BIOMETRICAL AND YIELD PARAMETERS OF WINGED BEANS [*Psophocarpus tetragonolobus* (L) DC.] AS INFLUENCED BY CYTOZYME

By

KHURAIJAM MALA DEVI
Reg. No. 94 PLS 07

A THESIS SUBMITTED TO
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CERTIFIED AS BONAFIDE RESEARCH WORK

Signature of the Head of the Department	Signature of the Dean of Faculty	Signature of the Guide
6/5/96	6/5/96.	A. Vijayalakshmi 6/5/96

Dedicated to my
Beloved Parents

Acknowledgement

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Introduction

INTRODUCTION

Cultivation of legumes is the best and quickest way of augmenting the production of food proteins. The entire human population depends upon the fortunes of about 20 plants species. This is dangerously very small step from which to feed a planet. Hence to feed the increasing population, biologists have been digging into the nature's genetic stockpile for lesser known plants, which could drive famine. Hence the biggest interest today is in wild plants that would be brought under cultivation as cash crops. To enrich deficient diet with high quality protein a plant with promising economic value called **"Winged bean"** **Psophocarpus tetragonolobus(L) DC.** has been chosen for present investigation. Due to its multiplicity of uses, it has gained the following names , **"A high protein crop for the tropics", "poor man's soyabean", "A supermarket on a stalk", "A virtual" and "Winged bean - a boon to the poor".**

Winged bean is regarded as one of the most important tropical legume. The plant is native to papua New Guinea.

It was first introduced to India in 1799 at sibpur botanical Gardens, Calcutta. The cultivation of the plant is largely confined to North Eastern Bengal, Assam, Manipur and

Mizoram. In South India too the plant is gained a gradual and steady acceptance.

With winged bean almost everything goes into the pot. The sprouts shoots and leaves have the highest vitamin A ever recorded in a tropical plant. Young pod makes a succulent green vegetable and it contain high amount of protein. The seeds virtually duplicate soyabeans in composition and nutritional value. Both are rich in protein, oil, minerals, vitamins and essential aminoacids. The tubers have four times the protein content of potatoes.

Foliar application of nutrients and hormones have proved to increase the yield and the quality of agricultural and horticul tural crops. **cytozyme** is a growth regulator which is biologically derived heterogenus protein hydrolysate. It consists of enzyme precursors and plant growth promoters such as auxin, cytokinin and Gibberellin. It is manufactured in India using technology exclusive to cytozyme laboratories.

A survey of previous literature reveals that work on the effect of cytozyme on winged beans is very meagre. In order to improve the quality and quantity of winged bean cytozyme is used in the present investigation.

OBJECTIVES

1. In order to find out the effect of cytozyme on biometrical parameters.
2. To assess the yield potential of winged bean under different treatment of cytozymes.
3. To evaluate the relationship between the concentration of cytozyme application and the growth characters.

Hence in the present study the cytozyme has selected and treatment is given to winged beans "Psophocarpus tetragonolobus (L) DC."

Review of Literature

REVIEW OF LITERATURE

In the 19th century, Julius Vonsaches was the first to suggest the presence of the growth regulating substance called "hormone" in plants. The plant body consists of two sets of internal factors namely nutritional and hormonal which are responsible for growth and development. The growth substances include both synthetic chemicals which do not occur in plants and those that are synthesised by the plants itself. Hormones are the naturally occuring compounds rather than the synthetic anologues.

There is differences of opinion among the botanists regarding the expression "plant hormones" and "plant growth regulators". It was recognized that most of the physiological activity of the plant was regulated by chemical substance called hormones. Plant growth regulators are substances that when added in small amount modify the growth of plants usually stimulating part of a natural growth regulative system.

Charles Darwin (1881) was the first to trace the presence of auxin in the coleoptile of canary grass (Phalaris canariensis). According to Laibach and Kribben (1950) auxins

are generally involved in several physiological phenomena like stem growth, root growth, leaf growth, adventitious root formation, apical dominance, flowering, sex-expression and parthenocarpy etc. Gibberellin was discovered by Kurosawa in 1920 in a fungus "Gibberella fujikuroi". According to Hillman (1962) and Salisburry (1963) Gibberellin help in overcoming seed and bud dormancy and genetic dwarfism of rosette plants.

Cytozyme is a plant growth regulator. It is a biologically derived heterogenous protein, hydrolysate enzyme precursors and plant growth promotors such as auxin, cytokinin and Giberellin.

An increase in oil percentage of groundnut due to cytozyme treatment was observed by Gurbakshi Singh et al., (1978). In potatoes, Pandita and Hooda (1979) noticed an increase in plant height due to cytozyme application. It was also noticed that, foliar application of cytozyme significantly increased the zinc and iron content of potato. Silva and Stuff (1980) reported that by cytozyme application in rice, the nitrogen loss was prevented within seven days. One spray of cytozyme increase the seed cotton yield by 14% (Cothren and Cotterman, 1980).

Pandita et al., (1981) found that cytozyme treatment as seed plus or crop plus or in combination resulted in highest yield in radish. Debata and Murthy (1981) are of the opinion that increase in thousand seed weight of rice in cytozyme treated plants is due to the presence of cytokinin in cytozyme which may mimic the effect exhibited by auxins and giberellins. Cytozyme treatment increased yield/plant and yield/hectare of muskmelon (Pandita et al., 1982).

Foliar application of nutrients and hormones have proved to increase the yield and quality of agricultural and horticultural crops. However, cytozyme application was neither favourable nor detrimental effect on yield of rice. (Sankara Reddy et al., 1983). Sudhakaro Rao et al., (1984) found an increase in the number of pods per plant in groundnut. Halwankar et al., (1984) observed that germination, flowering and maturity were less affected by cytozyme treatment.

In the experiments conducted by Hooda et al.,(1985) on tomato, brinjal and chillies, it was found out that the cytozyme when applied as foliar spray (1.25%) and through seed treatment (10%) was very efficient in improving the growth of all the three plants.According to Vashistha and Rana, (1985) chlorophyll content in leaf increased rapidly in

radish when sprayed with cytozyme at 100ml per acre. An increase in leaf area was observed due to foliar spray of cytozyme in cauliflower (Asandhi and Sumiati, 1987 a) and sweet pepper (Sumiati and Asandhi, 1987 b).

Application of cytozyme as seed treatment or crop plus increased the yield of cotton significantly over the control. Sharma et al., (1989) reported that cytozyme has no significant effect on the growth characters like plant height, dry matter accumulation, racemes per plant, length of the siliquae and seed yield in mustard.

A detailed study was made by Chairani (1989) on the effect of cytozyme when sprayed at various concentrations (0.15 to 0.45%) on the vegetative growth of oil palm. The experiments were conducted in the glass house. A positive effect was observed on seedling height however the number of leaves, leaf area, and chlorophyll content was not significant. Sabir Ahamed and C.P.Thiagarajan (1989) proved that foliar spray with cytozyme 1.25% increased germination percentage and pod seed yield in soyabean. Despande and Lakdive (1989) observed a raise in the yield of seed cotton by the cytozyme treatment. But according to Yasin and Carpuz (1989) there is no significant effect when cytozyme is treated at 0.25% in the characters such as plant weight and

yield in rice.

A study on cytozyme treatment in green gram was made by Jacquelin et al., (1990), and they reported that 0.5% concentration given twice on 30^{th} and 45^{th} day after growing enhanced the pod and grain yield in green gram. According to Kaleeswari et al., (1990) cytozyme crop plus at 45^{th} and 90^{th} day after planting improved the yield of juice quality. Ramanathan (1990) reported a positive effect in chlorophyll content in groundnut and sunflower due to cytozyme application. Doddaman and Panchal (1991) observed an increase in yield in chillies by foliar application of cytozyme.

Methodology

METHODOLOGY

The study was conducted at Avinashilingam Deemed University, Coimbatore during the year 1995-96. Seeds of winged bean **Psophocarpus tetragonolobus** (L) DC. Obtained from Agriculture University, Coimbatore were used for the investigations.

Winged bean seeds were sown in the experimental pot and field. Three sets of experiments were conducted.

EXPERIMENT-I

For evaluating the rate of seedling growth, the seeds were germinated in germination towels and characters like shoot length, root length and number of lateral roots were statistically analysed.

EXPERIMENT-II

To study various morphometric characters (Root length, shoot length, petiole length, internodal length, number of leaves, number of nodules and volume of nodules) during mid vegetative period of growth, the seeds were sown in pots and the characters were statistically analysed.

EXPERIMENT-III

The seeds were sown in statistically designed randomized compact blocks in the research field and the investigations on pods and seeds such as pod length, circumference, weight, number of seeds/pod and weight of seeds/pod were carried out and statistically analysed.

The detail experimental methods of the three experiments are given below:

EXPERIMENT-I

To study the effect of cytozyme on seeding growth, different concentration of cytozyme like 25 ppm, 50ppm, 75ppm and 100 ppm were used. The seeds were soaked in 50ml of respective solution for 24 hours. A control was also maintained. The seeds were allowed to germinate in the germination towels for 10 days. Periodically they were moistened with distilled water. On the 10th day the following characters were studied.

a. Root length

b. Shoot length

c. Number of lateral roots

EXPERIMENT-II

To study the effect of cytozyme on mid-vegetative characters of winged bean, different concentrations of cytozyme were used (control, 25ppm, 50ppm, 75ppm and 100ppm) Two foliar sprays were given at an interval of 10 days. On the 40th and 60th day, the plants were uprooted from the pots and the following characters were analysed.

a. Root length
b. Shoot length
c. Petiole length
d. Internodal length
e. Number of leaves
f. Number of nodules
g. Volume of nodules

EXPERIMENT-III

To observe the effect of cytozyme on the pod and seed characters, seeds were sown on the field. Foliar sprays at a concentration of 25ppm, 50ppm, 75ppm and 100ppm, were given at an interval of 10 days. Five sprays were given. At maturity 20 pods were collected and analysed for the following parameters.

a. Pod length

b. Pod circumference

c. Pod weight

d. Number of seeds/pod

e. Weight of seeds/pod

f. Tuber length and weight.

All the data recorded were statistically analysed.

Results and Discussion

RESULTS

EXPERIMENT-I

The seedlings of winged bean treated with cytozyme were assessed by studying their morphological characters. The results of the experiment were shown in Table 1 plate 1 fig 1.

EFFECT OF CYTOZYME ON GERMINATION OF WINGED BEAN:

Cytozyme treatment showed a significant increase in shoot length of the seedling of winged bean. The shoot length increased at 25 ppm (11.9cm), 50 ppm (12.9cm), 75 ppm (13.1cm) and 100 ppm (14.2cm) compared to the control (9.5cm).

The root length showed an appreciable increase with the application of cytozyme. There was a significant increase at 25 ppm (8.9cm), 50 ppm (10.3cm), 75 ppm (12.2cm) and 100 ppm (13.2cm), when compared with the control (5.9cm).

A significant increase in the number of lateral roots with cytozyme treatment was observed at all the

TABLE I

EFFECT OF CYTOZYME ON GERMINATION OF WINGED BEAN

	CONTROL	25 ppm	50 ppm	75 ppm	100 ppm	S.E	C.D
SHOOT LENGTH	5.9	8.9	10.25	12.15	13.2	0.89	0.70
ROOT LENGTH	9.49	11.85	12.85	13.1	14.15	0.89	0.83
NUMBER OF LATERAL ROOTS	10.81	12.1	14.7	22.3	24.3	1.83	1.44

PLATE 1

EFFECT OF CYTOZYME ON SEEDLING GROWTH

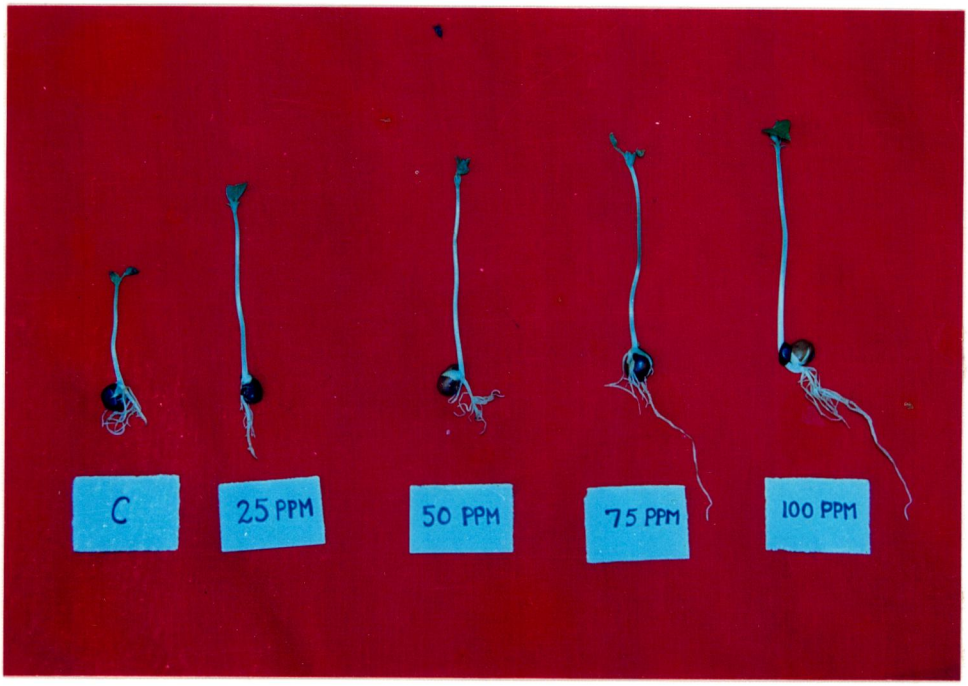
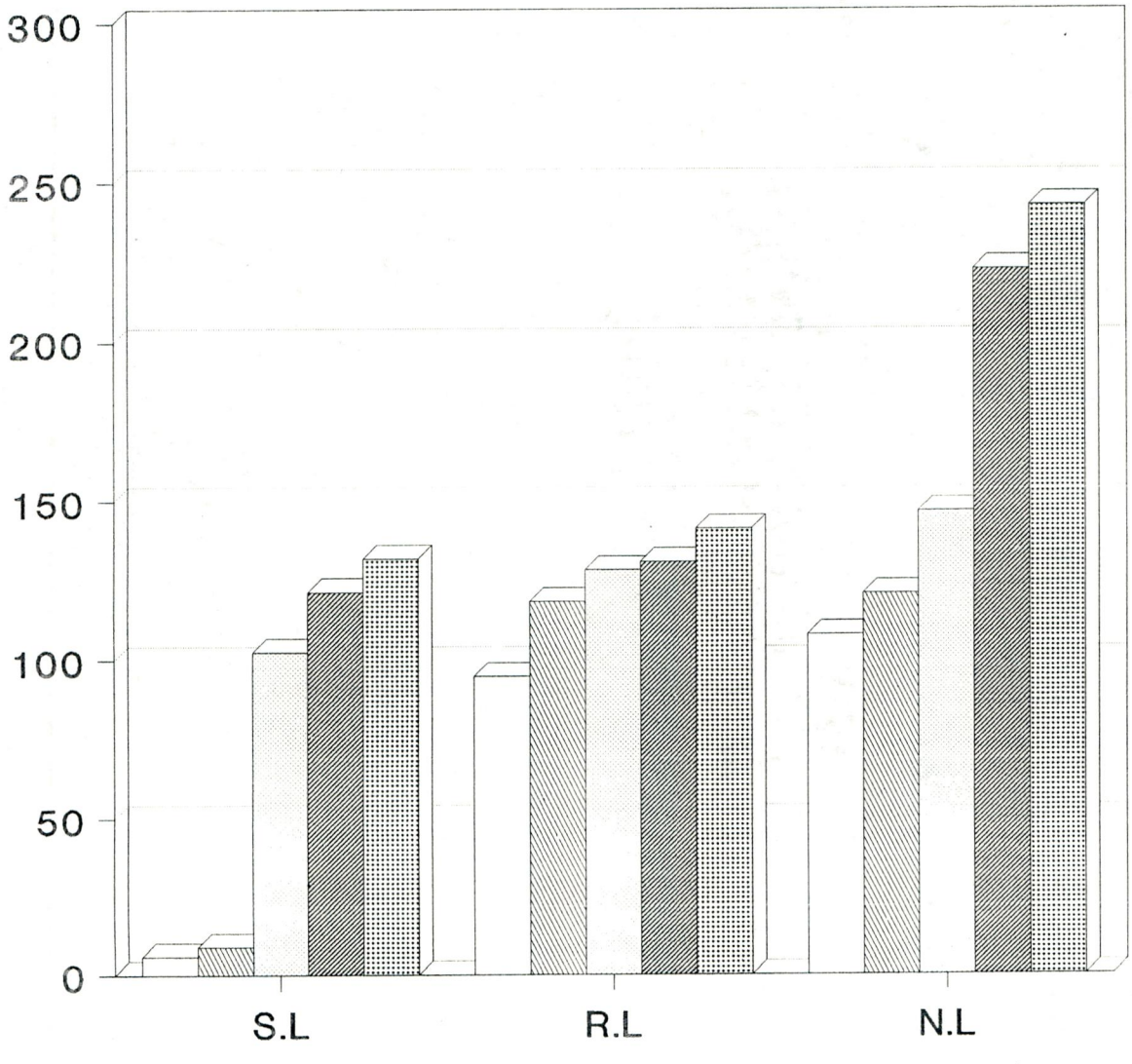


FIG.1 EFFECT OF CYTOZYME ON GERMINATION OF WINGED BEAN



concentrations (25 ppm - 12.1, 50 ppm - 14.7, 75 ppm - 22.3 adn 100 ppm - 24.3) when compared to the control (10.8).

EXPERIMENT - II

EFFECT OF CYTOZYME ON THE VEGETATIVE CHARACTERS OF WINGED BEAN (40 DAYS)

The results of the experiment was presented in Table 2, plate 2 fig 2 .

SHOOT LENGTH AS INFLUENCED BY CYTOZYME:

All the treatments given increased the shoot length of winged bean. The length of the shoot increased at 25 ppm (67.8cm), 50 ppm (74.7cm), 75 ppm (80.4cm) and 100 ppm (99cm) when compared with the control (54.8cm).

ROOT LENGTH AS INFLUENCED BY CYTOZYME:

Cytozyme showed an appreciable increase in the results obtained for the root length. All the treatments gave positive results (25 ppm-53.8cm, 50 ppm - 62.6cm, 75 ppm - 71.3cm and 100 ppm - 82.4cm) when compared with the control (40.6cm).

PETIOLE LENGTH AS INFLUENCED BY CYTOZYME:

A significant increase in the length of the petiole was noted at all the concentrations (25, 50, 75 and 100 ppm) when compared to the control (2.4cm). The highest being at 100 ppm (3.5cm).

INTERNODAL LENGTH AS INFLUENCED BY CYTOZYME:

A significant increase in the length of the internode was observed at all the treatments when compared to the control (1.83cm). The highest being at 100 ppm (2.22cm).

NUMBER OF LEAVES AS INFLUENCED BY CYTOZYME:

The number of leaves increased significantly at 25 ppm (48), 50 ppm (51), 75 ppm (55) and 100 ppm (57.3) when compared to the control (47.3).

NUMBER AND VOLUME OF NODULES AS INFLUENCED BY CYTOZYME:

The number and volume of the nodules increased significantly at all the concentrations of cytozyme (25 ppm, 50 ppm, 75 ppm and 100 ppm).

TABLE II

EFFECT OF CYTOZYME ON VEGETATIVE CHARACTERS OF WINGED BEAN (40 DAYS)

	CONTROL	25 ppm	50 ppm	75 ppm	100 ppm	S.E	C.D
SHOOT LENGTH	54.8	67.8	74.7	80.4	99	7.15	6.23
ROOT LENGTH	40.6	53.8	68.6	71.3	82.4	6.29	5.48
PETIOLE LENGTH	2.4	2.5	2.7	2.8	3.5	0.43	0.37
INTERNODAL LENGTH	1.83	1.88	2.06	2.11	2.22	1.80	1.57
NUMBER OF LEAVES	47.3	48	51.11	55	57.3	4.84	4.21
NUMBER OF NODULES	13.44	13.8	19.3	23.3	27.3	3.15	2.74
VOLUME OF NODULES	0.15	0.16	0.16	0.18	0.2	0.16	0.14

TABLE III

EFFECT OF CYTOZYME ON VEGETATIVE CHARACTERS OF WINGED BEAN (60 DAYS)

	CONTROL	25 ppm	50 ppm	75 ppm	100 pp	S.E	C.D
SHOOT LENGTH	72.8	80	91.7	95.7	108.2	6.58	5.73
ROOT LENGTH	56.1	73	74.3	76.0	86.7	5.72	4.98
PETIOLE LENGTH	7.0	7.1	7.3	8.1	9.0	0.44	0.38
INTERNODAL LENGTH	1.6	2.2	2.5	2.7	2.9	0.26	0.23
NUMBER OF LEAVES	82	84.9	87.1	90.2	91.6	4.31	3.76
NUMBER OF NODULES	11	15.1	16.7	19.3	21.2	1.29	1.13
VOLUME OF NODULES	0.2	0.2	0.2	0.24	0.24	0.02	0.02

PLATE 2

EFFECT OF CYTOZYME ON VEGETATIVE CHARACTERS (40 DAYS)

EXPERIMENTAL PLANTS ON 40 DAYS

PLATE 3

EFFECT OF CYTOZYME ON VEGETATIVE CHARACTERS (60 DAYS)

EXPERIMENTAL PLANTS ON 60 DAYS OF GROWTH

FIG 2. EFFECT OF CYTOZYME ON VEGETATIVE CHARACTERS OF WINGED BEAN (40 DAYS)

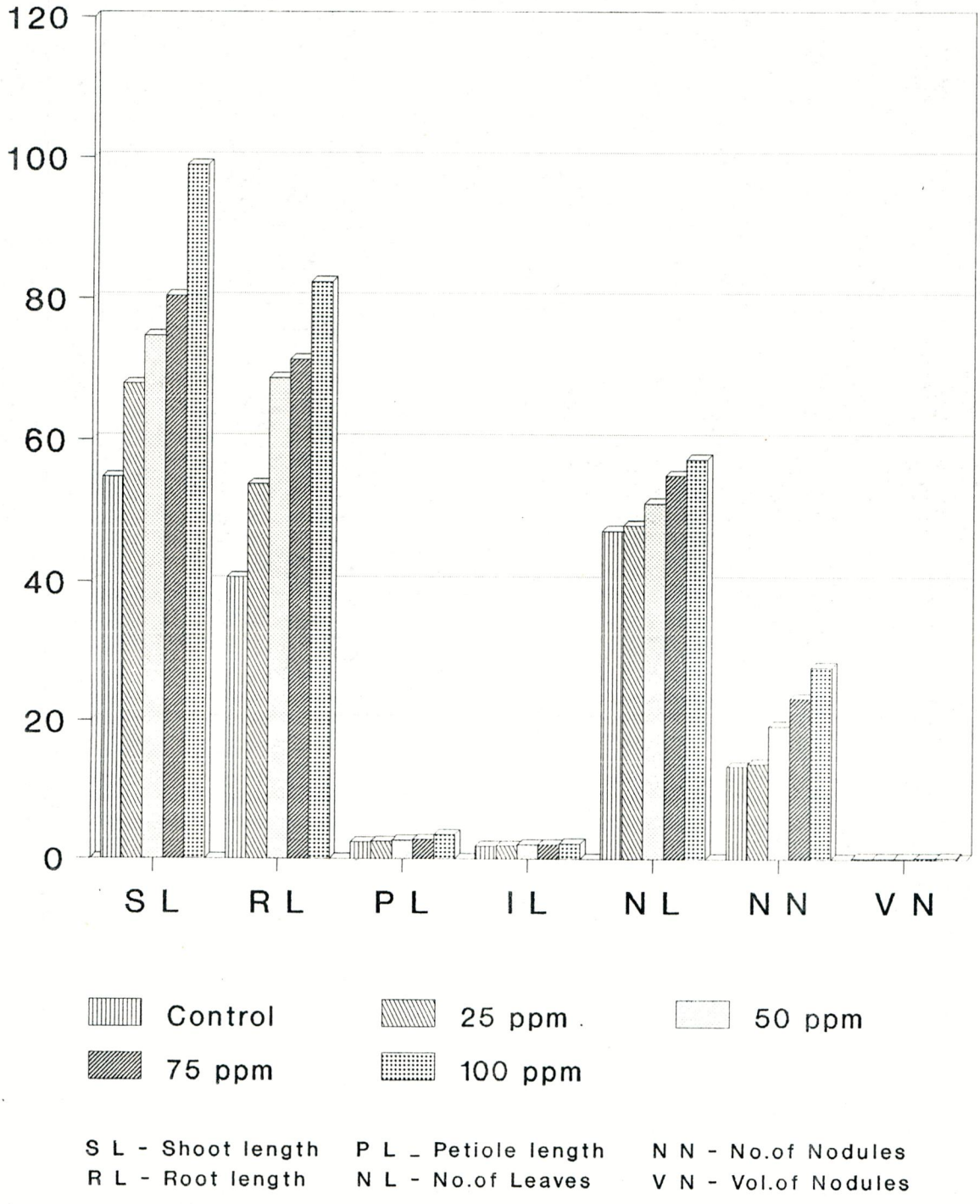
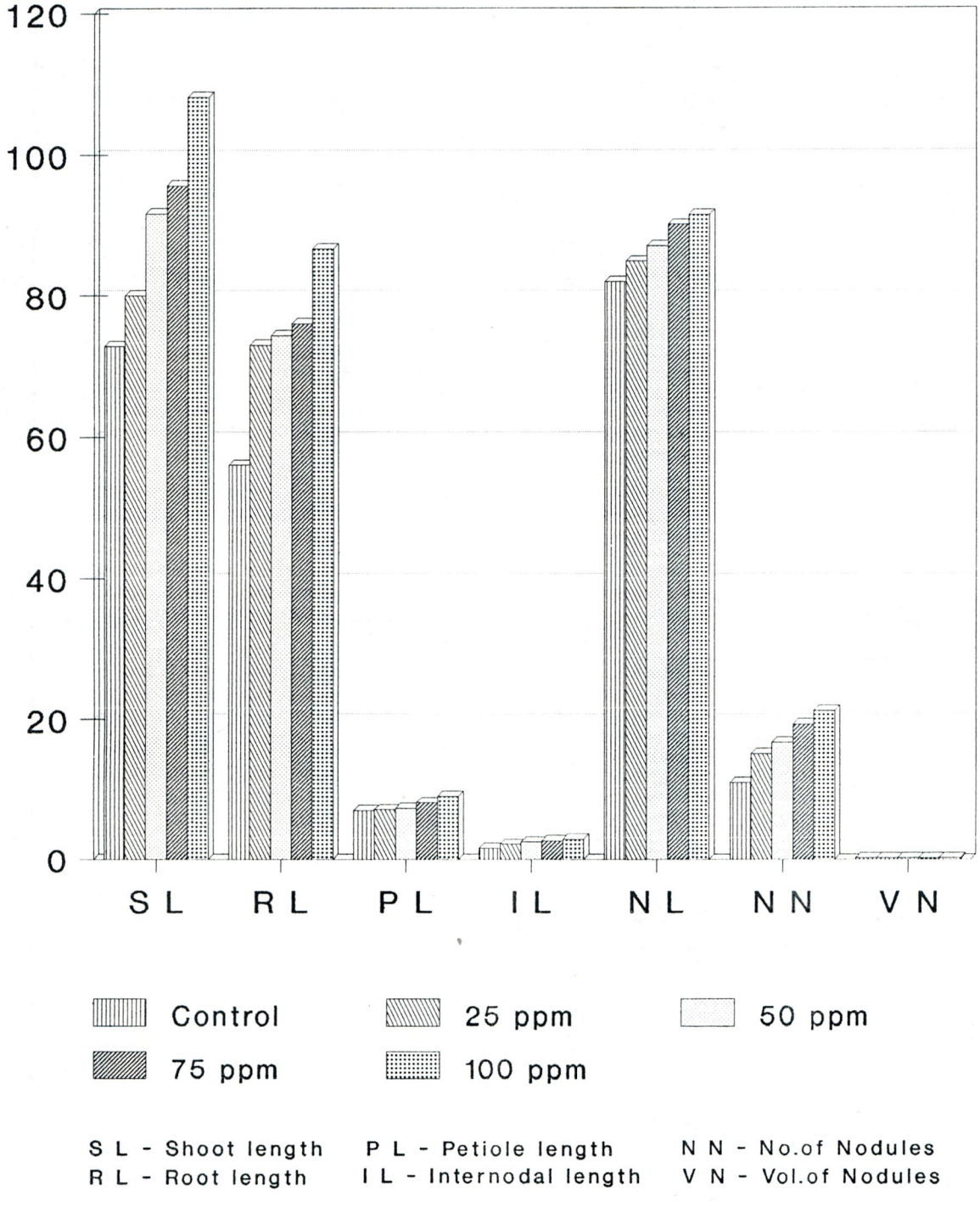


FIG 3.EFFECT OF CYTOZYME ON VEGETATIVE CHARACTERS OF WINGED BEAN (60 DAYS)



EFFECT OF CYTOZYME ON THE VEGETATIVE CHARACTERS OF WINGED BEAN (60 DAYS)

The results obtained for the 60th day plants treated with cytozyme were given in Table 3 plate 3 fig 3 .

SHOOT LENGTH AS INFLUENCED BY CYTOZYME:

A significant increase in the shoot length of winged bean at 60 days after sowing were noted. The shoot length increases with increased concentration (25 ppm - 80cm, 50 ppm - 91.7cm, 75 ppm - 95.7cm and 100 ppm - 108.2cm) compared to the control (72.8cm).

ROOT LENGTH AS INFLUENCED BY CYTOZYME:

The root length increased significantly at 25ppm (73cm), 50 ppm (74.3cm), 75 ppm (76cm) and 100 ppm (86.7cm) when compared with the control (82cm).

PETIOLE LENGTH AS INFLUENCED BY CYTOZYME:

All the treatments given increased the petiole length of winged bean (25 ppm - 7.1cm, 50 ppm - 7.3cm, 75 ppm - 8.1cm and 100 ppm - 9cm) compared to the control (7cm).

INTERNODAL LENGTH AS INFLUENCED BY CYTOZYME:

The internodal length of winged bean increased significantly at 25 ppm (2.2cm), 50 ppm (2.5cm), 75 ppm (2.7cm) and 100 ppm (2.9cm) when compared with control (1.6cm).

NUMBER OF LEAVES AS INFLUENCED BY CYTOZYME:

There was a significant increase in the number of leaves at the concentrations 25 ppm (84.9), 50 ppm (87.1), 75 ppm (90.2) and 100 ppm (91.6) compared with the control (82).

NUMBER AND VOLUME OF NODULES AS INFLUENCED BY CYTOZYME:

A significant increase was noted at 25 ppm, 50 ppm, 75 ppm and 100 ppm in the number and volume of nodules when compared to the control.

EFFECT OF CYTOZYME ON THE POD AND SEED CHARACTERS:

The effect of cytozyme on the pod and seed characters were studied and the results obtained were presented in Table 4 plate 4 fig 4.

POD LENGTH AS INFLUENCED BY CYTOZYME:

The pod length was significantly increased with the application of cytozyme at 25 ppm (17.03cm), 50 ppm (17.31cm), 75 ppm (17.73cm) and 100 ppm (21.6cm) when compared to the control (13.5).

POD CIRCUMFERENCE AS INFLUENCED BY CYTOZYME:

A significant increase in the circumference of pod was observed in all the treatments compared to the control (6.51cm) and the highest being at 100 ppm (7.92cm).

POD WEIGHT AS INFLUENCED BY CYTOZYME:

The weight of the pod increased significantly at the treatments (25 ppm - 17.02gm and 100 ppm - 24.78gm) when compared with the control (11.39gms). There is a slight decrease at 50 ppm and 75 ppm.

NUMBER OF SEEDS/POD AS INFLUENCED BY CYTOZYME:

The seeds number/pod increased significantly with increased concentration. When compared to the control (6.4). The highest being at 100 ppm (11.73).

WEIGHT OF SEEDS/POD AS INFLUENCED BY CYTOZYME:

The seeds weight per pod increased significantly at 25 ppm (4.58gm) 50 ppm (4.82gm), 75 ppm (5.07gm) and 100 ppm (5.02gm) when compared with control (3.05gm).

INFLUENCE OF CYTOZYME ON TUBER PRODUCTION

The size and weight of the tuber were increased with the treatment of cytozyme [plate]. The tuber weight increased at 25 ppm (35.6gm) 50 ppm (45.62gm) 75 ppm (54.75gm) and 100 ppm (60.75gm) compared to the control (25.93gm).

TABLE IV

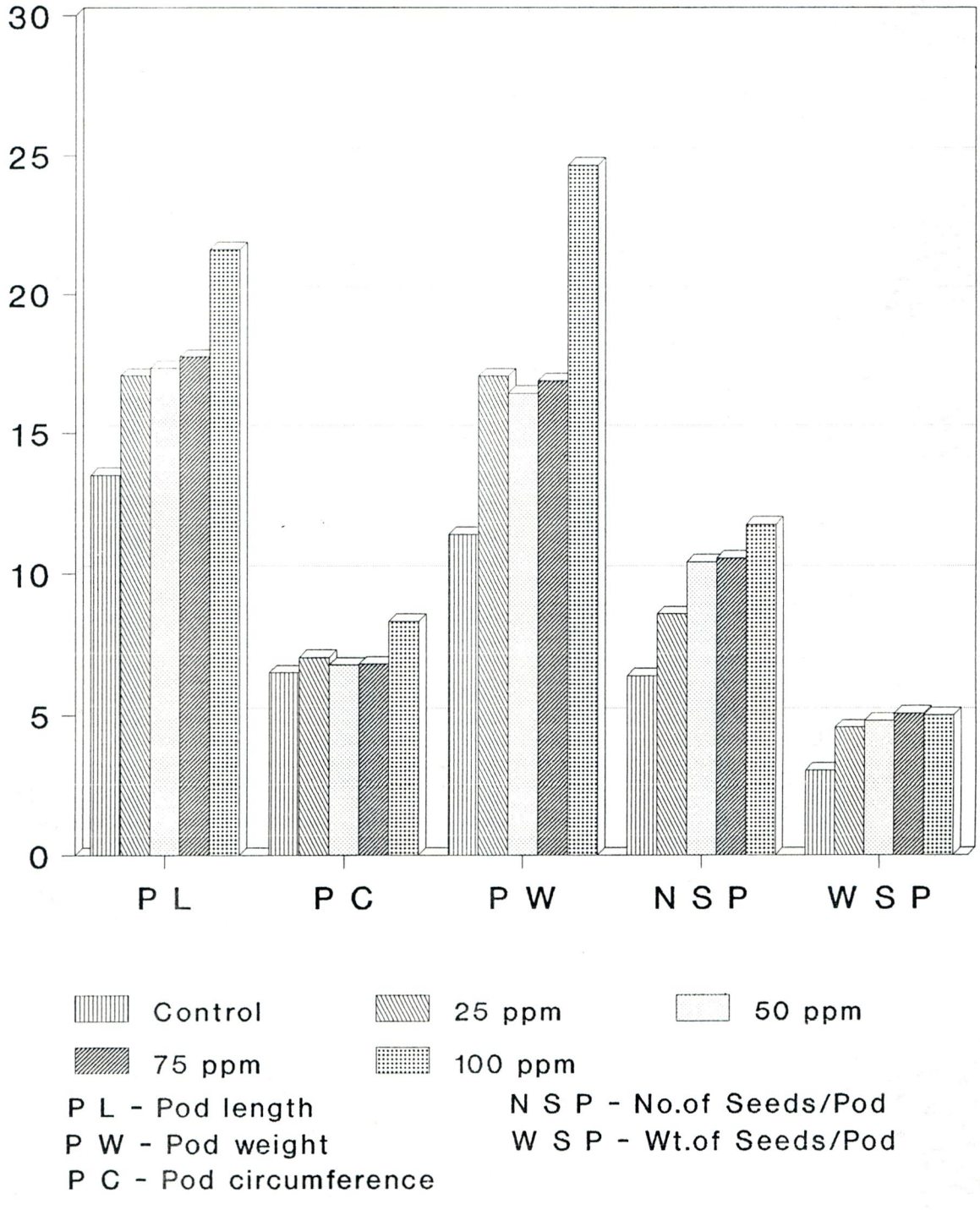
EFFECT OF CYTOZYME ON YIELD PARAMETERS ON WINGED BEAN

	CONTROL	25 ppm	50 ppm	75 ppm	100 ppm	S.E	C.D
POD LENGTH	13.49	17.03	17.31	17.73	21.6	1.09	0.57
POD CIRCUM-FERENCE	6.51	7.04	6.78	6.82	8.32	0.38	0.20
POD WEIGHT	11.39	17.02	16.4	16.85	24.65	2.22	1.16
NUMBER OF SEEDS/POD	6.4	8.58	10.4	10.53	11.73	0.97	0.51
WEIGHT OF SEEDS/POD	3.05	4.58	4.82	5.07	5.02	0.63	0.33

PLATE 4

EFFECT OF CYTOZYME ON TUBER

FIG 4.EFFECT OF CYTOZYME ON YIELD PARAMETERS OF WINGED BEAN



DISCUSSION

Cytozyme is a biologically derived nutrient support product and its active components are

a) Biologically activated chelated micro nutrients.

b) Active endo and exo enzymes.

c) Hydrolysed protein complexes and

d) Plant growth promoters.

Voluminous research efforts have been made on application of growth regulators exogenously or endogenously that had resulted in improved photosynthetic efficiency and yield of plants. In this contest the use of cytozyme for seedling growth vegetative and fruit and seed production assumes paramount significance.

The growth regulator cytozyme has been recently introduced for improving soil growing conditions increasing nutrient availability, organic matter content, aeration and root mass. The other benefits of using cytozyme are faster maturity of fruits,better fruit setting, uniform fruit size and greater resistance to pest and diseases, greater initiation of flowering, better retention of blooms, increased crop yield and increased resistance to adverse conditions (Singh et al., 1978; Pandita et al., 1981 ; Sing

and Kaur,1981; Halwankar et al., 1984; Hoods et al., 1985 and Mugunthan,1986).

The results on the effect of cytozyme on the seedling growth, vegetative growth and yield were discussed.

The experimental results of cytozyme on winged bean has shown an increase in the seedling growth. This in agreement with the work done by Halwankar et al., (1984) in soyabean, Chairani (1989) in oil palm, Sabir Ahamed (1989) in soyabean.

The experimental results of cytozyme on the vegetative characters reveal a significant increase in shoot length, root length, petiole length, internodal length, number of leaves, number of nodules and volume of nodules.

As in the present study, the shoot length was increased in potatoes (Pandita and Hooda,1979) Tomato, Brinjal and chillies (Hooda et al., 1985). The number of leaves increased in the present investigation, is contrary to the earlier report in oil palm (Chairani 1989).

In the present investigation cytozyme improved the yield of winged bean. This result was in agreement with cotton (Cothren and Cotterman 1980, Padole 1988,Despande and

Lakhdive 1989), Radish (Pandita et al., 1981), Muskmelon (Pandita et al., 1982), groundnut (Sudhakara Rao et al., 1984), Green gram (Jacqueline and Mugunthan, 1990) and Chillies (Doddaman and Panchal, 1991).

Summary and Conclusion

SUMMARY AND CONCLUSION

The effect of different concentrations of cytozyme on seedling growth, vegetative characters and yield parameters has been studied.

The cytozyme increased the seedling growth by increasing the root length, shoot length and number of the lateral roots significantly at all the treatments.

On the 40^{th} & 60^{th} days of growth the shoot length, root length, petiole length, inter-nodal length, number of leaves, number of nodules and volume of nodules was increased at all the concentrations employed.

The concentration of cytozyme was directly proportional to the stimulation for the following characters: pod length, pod circumference, pod weight, number of seeds/pod and weight of seeds/pod. The stimulation was significant at all the concentrations.

To conclude, cytozyme treatments improved the qualitative and quantitative characters of the winged bean significantly.

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