CHAPTER 12

GROWTH PERFORMANCE IN CULTURE EXPERIMENTS

Culture experiments were performed in order to study the effect of some of the important climatic, edaphic and biotic factors mentioned below on the growth performance of P. humilis :-

(i) Light intensity, (ii) Soil moisture regime, (iii) Organic matter content in soil, (iv) Intraspecific competition, and (v) Interspecific competition.

12.1. Light intensity and growth performance

Experimental Procedure - The same procedure as that described under 6.1 in Chapter 6 was employed in this experiment. The experimental pots were arranged into four sets for being subjected to varying light intensity as follows :-

Set		Treatment
T_1	-	Open sun (100 % sunlight),
T_2	-	Artificial shade of one layer of cloth (approximately 75% sunlight),
T_3	-	Artificial shade of two layers of cloth (approximately 50% sunlight),

PLATE No.

T_4 - Artificial shade of three layers of cloth (approximately 25% sunlight).

The duration of the experiment was about two and a half months from April to June, 1979. The experimental data were analysed statistically and are presented in Table 12.1 and graphs 18, 19 and 20. Plate 27.

Results and Discussion - The plant responds differently to different light intensities. The overall growth was much suppressed and stunted in plants of T_1. The values of all the parameters except root : shoot ratios on fresh and dry weight basis were minimum under T_1 treatment. In most of the parameters studied, the plants of T_2 showed better performance which progressively declined in those of T_3 and T_4, and was poorest in those of T_1. Length and breadth of the largest leaf were, however, maximum in plants of T_4, while root : shoot ratios were maximum under T_1 treatment.

The statistical analysis reveals that the overall effect of varying light intensity is significant at 1% level with respect to all the parameters studied. However, on making independent comparisons, it is revealed that there is no significant difference - (i) between the effects of T_2 and T_3 with respect to root length, circumference of shoot and root, length of the largest leaf, number of inflorescence axes and fresh weight of root, (ii) between the effects of T_3 and T_4 with respect to shoot length and fresh weight of shoot, and (iii) among the effects of T_2, T_3 and T_4 with respect to breadth of the largest leaf. The growth performance of the plants of T_1 is significantly lower than that of the plants of rest of the treatments with respect to all the parameters, except number of inflorescence axes where the difference between the effects of T_1 and T_4 is not significant. The performance of plants of T_2 and T_3 is significantly higher than that of plants of T_4 and T_1 with respect to root length, circumference of root and shoot, number of inflorescence axes and fresh weight of root. Similarly the performance of plants of T_2 is significantly higher than that of plants of T_3, T_4 and T_1 with respect to shoot length, number of leaves and fresh weight of shoot. T_4 treatment gave significantly better results than the rest of the treatments with respect to only one parameter, viz. length of the largest leaf.

The results of the experiment show that full sunlight had markedly adverse effect on the overall growth performance of R. humilis, 75% and 50% sunlight as obtained under T_2 and T_3 treatments respectively favourably affected the overall growth performance, and 25% sunlight as obtained under T_4 treatment had favourable influence only on leaf size. Thus the light intensity has a profound influence on growth performance of R. humilis. The overall growth performance is best under more or less shaded condition, while growth is suppressed or stunted under open sunlight. Further, it was also observed that floral initiation took place earlier in plants of T_2 and T_3 treatments than in those of T_1 and T_4 treatments.

Similar trend in results of varying light intensity has also been observed by Singhal (1967), and many other workers.

12. . <u>Soil moisture regime and growth performance</u>

<u>Experimental Procedure</u> - The same procedure as that described under 6.2.1 in Chapter 6 was followed in this experiment. The experimental pots were arranged into five sets for being subjected to differential watering treatments as follows :-

Set		Treatment
T_0	-	Waterlogged condition,
T_1	-	Watering daily,
T_2	-	Watering thrice a week,
T_3	-	Watering twice a week,
T_4	-	Watering once a week.

The duration of the experiment was about three and a half months from January to April, 1980. The experimental data were analysed statistically and are presented in Table 12.2 and graphs 21, 22, and 23.

Results and Discussion - R. humilis seems to be highly susceptible to waterlogged condition. The plants grown under this condition could not survive for more than a few weeks. Growth appeared to be suspended under this treatment, and the plants died after a few weeks. The probable reason of this may be the lack of soil aeration under waterlogged condition of the soil which prevents the development of healthy roots.

From the data, it appears that T_1 treatment (daily watering) gave best result with respect to most of the growth parameters studied, maximum values being obtained for them under this treatment. However, root penetration was favoured by T_4 treatment, and leaf size was favoured by T_2 treatment. Under T_4 treatment (watering once a week) growth performance of the plant with respect to all the parameters studied, except root : shoot ratio on the fresh and dry weight basis, was poorest.

The statistical analysis, however, reveals that the differences in growth performance of the plant under differential watering treatments are apparent with respect to many of the parameters studied, viz. diameter of shoot and root, length and breadth of the largest leaf, total number of inflorescence axes per plant, length of the longest fruiting inflorescence, and number of fruits on the longest fruiting inflorescence, as the variance ratios obtained with respect to all of these parameters are not significant. The overall effect of the varying soil moisture regime is significant at 1% level with respect to only two parameters, viz. length of shoot and root, and at 5% level with respect to two other parameters, viz. number of leaves and fresh weight of shoot. Shoot length was significantly lower in plants of T_4 treatment than that in plants of rest of the treatments, while root length was significantly higher in plants of T_4 treatment than that in plants of rest of the treatments. T_1 treatment gave values which are significantly higher than those under T_3 and T_4 treatments with respect to shoot length, number of leaves and fresh weight of shoot. However, there is no significant difference - (i) between the effects of T_1 and T_2 treatments with respect to shoot length, number of leaves, and fresh weight of shoot, (ii) among the effects of T_2, T_3 and T_4 with respect to number of leaves and fresh weight of shoot, and (iii) among the effects of T_1, T_2 and T_3 with respect to root length.

The results of the experiment indicate that R. humilis shows fair tolerance to a wide range of varying soil moisture regime, as obtained from daily watering upto once a week watering treatments. Significantly favourable or adverse effects of these treatments are manifested only in a few characters as already referred to earlier. The plants, however, did not survive in waterlogged condition. Further, it was observed during the course of the experiment that under T_4 (watering once a week) treatment plants started showing signs of temporary wilting on the last dry day of each watering cycle i.e. on the day just before each succeeding irrigation day. This indicates that the plants could not have tolerated any further delay in watering.

Similar trend in results of varying soil moisture regime has also been observed by Singhal (1967), Gupta (19 2) and Bechu Lal (1976).

12. . Organic matter content in soil and growth performance

Experimental Procedure - The same procedure as that described under 6.2.2 in Chapter 6 was followed in this experiment. The experimental plants were subjected to differential manuring treatments as follows :-

Set	Treatment		
	Garden soil		Farm-yard manure
T_1	1	:	0
T_2	3	:	1
T_3	1	:	1
T_4	1	:	3
T_5	0	:	1

The duration of the experiment was about three and a half months from December, 1979 to March, 1980. The experimental data were analysed statistically and are presented in Table 12.3 and graphs 24, 25 and 26.

Results and Discussion - It is evident from the data that presence of organic manure in the soil has a profound influence on the growth performance of R. humilis. In general, the best growth of the plant was obtained under treatment T_5 (i.e. in pure manure), and the growth was poorest under treatment T_1 (where no manure was added to the soil). The results obtained clearly show that organic matter content in soil has favourable effect on the growth performance of the plant. Almost all parameters exhibit a progressive rise in values proceeding from the treatments T_1 to T_5, maximum values being obtained under T_5. The root : shoot ratio both on fresh and dry weight basis, however, exhibit a progressive decline in values proceeding from the treatments T_1 to T_5, maximum values being obtained under T_1 and minimum under T_5. This indicates that the favourable effect of increasing organic matter content in soil is more pronounced in shoot than in root.

The statistical analysis reveals that the overall effect of the differential manuring is significant at 1% level with respect to all the parameters studied, except root length where the effect is not significant. On making independent comparisons, however, it is revealed that there is no significant difference - (i) between the effects of T_2 and T_3 with respect to length and breadth of the largest leaf, and fresh weight of root, (ii) between the effects of T_3 and T_4 with respect to shoot length, and dry weight of shoot,

(iii) between the effects of T_4 and T_5 with respect to shoot length and fresh weight of root, (iv) among the effects of T_3, T_4 and T_5 with respect to diameter of shoot and root, total number of inflorescence axes per plant and dry weight of root, length of the longest fruiting inflorescence and number of fruits on it. The values obtained under T_1 are significantly lower than those under the rest of the treatments with respect to all parameters, except total number of inflorescence axes where the difference is not significant between T_1 and T_2. The values obtained under T_5 are significantly higher than - (i) those under the rest of the treatments with respect to length and breadth of the largest leaf, and fresh and dry weight of shoot, (ii) those under T_1, T_2 and T_3 with respect to shoot length, number of leaves and fresh weight of root, and (iii) those under T_1 and T_2 with respect to diameter of shoot and root, total number of inflorescence axes, and dry weight of root.

The present findings are supported by those of Singhal (1967), Biswas (1967), Ratra (1970), Lavania (1971), Gupta (1972) and Bechu Lal (1976).

12.4. Intraspecific competition and growth performance

Experimental Procedure - The same procedure as that described under 6.3.1 in Chapter 6 was followed in this experiment. The following treatments were applied in the experiment :-

Set		Treatment No. of seedlings/pot
T_1	-	One
T_2	-	Three
T_3	-	Five
T_4	-	Eight
T_5	-	Twelve.

The duration of the experiment was about three and a half months from September to December, 1979. The experimental data were analysed statistically and are presented in Table 12.4 and graphs 27, 28 and 29.

Results and Discussion - It was observed that growth of E. humilis plants with respect to all the parameters studied suffered heavily under the stress of competition with increasing population density. The best performance was obtained under T_1 where there was no competition. From T_1 onwards a progressive decline in the values for all the parameters, except root : shoot ratio both on fresh and dry weight basis, was observed with increasing intensity of intraspecific competition so that T_5 gave minimum values. The deleterious effect of intraspecific competition was, however, more pronounced on the reproductive potential as evidenced by the total number of inflorescence axes per plant, and also on the fresh and dry matter yield as compared to the remaining parameters. Further, the deleterious effect of intraspecific competition was more pronounced on shoot as compared to root as indicated by the progressive rise in the value of root : shoot ratio both on fresh and dry weight basis with the increase in population density.

The statistical analysis reveals that the overall effect of varying population density on growth performance of the plant is highly significant. The variance ratios for all the parameters are significant at 1% level. On making independent comparisons, it is revealed that the values obtained under T_1 are significantly higher than those under the rest of the treatments with respect to most of the parameters. However, the effect of varying population density does not show significant difference - (i) between T_2 and T_3 with respect to shoot diameter, length and breadth of the largest leaf, total number of inflorescence axes, dry weight of shoot and root, (ii) between T_3 and T_4 with respect to root length, diameter of shoot and root, and fresh weight of root, (iii) between T_4 and T_5 with respect to diameter of shoot and root, number of leaves, total number of inflorescence axes, fresh weight of shoot and root, and dry weight of shoot, (iv) between T_1 and T_2 with respect to roo length, and length of the longest fruiting inflorescence, (v) among T_1, T_2 and T_3 with respect to shoot length, and num er of fruits on the longest fruiting inflorescence, and (vi among T_3, T_4 and T_5 with respect to dry weight of root.

Similar trend [redacted] in the results of int aspecific competition has also been observed by Sri astava (1963), Singhal (1967), Singh (1969) and Lav nia (1971).

12. . Interspecific competition and growth performance

Experimental Procedure - The same procedure as that des ribed under 6.3.2 in Chapter 6 was followed in this exp riment. The following treatments were applied in the exp riment :-

Set		Treatment
T_1	-	Regular weeding was practiced, so that the plant had not to undergo interspecific competition.
T_2	-	Weeding was not practiced, so that the plant had to undergo interspecific competition.

The duration of the experiment was abcut three and a hal months from September to December, 1979. The experimental dat were analysed statistically and are presented in Table 12. and graphs 30 and 31.

Table 12.5 : Effect of interspecific competition on growth performance of R. humilis.

		[Treatments]		[Student's t]	
		(0.56)	(0.64)		
18.	Dry weight of root (g)	1.35 (0.59)	0.36 (0.21)	3.864	* *
19.	Root : Shoot ratio (on fresh weight basis)	0.104 (0.033)	0.191 (0.043)		
20.	Root : Shoot ratio (on dry weight basis)	0.146 (0.063)	0.286 (0.045)		

Note : (1) Values are based on six observations.

(2) Figures in parentheses are standard deviations.

Table value of t = 2.228 at 5% level with 10 df

t = 3.169 at 1% level with 10 df

Results and Discussion - It was observed that at the time of harvesting 12 to 34 individuals belonging to 5 to 8 different weed species were flourishing in the pots of T_2 treatment. It is evident from the table that the interspecific competition had markedly deleterious effect on the growth performance of R. humilis. The values of the different parameters under T_2 are reduced upto approximately one-half to one-eighth of those under T_1. The deleterious effect of interspecific competition was, however, more pronounced on total number of inflorescence axes and fresh and dry matter yield as compared to the remaining parameters. Further, the deleterious effect of interspecific competition was more pronounced on shoot as compared to root as indicated by the higher value of root : shoot ratio both on fresh and dry weight basis under T_2.

The statistical analysis reveals that the effect of interspecific competition on growth performance of the plant is highly significant. 't' values obtained for all the parameters are significant at 1% level.

The detrimental effect of interspecific competition has also been observed in Malvastrum tricuspidatum (Srivastava, 1963), Phyllanthus urinaria (Singhal, 1967), Melilotus indica (Lavania, 1971), etc.

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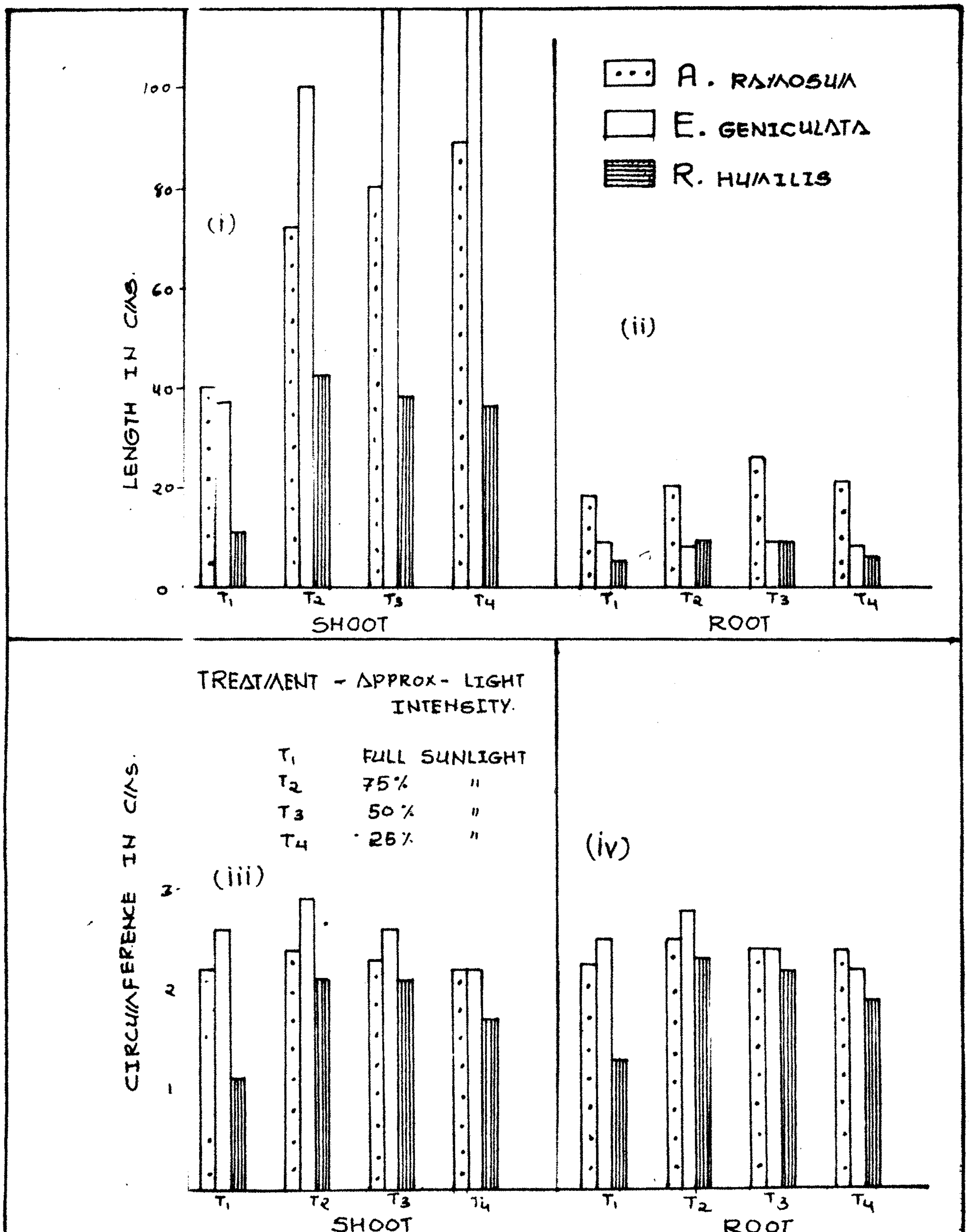
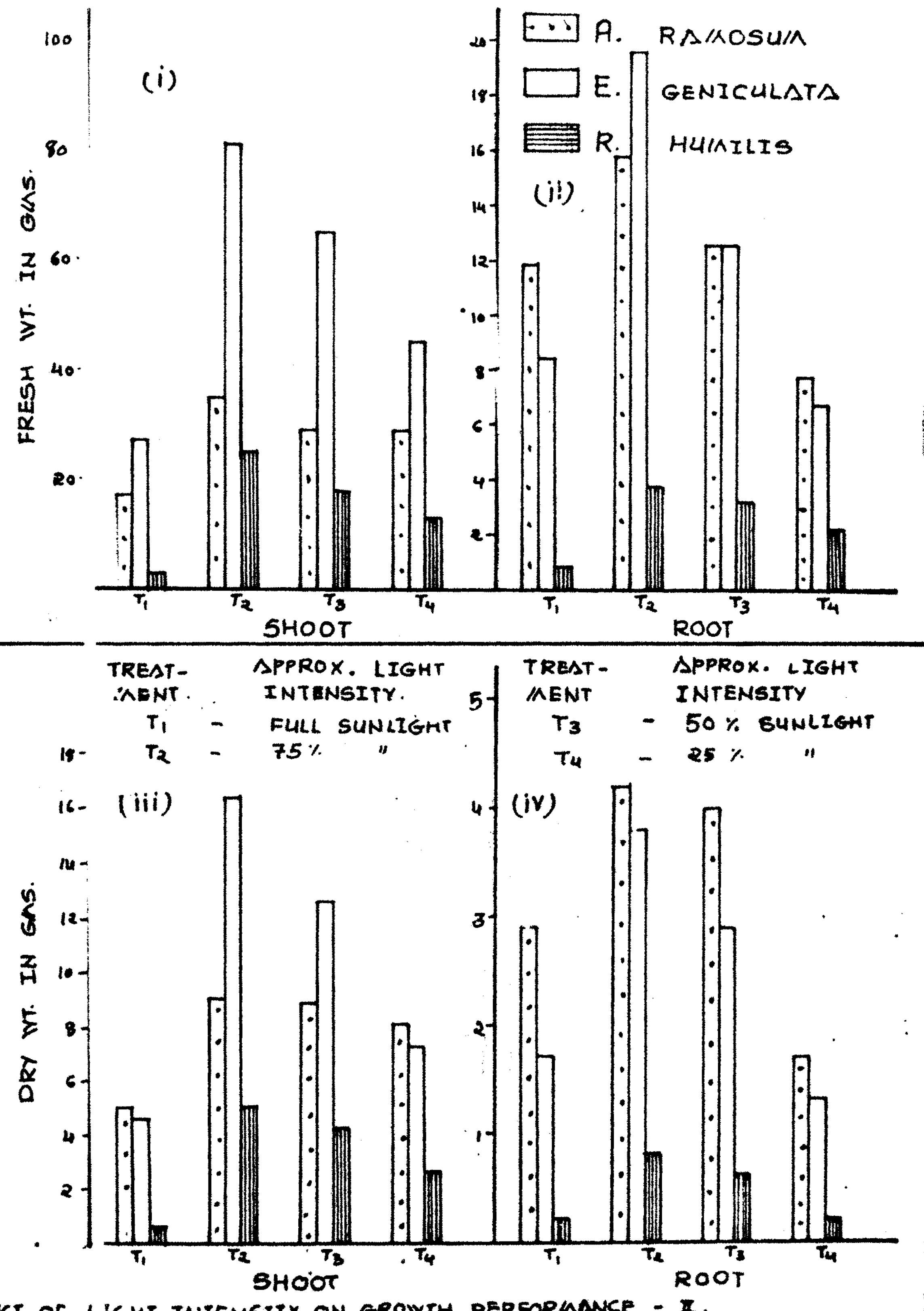


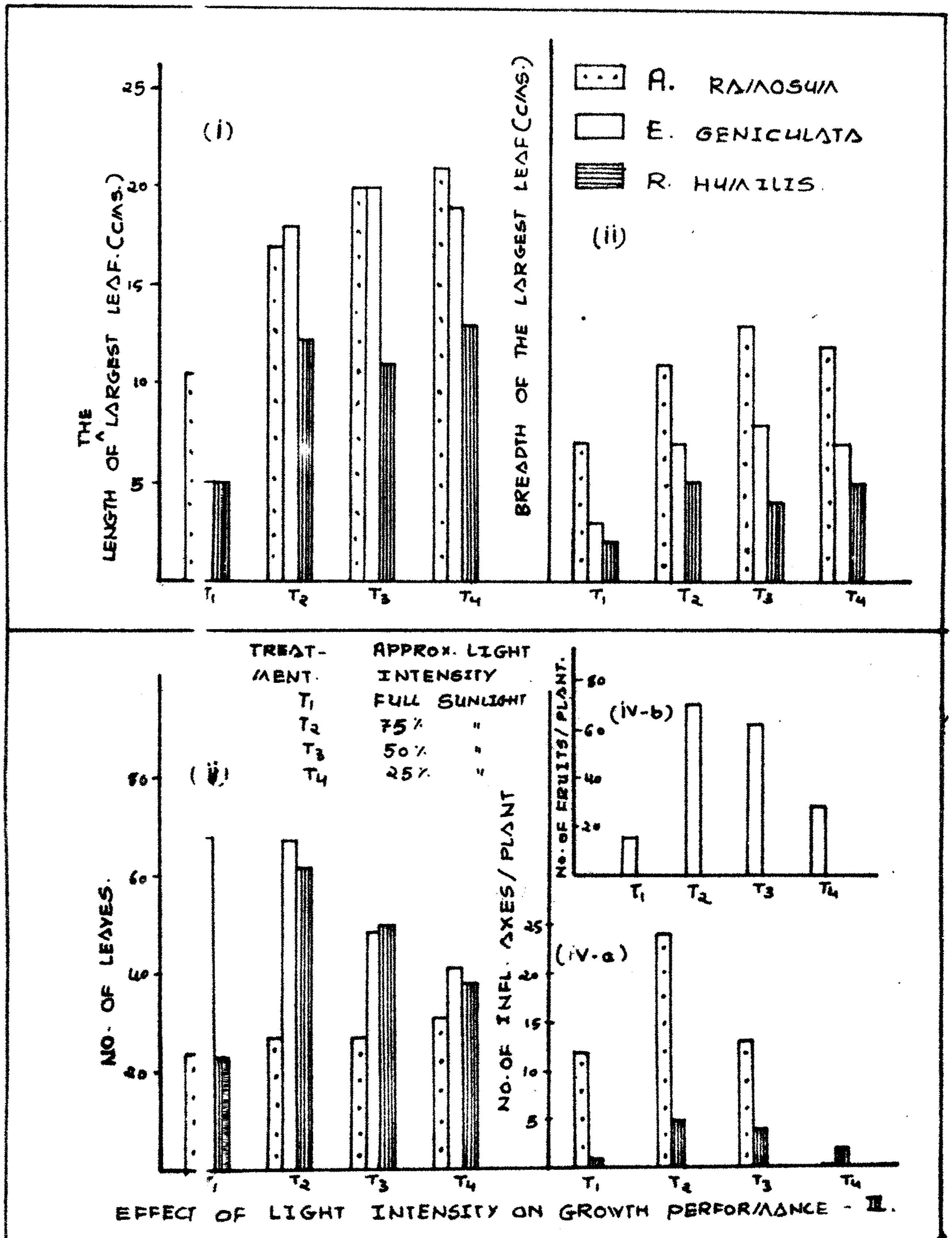
EFFECT OF LIGHT INTENSITY ON GROWTH PERFORMANCE - I.

GRAPH - 18



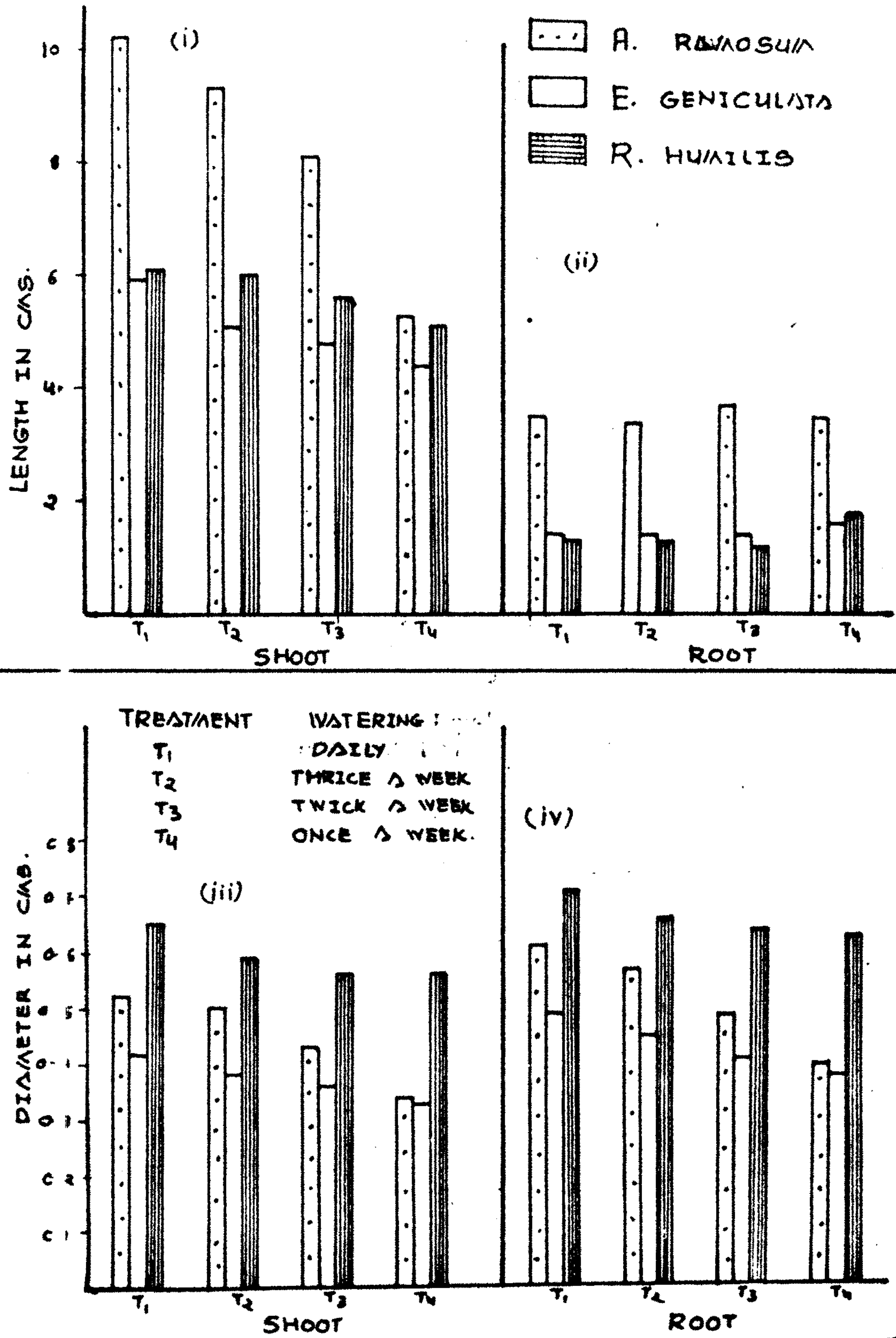
EFFECT OF LIGHT INTENSITY ON GROWTH PERFORMANCE - II.

GRAPH - 19



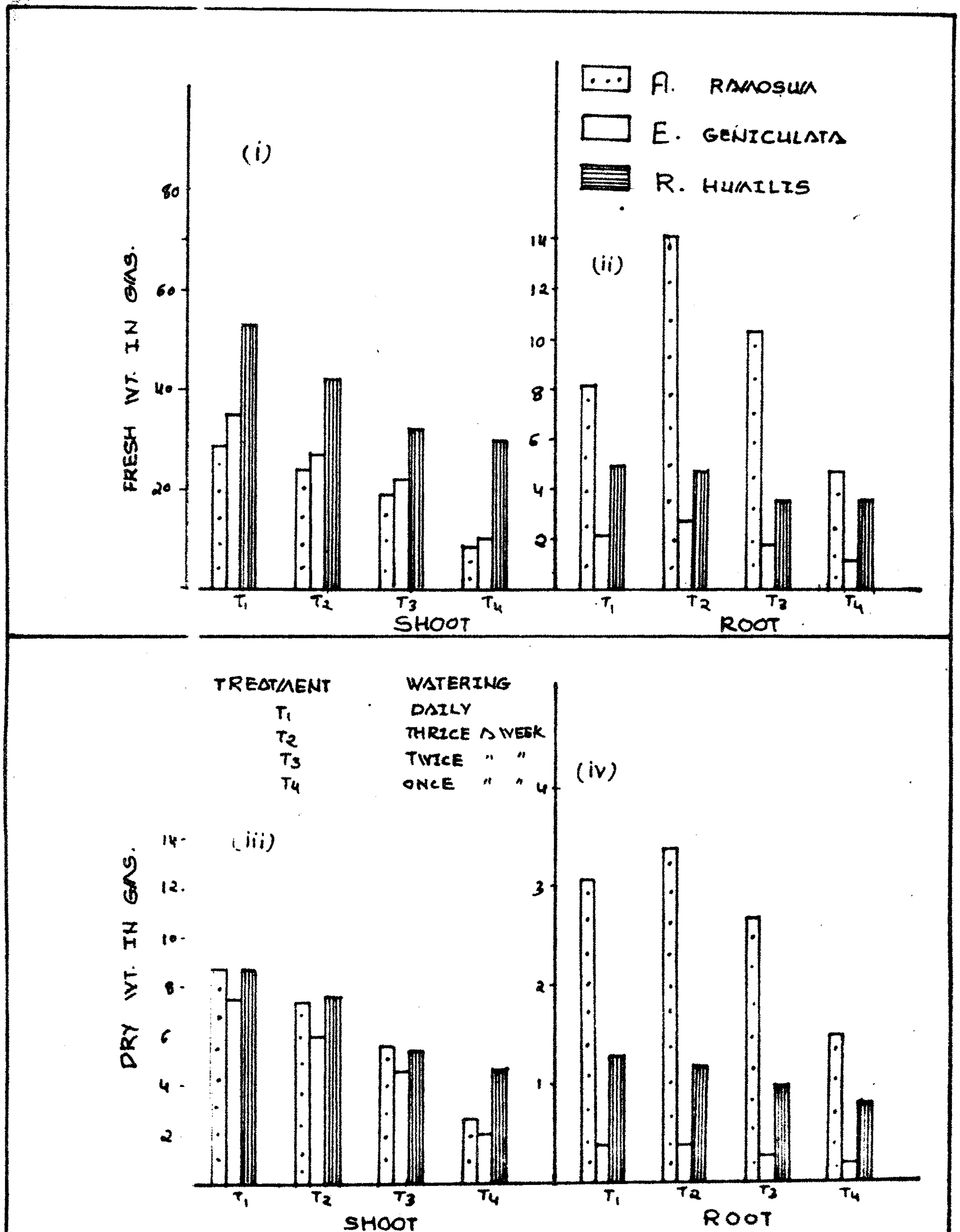
EFFECT OF LIGHT INTENSITY ON GROWTH PERFORMANCE - III.

GRAPH - 20



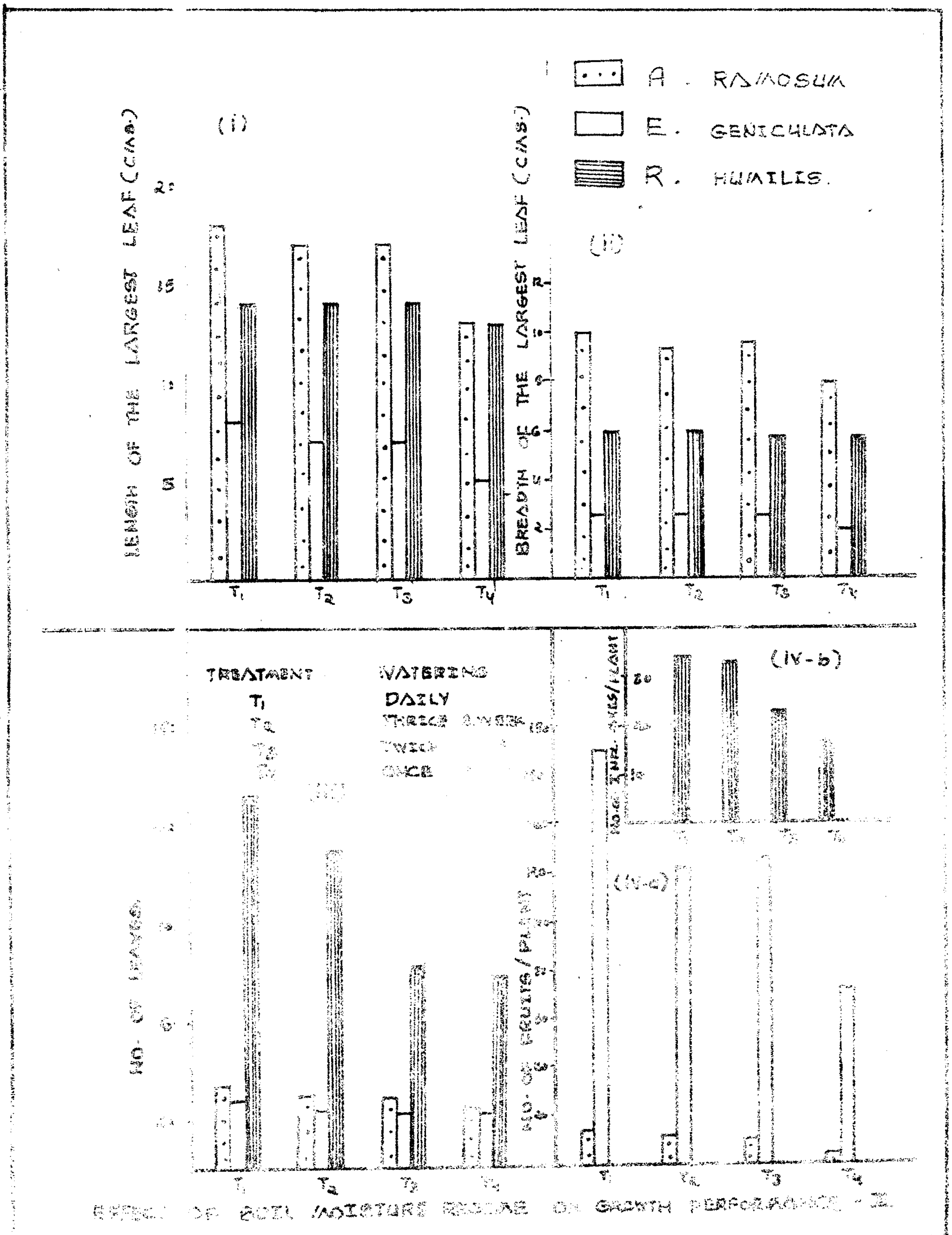
EFFECT OF SOIL MOISTURE REGIME ON GROWTH PERFORMANCE - I.

GRAPH - 21

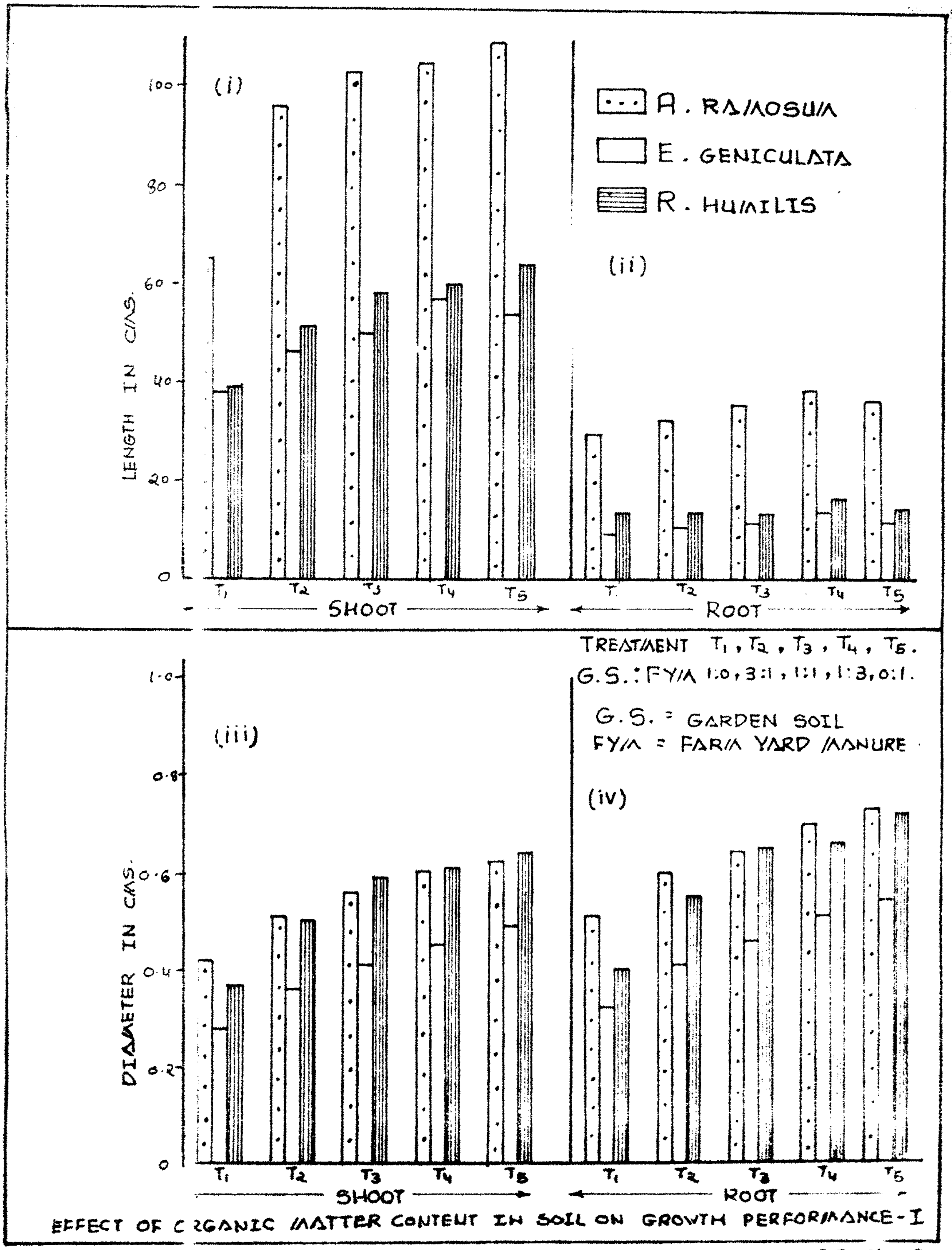


EFFECT OF SOIL MOISTURE REGIME ON GROWTH PERFORMANCE - II

GRAPH - 22

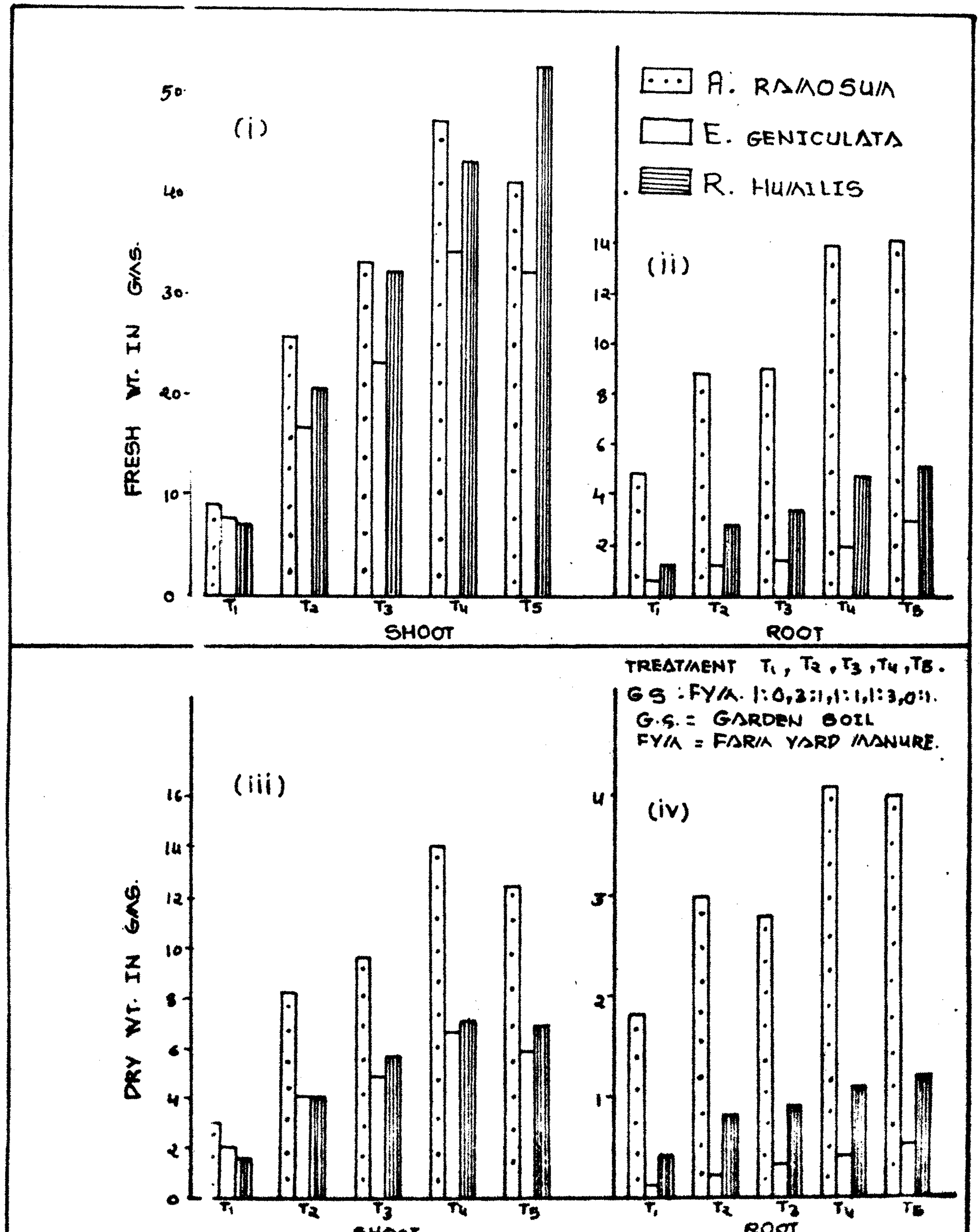

A. RAMOSUM
E. GENICULATA
R. HUMILIS.
(i)
LENGTH OF THE LARGEST LEAF (CMS.)
(ii)
BREADTH OF THE LARGEST LEAF (CMS.)
T1
T2
T3
T4
TREATMENT
WATERING
DAILY
THRICE A WEEK
TWICE
ONCE
NO. OF LEAVES
(IV-b)
(IV-a)
NO. OF FRUITS/PLANT
EFFECT OF SOIL MOISTURE REGIME ON GROWTH PERFORMANCE

GRAPH-23



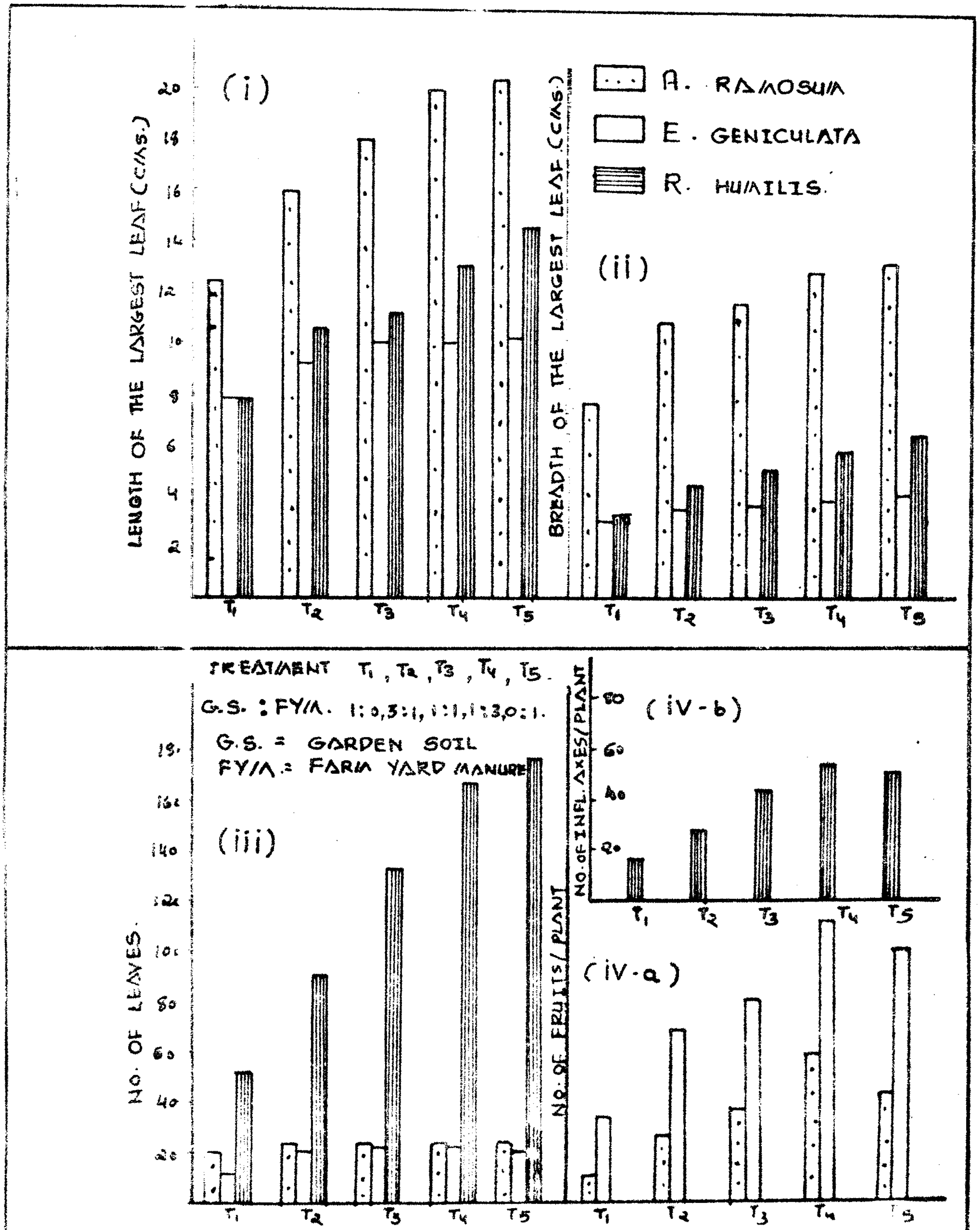
EFFECT OF ORGANIC MATTER CONTENT IN SOIL ON GROWTH PERFORMANCE-I

GRAPH-24



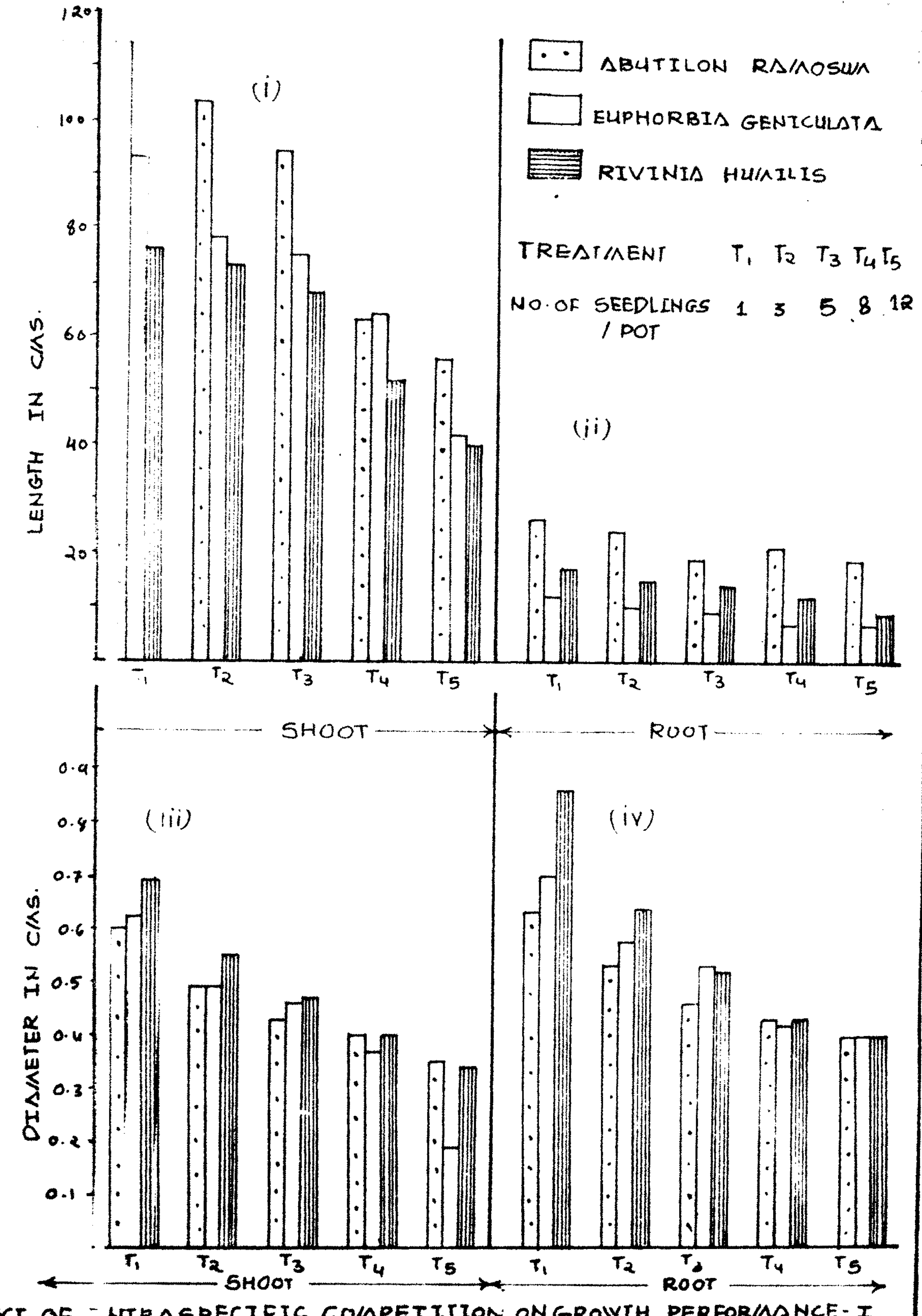
EFFECT OF OR ANIC MATTER CONTENT IN SOIL ON GROWTH PERFORMANCE - II.

GRAPH - 25



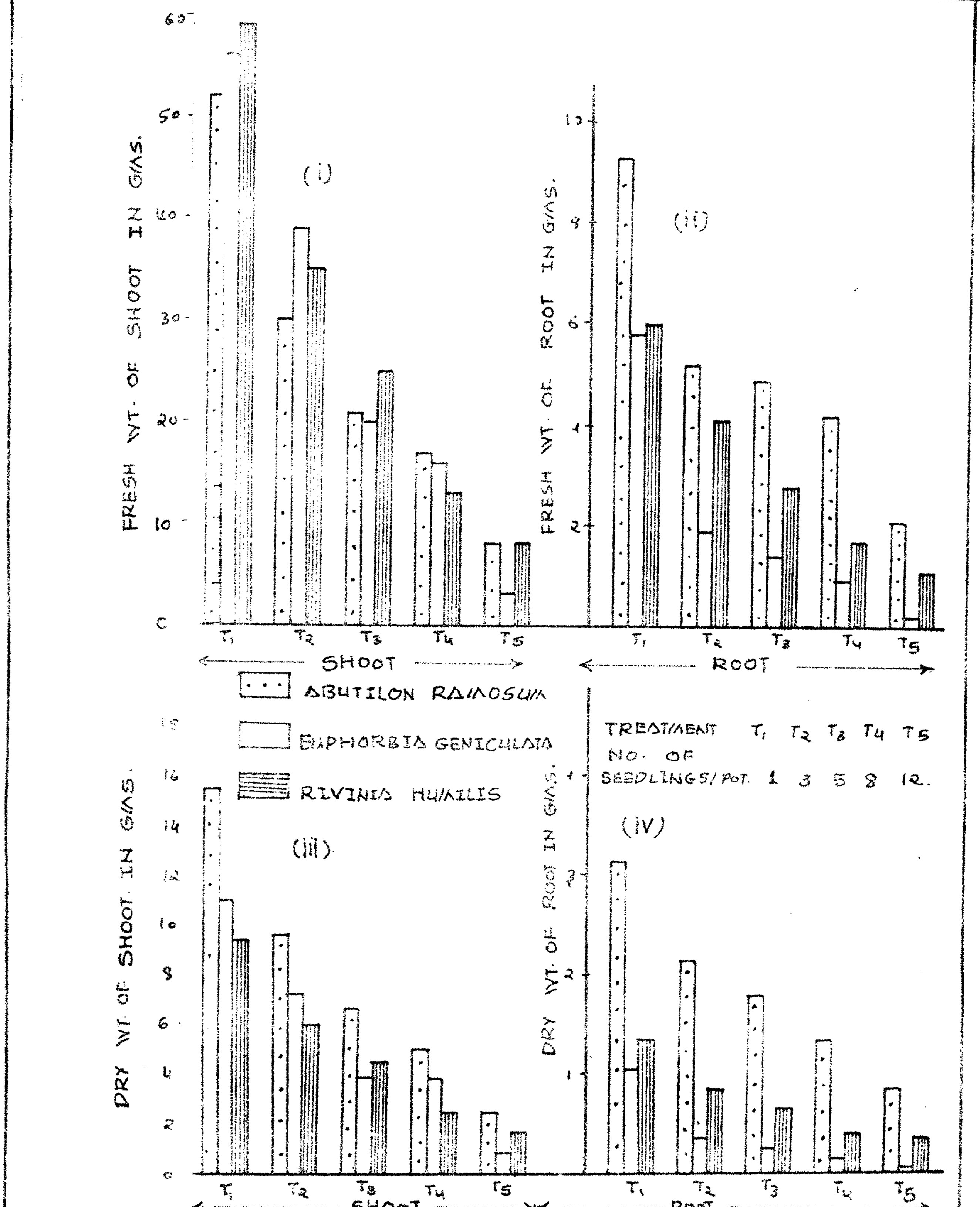
EFFECT OF ORGANIC MATTER CONTENT IN SOIL ON GROWTH PERFORMANCE - III.

GRAPH - 26



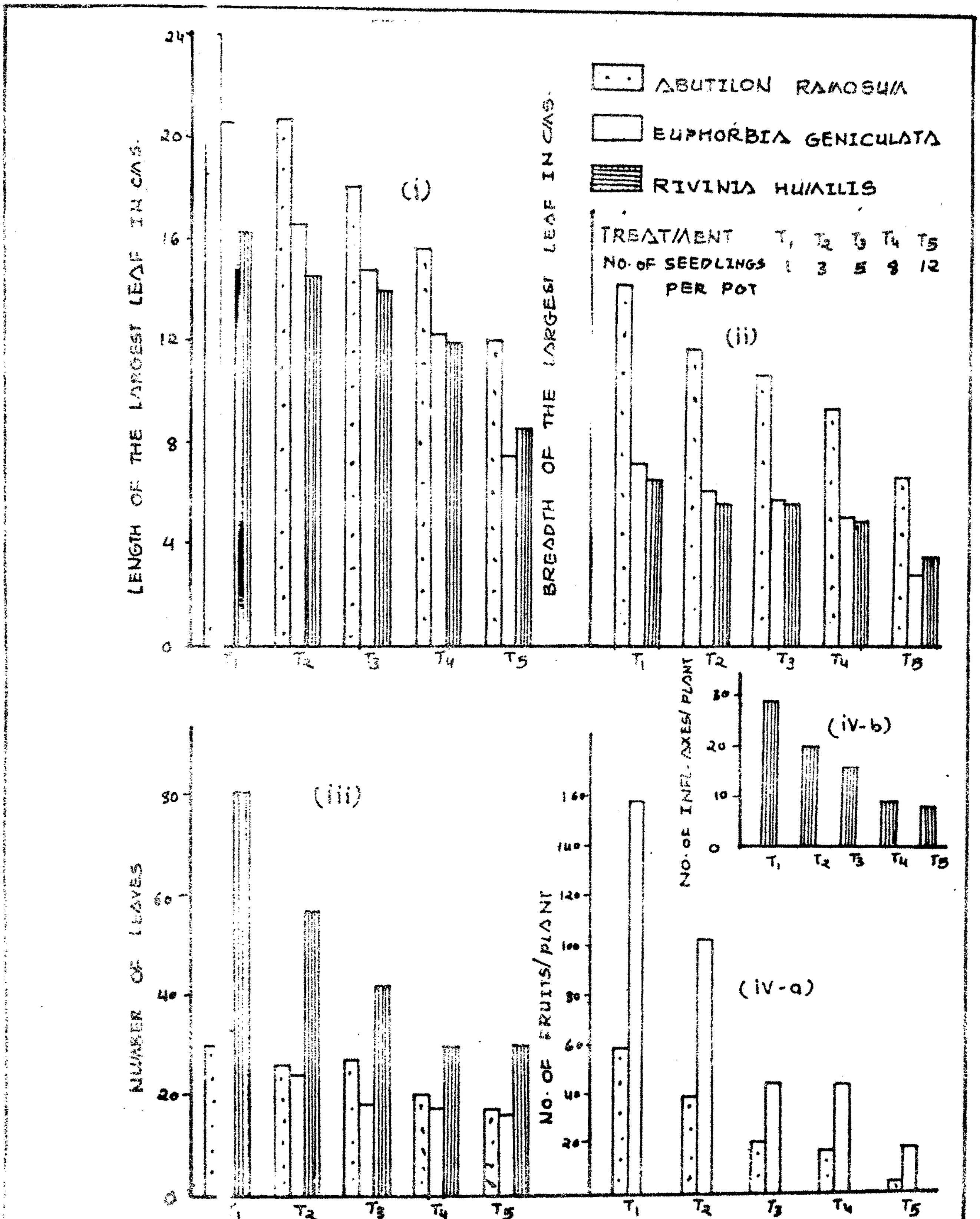
EFFECT OF INTRASPECIFIC COMPETITION ON GROWTH PERFORMANCE - I.

GRAPH - 27



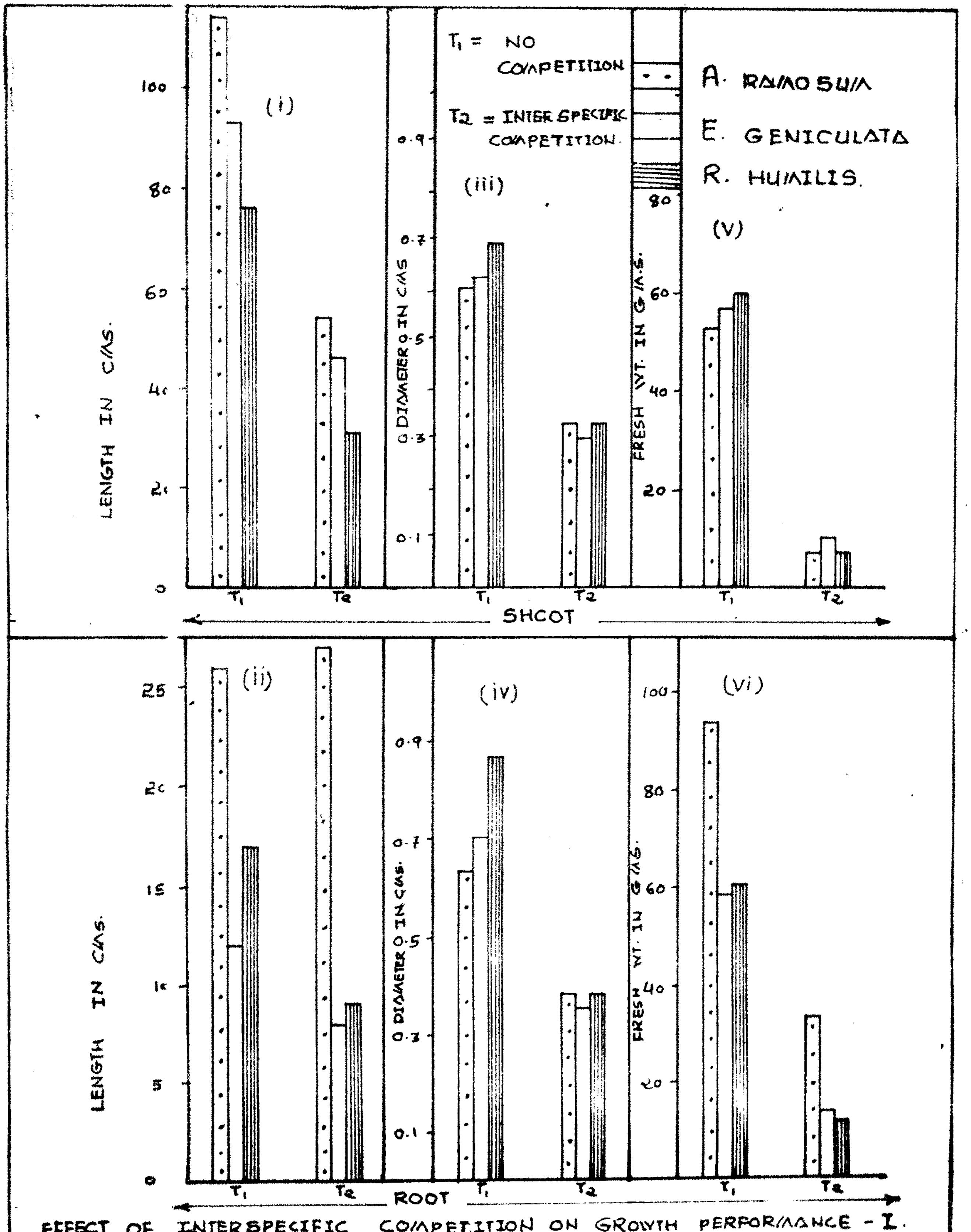
EFFECT OF INTRASPECIFIC COMPETITION ON GROWTH PERFORMANCE - II.

GRAPH - 28



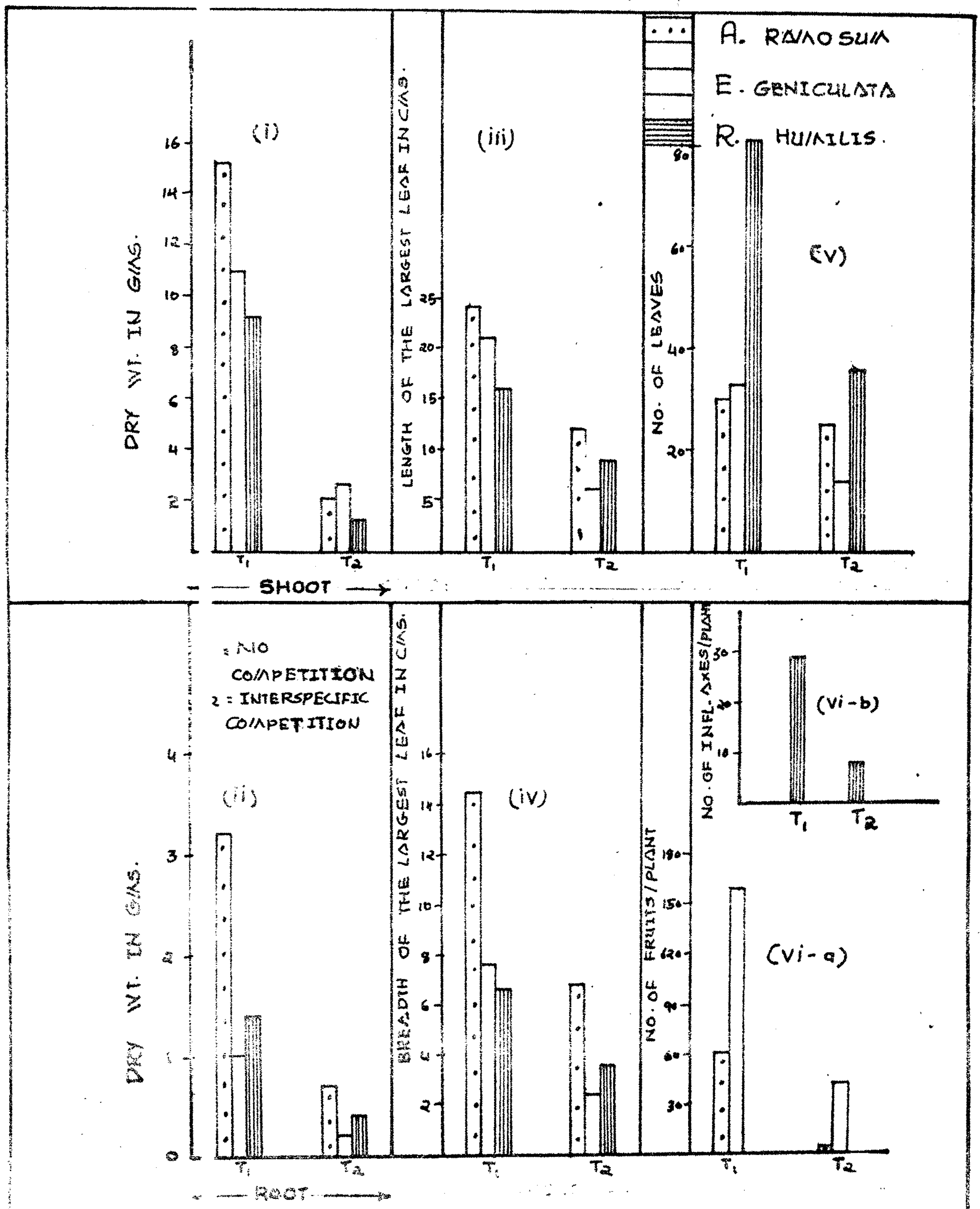
EFFECT OF INTRASPECIFIC COMPETITION ON GROWTH PERFORMANCE-III

GRAPH - 29.



EFFECT OF INTERSPECIFIC COMPETITION ON GROWTH PERFORMANCE - I.

GRAPH - 30



EFFECT OF I TERSPECIFIC COMPETITION ON GROWTH PERFORMANCE - II.

GRAPH - 31