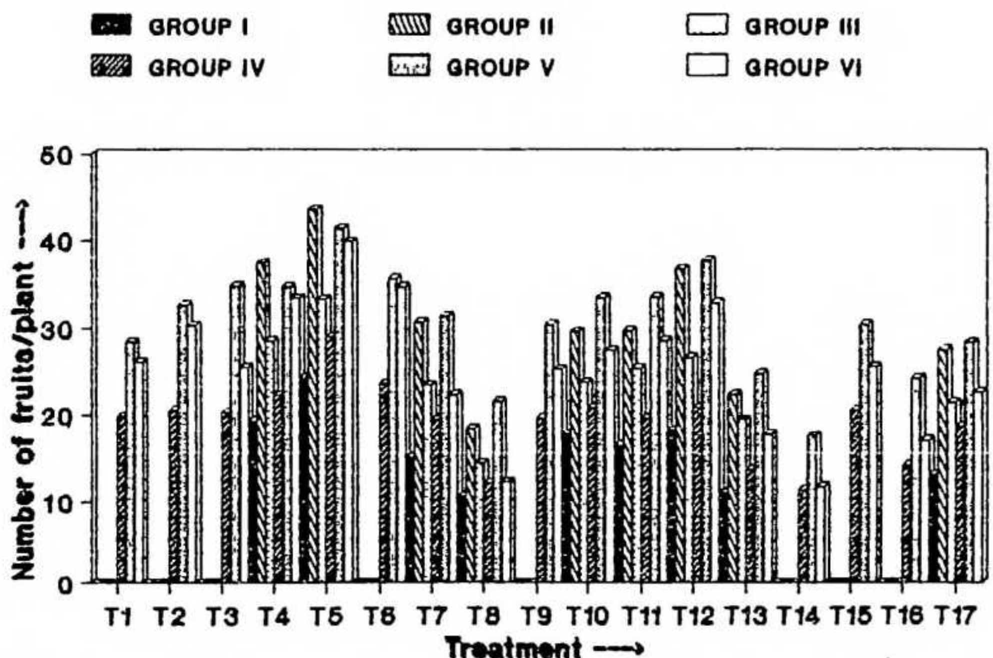

Fig.XI Effect of growth regulators on number of fruits per plant in seedling segregates

Santos and Lopes (1981), Patil *et al.* (1983), Matlob and Basher (1983), Dubey (1983), Singh and Singh (1984), Talalova (1984), Sarkar *et al.* (1989) and, Ratnapala and Silva (1989) in different cucurbits. On the contrary, there are several reports on increased femaleness by GA, CCC, in a number of cucurbits also [Ghosh and Bose (1970); Singh and Chowdhury (1977); Krishnamurthy and Sandooza (1982) and Ghosh and Basu (1983)].

The increased number of female flower due to Ethrel application can be supported with the views of Weaver (1972). He explained that ethylene producing compounds like Ethrel plays a role in transcription and translocation of the genetic code from DNA to RNA and protein, and may incorporate into the RNA. Thus it would contribute to the regulation of development phenomena like flowering, which causes transformation of male to female one. The action of MH in increasing the average number of female flowers can possibly be explained in the light of reports of Griesel (1954) that the starch digestion in the plant tissues after the chemical treatments was retarded. This causes reduction in the rates of transpiration as well as respiration and reduces the cotabolic activities inside the plants and acts in the same way as that of low temperature and short days. According to Nitsch (1952), the differentiation of ovary primordia is dependant upon a chain of biochemical events. The application of these chemicals at the early stage of growth of the plants might have helped in promoting these biochemical activities, thereby promoting the ovary primordia.

YIELD ATTRIBUTES AND YIELD:

Observations on yield attributes like number of fruit per plant and fruit weight as well as yield were presented in Table XVIII and Fig. XI, XII and XIII.

Number of fruits per plant:

The trend for number of fruits per plant resembled to the number of female flowers per plant. The highest number of fruits was obtained from Ethrel (100 ppm) treated plants in each year followed by either Ethrel (200 ppm) or NAA (50 ppm) where flowering was not occured in first year by Ethrel (200 ppm). The highest number of fruits in each treatment including control was obtained from the plants which flowered succeedingly for the second time in third year and the lowest number was obtained from their first flowering . The successive third flowering gave intermediate result.

In the first year Ethrel (100 ppm) produced the highest number (24.41) of fruits followed by NAA (50 ppm), whereas GA (100 ppm) produced the lowest (10.7) number of fruits followed by CCC (100 ppm) which were even lower than the control. In their second and third flowering in 1991-92 and 1992-93 respectively the same trend was followed, though number of fruits were increased. Similarly, the highest number of fruits was obtained from Ethrel (100 ppm) where plants flowered first time in 1991-92 (Group IV) and in their successive flowering in 1992-93 (Group V)

TABLE XVIII: EFFECT OF GROWTH REGULATORS ON YIELD ATTRIBUTES AND YIELD OF SEEDLING SEGREGATES OF POINTED GOURD.

Tr. No.	Treatment	Number of fruits per plant GROUP*							Fruit Weight (g) GROUP							Yield per plant (kg): GROUP*						
		I	II	III	IV	V	VI	Mean	I	II	III	IV	V	VI	Mean	I	II	III	IV	V	VI	Mean
1	IAA 100 ppm	-	-	-	19.86	28.44	26.21	24.83	-	-	-	42.00	41.52	42.34	41.94	-	-	-	0.83	1.18	1.11	1.04
2	IAA 200 ppm	-	-	-	20.51	32.65	30.33	27.83	-	-	-	38.33	38.44	37.71	38.96	-	-	-	0.77	1.26	1.14	1.06
3	NAA 25 ppm	-	-	-	20.33	34.87	25.62	26.94	-	-	-	43.44	43.73	44.00	48.72	-	-	-	0.88	1.52	1.13	1.17
4	NAA 50 ppm	19.34	37.51	28.63	22.35	34.73	33.43	29.33	48.00	47.85	47.73	47.82	47.94	47.9	47.94	0.93	1.79	1.37	1.07	1.66	1.60	1.40
5	Ethrel 100ppm	24.41	43.65	33.32	29.14	41.44	39.91	34.81	45.33	46.00	46.2	45.56	45.65	45.81	45.75	1.11	1.86	1.34	1.32	1.89	1.83	1.59
6	Ethrel 200ppm	-	-	-	23.74	35.66	34.75	31.38	-	-	-	49.63	49.46	49.73	49.27	-	-	-	1.18	1.96	1.73	1.55
7	GA 50ppm	15.22	30.74	23.51	19.55	31.52	22.44	23.83	43.25	42.77	41.9	42.39	42.64	42.43	42.56	0.66	1.31	0.99	0.83	1.34	0.95	1.01
8	GA 100ppm	10.7	18.50	14.60	12.31	21.64	12.40	15.03	46.31	45.7	46.3	45.81	45.73	44.93	45.8	0.49	0.84	0.67	0.52	0.99	0.56	0.67
9	IBA 25ppm	-	-	-	19.73	30.53	25.35	24.54	-	-	-	43.60	43.80	43.62	43.67	-	-	-	0.86	1.34	1.11	1.10
10	IBA 50ppm	17.86	29.72	23.82	20.94	33.54	27.53	25.57	40.9	41.2	41.3	40.92	41.32	41.43	41.18	0.73	1.22	0.98	0.86	1.39	1.14	1.05
11	Kinetin 5ppm	16.53	29.83	25.45	19.74	33.63	28.71	25.65	42.52	43.73	43.4	42.71	43.66	42.82	43.14	0.70	1.3	1.1	0.84	1.47	1.23	1.10
12	Kinetin 10ppm	18.32	36.87	26.73	21.00	37.72	32.92	28.93	44.44	44.65	44.8	45.00	45.37	45.00	44.87	0.81	1.64	1.2	0.95	1.71	1.48	1.30
13	CCC 100ppm	11.21	22.42	19.57	13.88	24.91	17.85	18.3	34.83	35.00	34.9	34.64	35.05	35.32	34.95	0.39	0.78	0.48	0.48	0.87	0.52	0.58
14	CCC 200ppm	-	-	-	11.61	17.64	11.84	13.69	-	-	-	37.65	37.73	37.34	37.54	-	-	-	0.44	0.88	0.44	0.51
15	MH 50ppm	-	-	-	20.67	30.54	25.73	25.64	-	-	-	43.43	42.84	42.73	43.00	-	-	-	0.89	1.31	1.09	1.09
16	MH100ppm	-	-	-	14.33	24.32	17.12	18.59	-	-	-	44.32	43.72	44.24	44.6	-	-	-	0.64	1.06	0.76	0.82
17	Control	13.34	27.65	21.54	18.82	28.44	22.71	22.08	40.44	41.34	40.9	40.73	41.21	40.93	40.93	0.54	1.14	0.88	0.77	1.17	0.93	0.91
S.Em±		0.193	0.212	0.187	0.245	0 237	0.252		0.221	0.117	0.281	0.304	0.234	0.217		0.012	0.021	0.025	0.016	0.023	0.034	
CD at 5%		0.39	0.428	0.378	0.496	0.478	0.509		0.447	0.236	0.568	0.615	0.473	0.438		0.024	0.043	0.051	0.033	0.047	0.069	

Group I: Those flowered in 1990-91 for first time
Group II: Those flowered successively in 1991-92 for second time
Group III: Those flowered successively in 1992-93 for third time
Group IV: Those flowered in 1991-92 for first time
Group V: Those flowered successively in 1992-93 for second time
Group VI: Those flowered in 1992-93 for first time

* In graphical representation, groups of the seedling segregates were presented as Group I, II, III, IV, V and VI.

also .The trend was also same for the plants which flowered first time in the third year i.e. 1992-93 (Group VI). Number of fruits was found to be minimum at CCC (200 ppm) followed by GA (100 ppm) Maximum (41.44) number of fruits was obtained at Ethrel (100 ppm) from the successive second flowering in third year (Group V) including the control (28.44) in this group. The other treatments had also the higher values in this relation in comparison to the other groups.

Among the growth regulators tried GA, MH at higher concentration and CCC at all concentration produced lesser number of fruits even than the control. Increased number of fruits by Ethrel, MH and NAA was earlier marked by Verma (1969), Verma and Choudhury (1980) in cucumber and Santos and Lopes (1981) in cucumber. But in pumpkin, Krishnamurthy and Sandooja (1982) noted that NAA reduced femaleness. Decreased fruitset by NAA was reported by Choudhury and Babel (1969) . The present result is not in a line with the findings of these workers.

Increased number of fruits per plant in Ethrel and other treatments was due to more number of female flowers in the concerned treatments.

Fruit weight:

It appeared from Table XVIII that growth regulators had a significant impact on the fruit weight of seedling segregates though the variations were not so pronounced in different years of experimentation. In the first year, fruit weight varied from

34.83 to 48.0 g in the plants where flowering occured for the first time and the trend was almost same for the second and third flowering in the subsequent years. The highest fruit weight (48.0 g), however, recorded from NAA (50 ppm) and the lowest (34.83 g) at CCC (100 ppm). In the second year, Ethrel (200 ppm) produced the fruits of greater weight (49.63 g) in its first flowering while the same treatment recorded the fruits with slightly lower weight (49.46 g) at second flowering in the third year. In these groups (IV and V) , the trend for fruit weight was more or less similar. The other treatment next to Ethrel (200 ppm) which produced fruits of higher weight was NAA(50 ppm). In these groups, CCC(100 ppm) had the lowest fruit weight which was even less than the control. The other treatments had moderate values in this regard. The fruits from the first flowering in the third year had more or less same weight than that of second year fruits. In this year, Ethrel (200 ppm) produced fruits with the highest weight (49.73 g) followed by NAA (50 ppm) and Ethrel (100 ppm) while CCC(100 ppm) had the lowest value (35.32 g) in this relation.

The increased fruit weight by Ethrel, NAA and Kinetin was probably due to the cell enlargement (Weaver, 1972). The increased fruit weight in GA might be due to more number of seeds in a fruit which can be supported with the findings of Arora and Partap (1988), who found more seeds in bottle gourd with GA application.

Yield per plant:

A wide variation was marked regarding yield of an individual seedling segregates of pointed gourd by different growth regulators. The highest yield was obtained from Ethrel (100 ppm) in each group followed either by NAA (50 ppm) or Ethrel (200 ppm). Each treatment gave higher yield in its second fruiting.

From Table XVIII it revealed that the plants which flowered for the first time in the frist year produced a maximum yield of 1.11 kg with Ethrel (100 ppm) followed by 0.93 kg at NAA (50 ppm) in comparison to 0.54 kg only in control. CCC (100 ppm) produced a minimum yield of 0.39 kg followed by 0.49 kg in GA (100 ppm) . But in the second year when the plants flowered for second time produced a maximum yield of 1.86 kg with Ethrel (100ppm) against 1.14 kg in control. In other successive flowering in third year a maximum yield of 1.34 kg was produced by Ethrel (100 ppm) against 0.88 kg only in control. In case of the plants which flowered first time in the second year produced a maximum yield of 1.32 kg with Ethrel (100 ppm) followed by 1.18 kg in Ethrel (200 ppm) .The minimum (0.44 kg) yield was obtained with CCC (200 ppm) followed by 0.48 kg in CCC(100 ppm) . But in its successive flowering in third year Ethrel (100 ppm) proved its superiority over other treatments and a maximum yield of 1.89 kg was recorded from this treatment. Whereas control plant produced only 1.17 kg. The highest yield (1.83 kg) of the plants which flowered for the first time in third year was obtained from Ethrel (100 ppm) followed by 1.73 kg in Ethrel (200 ppm) though there was no significant variation between the treatments. These were statistically better over any other treatments.

The increased yield in the treatments over control were mainly due to more number of fruits with higher weight resulted from more number of branches and female flowers as well in the respective treatments. The increased number of fruits per plant may be attributed to the production of more branches which are responsible for production of pistillate flowers ultimately fruit set and yield (Choudhury and Babel, 1969). The higher yield in the seedling segregates which flowered for the first time in third year over other plants those flowered for the first time in first and second year was probably due to its more physiological maturity.

From the mean it was found that IAA, IBA, Ethrel, NAA and Kinetin in all concentrations and, GA and MH at lower concentration increased the yield over control. But the other treatments like GA and MH at higher concentration and CCC at both concentrations were found to be inferior in this regard. Increased yield by ethephon and NAA was found by Ramaswamy *et al.* (1976), Dubey (1983), Talalova (1984), Ratnapala and Silva (1989) and Mandal *et al.* (1990) in different cucurbits. The reason for the increased yield was more number of fruits and fruit weight as well, because those parameters were positively correlated with yield.

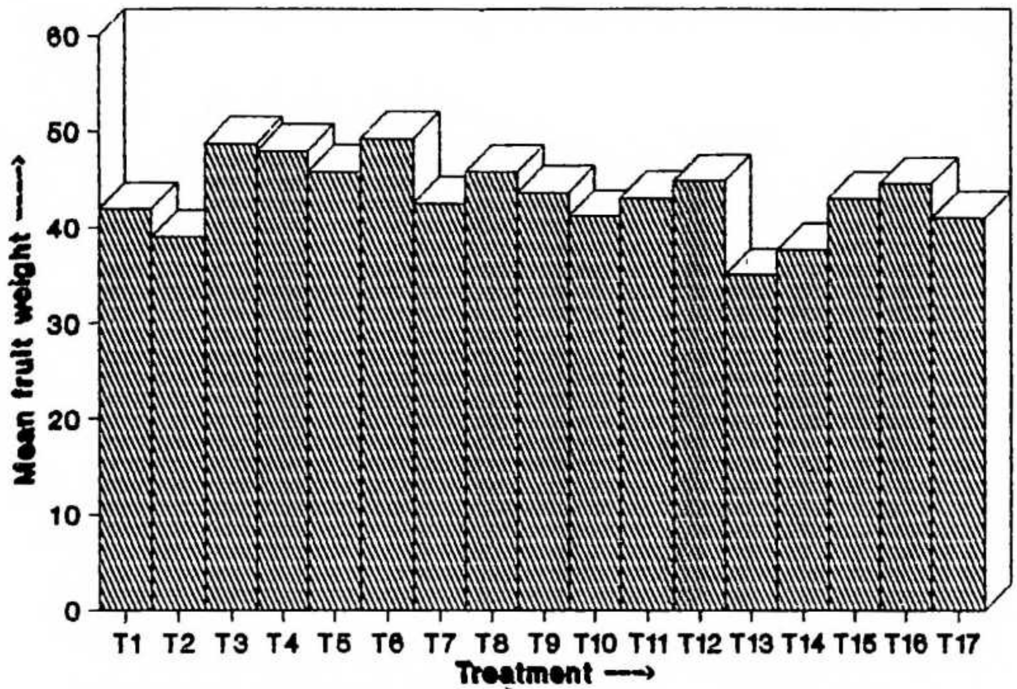

Fig.XII Effect of growth regulators on mean fruit weight of seedling segregates

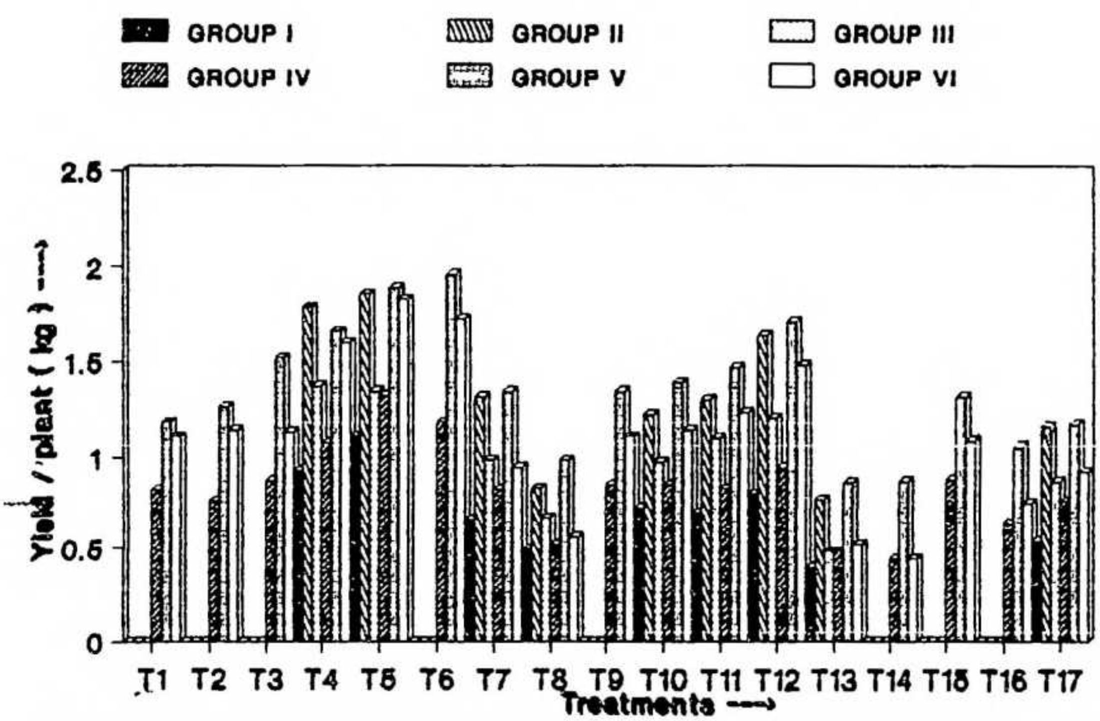

Fig.XIII: Effect of growth regulators on yield per plant in seedling segregates

Thus either Ethrel or NAA may be used to obtain increased yield in seedling segregates of pointed gourd.

CHAPTER–V

Summary and Conclusion

SUMMARY AND CONCLUSION

The present investigation consisting of three experiments was carried out at Horticultural Research Station, Mondouri, of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during 1990-91, 1991-92 and 1992-93 to study the genetical aspects for improvement of pointed gourd (*Trichosanthes dioica* Roxb.). Soil of the experimental site was sandy loam with good water holding capacity having a pH 6.0. Standard cultural practices scheduled for the cultivation of the crop were followed in time for all the experiments. The results of those experiments are summarised below:

EXPERIMENT NO.1 : EVALUATION OF GERMPLASMS

Twenty one widely divergent germplasms of pointed gourd collected from different parts of West Bengal, Bihar and Uttar Pradesh planted through root cuttings in a Randomised Block Design with three replications were used in this experiment to evaluate their performance on different growth characters namely, vine length, length of internode and number of primary branches per plant and, yield attributing characters like number of fruits per plant, fruit length, fruit diameter, core diameter, core diameter : fruit diameter ratio, fruit volume, number of seeds per fruit, pulp weight, fruit weight, pulp weight: fruit weight ratio, early yield per plant and total yield per plant.

A significant variation was found to be existed among germplasms for all the characters. Environment had no significant influences on length of internode, fruit length and fruit diameter. Moreover, correlation studies among the characters indicated that these characters along with vine length, fruit volume, fruits per plant, fruit weight showed a significant positive relationship with the total yield. From the average of three years, germplasms like BC-24, BC-53 and BC-15 were found to be better in relation to overall performances. The local types (collected from different parts of West Bengal), in general, were found to be better in comparison to the outside ones. Among these, BC-24 collected from Kaksa, Burdwan, was found to be superior with an increased yield of 2.16 kg per plant in its second year cropping followed by other two local types namely BC-53 (1.98 kg) and BC-15 (1.80 kg) as well. On the other hand BC-60, a germplasm collected from Uttar Pradesh produced a yield of only 0.53 kg per plant in its second year cropping.

Though total yield is the basic criteria in a selection programme, emphasis may also be given on those characters which contribute directly to the yield and also have higher genotypic variance with high percentage of heritability like fruit weight and fruit volume in addition to fruit length, fruit diameter and number of fruit per plant showing higher value of either genotypic variance or heritability. From this point of view, besides the above germplasms BC-1, BC-5, BC-7,BC-19, BC-23, and BC-64 may also be under the perview of a selection programme as these germplasms showed better performances in relation to the selective characters. In conclusion, it can be stated that germplasms like BC-24, BC-53 or BC-15 may be grown for commercial cultivation of pointed gourd in this region.

EXPERIMENT NO.2: SELECTION OF SEEDLING SEGREGATES FOR BETTER PLANT TYPE WITH HIGH YIELDING ABILITY.

The experiment was conducted with 585 seedling of pointed gourd cv. Kajli-Bombai, a local type with an aim to select better plant type with higher yield over mother plant. Observations were recorded on percentage of seedlings flowered in different years and sex ratio in addition to the characters considered for Experiment No.1 except early yield of the crop.

It was found that in the first year, only 14.7 per cent seedling segregates flowered with a sex ratio (Male:female) of 1:1.15. In the second year, it was found 70.77 per cent with a sex ratio of 1:0.89. Finally i.e., in the third year, flowering ~~was~~ occured in almost all the plants and the ratio (Male: Female) was found to be 1:0.94 which is nearly to the ratio of 1:1.

Regarding the growth characters and yield attributes a few seedling segregates were found to be superior, but not a single segregate superseded the yield of mother plant. A large number of seedling segregates showed more vine length than mother plant. Among those male plants were found to be more vigorous than a female one. It was also true for the number of primary branches per plant. In case of fruit characters, a few seedling segregates produced fruits of more fruit diameter, core diameter, seeds per fruit, pulp weight , fruit volume and also produced more number of fruits per plant than mother plant, but could not exceed the yield of mother plant in any year. Within the population, the types showing better performance relating to the different characters were identified and selected. These seedling segregates can be exploited for further improvement of the crop.

EXPERIMENT NO.3: EFFECT OF THE PLANT GROWTH REGULATORS ON INDUCTION OF FLOWERING AND SEX EXPRESSION IN SEED PROPAGATED PLANTS

The experiment was carried out in a Randomised Block Design with three replications. Seedlings of pointed gourd cv.Kajli Bombai were sprayed twice;one at 2-leaf stage and another at one month after first spray with IAA (100 and 200 ppm), NAA (25 and 50 ppm) ,Ethrel (100 and 200 ppm), GA (50 and 100 ppm), IBA (25 and 50 ppm), Kinetin (5 and 10 ppm), CCC (100 and 200 ppm), MH (50 and 100 ppm) and distilled water (control). Observations over the three years of experimentation on growth characters showed that GA (100 ppm) produced maximum vine length and length of internode followed by IBA (50 ppm) and GA (50 ppm), while application of MH and CCC resulted more primary branches per plant followed by Ethrel and Kinetin.

In the first year, flowering was observed only in GA (50 and 100 ppm), IBA (5 and 10 ppm), NAA (50 ppm), Ethrel (100 ppm), IBA (50 ppm) and CCC (100 ppm) treated plants with 14.7

per cent flowering in control. GA (100 ppm) proved its supremacy in flowering over other chemicals. In the second year flowering occured in all the treatments and maximum number of plants (86.45 per cent) flowered with CCC (100 ppm) which was closely followed by Ethrel (100 ppm) to the tune of 85.17 per cent. At the end of third year almost all the plants flowered in each treatment and 98.63 per cent flowering was observed in control.

Initially, growth regulator applications showed a varied response in sex ratio. Earlier male flower production was induced by GA; while Ethrel, Kinetin, CCC and NAA behaved in opposite direction i.e., production of early and more female flowers. With the increase in flowering in the subsequent years, the sex ratio tended to almost 1:1 in each treatment. From the average of three years, it was observed that male flowers were borne at lower nodes with GA (100 ppm), while female ones were with Ethrel (100 ppm) in comparison to other treatments. Ethrel (100 ppm) always proved its superiority to other treatments regarding total number of female flowers as well as number of fruits per female plant. The maximum number of fruits (34.81) was recorded in Ethrel (100 ppm) which was closely followed by Ethrel (200 ppm) with a number of 31.38. On the contrary, the lowest number (13.69) of fruits per female plant was obtained from CCC (200 ppm) which was even less than the control. Regarding individual fruit weight Ethrel (200 ppm), however, produced the highest value (49.27 g) followed by NAA (50 ppm) with the value of 48.72 g while CCC had the fruits with lowest weight (34.95 g).

A great variation in yield per plant was noted for the seedling segregates. The maximum yield (1.89 kg) was, however, obtained from the segregates which flowered successively second time in third year by the application of Ethrel (100 ppm) followed by Ethrel (200 ppm) and NAA (50 ppm) with the yield of 1.76 and 1.66 kg per plant, respectively.

Thus, seedling segregates may be sprayed with either Ethrel (100 or 200 ppm) or NAA (50 ppm) to obtain the earliest induction of flowering particularly in female plants and maximum yield as well. Ethrel (100 ppm) was found to be most effective in these regards.

CHAPTER–VI

Future scope

FUTURE SCOPE

The present study on genetical aspects for improvement of pointed gourd indicated some new opportunities for further investigation on this crop leading to the same goal. In evaluation programme, the germplasms recommended for this area on the basis of their increased yield, should also be tried through multilocation trial in different regions to evaluate their adaptability. Stability of yield against environment should be ascertained by stability-analysis. Regarding selection of the elite seedling segregates further trial with a large number of population may locate wider variability and hence scope for better selection. To get higher percentage of early flowering and also the increased yield of seedling segregates, the effective growth regulators may be tried with their other concentrations also and the result of the present findings may be ascertained by undertaking further trial in different locations before recommendation to the farmers.

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