CHAPTER 9

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 E. geniculata :-

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

9.1. Light intensity and growth performance

Experimental Procedure - The same procedure as that described under 6.1 in Chapter 6 was followed in this experiment. The various treatments applied in the experiment were 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).
T_4	Artificial shade of three layers of cloth (approximately 25% sunlight).

PLATE No. 1

The duration of the experiment was about two and a half months from March to May, 1979. The experimental data were analysed statistically and are presented in Table 9.1 and graphs 18, 19 and 20. Plate 18.

Results and Discussion - The plant responds differently to different light intensities. Maximum values of shoot and root circumference, number of fruits per plant, fresh and dry weights of shoot and root were obtained in plants of T_2 treatment. Leaf size was maximum under T_3 and minimum under T_1 treatment. Root length, number of leaves and root : shoot ratio both on fresh and dry weight basis were maximum under T_1 treatment and minimum under T_4. However, shoot length was maximum under T_4 and minimum under T_1 treatments. Thus various parameters respond differently to different light intensities. The overall growth was much suppressed and stunted in plants of T_1. In most of the parameters studied the plants of T_2 showed better performance, which gradually decreased in those of T_3 and T_4. Maximum fresh and dry matter yield was obtained under T_2 i.e. 75% sunlight, which also favoured the reproductive growth manifested by the number of fruits per plant. These characters were adversely affected by further increase or decrease in the intensity of light. The adverse effect of full sunlight on fresh and dry matter yield was more pronounced in shoot as compared to root, which is indicated by the maximum values of root : shoot ratios obtained under that treatment. Shoot length was favourably

affected by decrease in the intensity of light. Root length and number of leaves were favourably affected by increase in light intensity.

The statistical analysis reveals that the overall effect of varying light intensity is significant at 1% level with respect to all the parameters studied except the root length where the differences among the treatments are not significant. However, on making independent comparisons, it is revealed that there is no significant difference between the effects of T_2 and T_3 treatments with respect to shoot circumference, breadth of the largest leaf, and number of fruits per plant. Similarly there is no significant difference between the effects of T_3 and T_4 treatments with respect to shoot length, root circumference, number of leaves, and length of the largest leaf; and between the effects of T_1 and T_4 treatments with respect to number of fruits per plant and fresh weight of root.

It was further observed that floral initiation and maturity took place earlier in plants of T_2 and T_1 than in those of T_3 and T_4. It appears that the plant probably shows a tendency to delay commencement of the reproductive growth with decrease in light intensity.

Thus from the results obtained in the present experiment it is evident that the intensity of light has a profound influence on growth performance of E. geniculata. The

overall growth performance is best under more or less shaded condition, while growth is suppressed or stunted under open sunlight.

Similar trend in results of varying light intensity has also been observed by Singhal (1967). Increase in height (shoot length)and decrease in dry weight of plants grown in deep shade have also been reported by many other workers reviewed by Shirley (1936) and Burkholder (1936). Retardation of stem elongation under full sunlight may be due to some photomorphogenic effect of light intensity.

9.2 Soil moisture regime and growth performance

Experimental Procedure - The same procedure as that described under 6.2.1 in Chapter 6 was followed in this experiment. The various treatments applied in the experiment were 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 months

from January to April, 1980. The experimental data were analysed statistically and are presented in Table 9.2 and graphs 21, 22 and 23.

Results and Discussion - E. geniculata seems to be highly susceptible to waterlogged condition. The plants grown under this condition could not survive for more than a few weeks. Growth seemed to be suspended under this treatment, and the plants died after a few weeks. This might have happened probably due to lack of soil aeration under waterlogged condition of the soil which prevents the development of healthy roots.

From the data obtained, it is evident that maximum values for most of the parameters studied were obtained under T_1 and minimum values under T_4 treatment. The values for these parameters show progressive decline on passing from T_1 to T_4. However, number of axillary branches, breadth of the largest leaf, and fresh weight of root were maximum under T_2 treatment, while root length as well as root : shoot ratios on fresh and dry weight bases were maximum under T_4 treatment. Daily watering treatment helped to maintain favourable level of soil moisture, and so the plants under that treatment could show better performance with respect to most of the parameters, while once a week watering treatment could not maintain favourable level of soil moisture, and so the plants under that treatment showed

poorer performance with respect to most of the parameters. However, root penetration was favoured under the latter treatment.

The statistical analysis reveals that the overall effect of varying soil moisture regime is significant at 1% level with respect to shoot length, length of the longest axillary branch, length of the largest leaf, number of fruits per plant, and fresh and dry weights of shoot, while with respect to breadth of the largest leaf, and fresh and dry weights of root it is significant at 5% level. However, with respect to root length, diameter of shoot and root, number of leaves and axillary branches, the effect of differential watering does not show any significant difference. Independent comparisons further reveal that there is no significant difference among the plants of T_1, T_2 and T_3 treatments with respect to length and breadth of the largest leaf, as well as fresh and dry weights of root. Similarly no significant difference is observed among the plants of T_2, T_3 and T_4 treatments with respect to shoot length.

Daily watering favoured shoot length which is significantly higher under T_1 than that under the rest of the treatments. The plants of T_4 (once a week watering) showed significantly lower performance than those of the remaining treatments with respect to length and breadth of the largest leaf, number of fruits per plant, and fresh and dry weights

of shoot, while with respect to dry weight of root and length of the longest axillary branch they show lower values differing significantly only from those of T_1 and T_2.

Thus the plant can withstand a gap of upto 3 dry days between two successive irrigation days without showing, in general, significantly adverse effect on growth, but when the gap is extended upto 6 days the adverse effect is manifested in several characters. Further, under the latter condition (T_4 treatment), it was observed during the course of the experiment, that 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 several workers, viz. Singhal (1967), Biswas (1967), Gupta (1972) and Bechu Lal (1976).

9.3. 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 various treatments applied in the experiment were 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 months from December, 1979 to March, 1980. The experimental data were analysed statistically and are presented in Table 9.3 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 E. geniculata. In general, the best growth of the plant was observed either in set T_4 or T_5 (i.e. in soil with higher proportion of manure or in pure manure), and the growth was poorest in set T_1 (where no manure was added to the soil). The results obtained clearly bring it out that the 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 either T_4 or T_5.

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 and number of axillary branches where the level of significance is 5%. On making independent comparisons, it is revealed that the growth performance of plants of T_4 and T_5 is significantly higher than that of plants of T_1, T_2 and T_3 - with respect to length of shoot, number of axillary branches, fresh weight of shoot and dry weight of root. T_4 treatment gave significantly better results than (i) T_1 with respect to number of leaves, (ii) T_1 and T_2 with respect to length of root, and (iii) T_1, T_2 and T_3 with respect to number of fruits/plant and dry weight of shoot. Similarly T_5 treatment gave significantly better results than (i) T_1 and T_2 with respect to diameter of root, length of the longest axillary branch and length of the largest leaf, (ii) T_1, T_2 and T_3 with respect to diameter of shoot, and (iii) T_1, T_2, T_3 and T_4 with respect to fresh weight of root. However, the effect of differential manuring does not show significant difference-(i) between T_4 and T_5 with respect to length of shoot, diameter of shoot, diameter of root, number of axillary branches, number of fruits/plant, fresh weight of shoot, and dry weight of shoot and root, (ii) among T_3, T_4 and T_5 with respect to length of root, length of the longest axillary branch, length of the largest leaf, (iii) among T_2, T_3, T_4 and T_5 with respect to number

of leaves and breadth of the largest leaf, and (iv) among T_1, T_2 and T_3 with respect to fresh weight of root.

The favourable effect of organic manure on growth performance has also been observed in Phyllanthus urinaria (Singhal, 1967), Rauvolfia tetraphylla (Biswas, 1967), Achyranthes aspera (Ratra, 1970), Melilotus indica (Lavania, 1971), Rumex dentatus (Gupta, 1972), and Scoparia dulcis (Beohu Lal, 1976).

9.4. 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 months from September to December, 1979. The experimental data

were analysed statistically and are presented in Table 9.4 and graphs 27, 28 and 29.

Results and Discussion - It was observed that growth of *I. geniculata* 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 was observed with increasing intensity of intra-specific competition. The deleterious effect of intraspecific competition was, however, more pronounced in the reproductive potential as evidenced by the number of fruits per plant, and also in the fresh and dry matter yield as compared to the remaining parameters.

The statistical analysis reveals that the growth performance of the plant under varying population density differs significantly. The variance ratios for all the parameters are significant at 1% level, except that for the number of axillary branches which is significant at 5% 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 all parameters except root length where the difference is not significant between T_1 and T_2, and number of axillary branches where the difference is not significant among T_1, T_2, T_3 and T_4.

However, the effect of varying intensity of intraspecific competition does not show significant difference - (i) between T_2 and T_3 with respect to length of shoot and root, diameter of shoot and root, breadth of the largest leaf, fresh and dry weight of root, (ii) between T_3 and T_4 with respect to fresh weight of shoot and root, and dry weight of shoot and root, (iii) between T_4 and T_5 with respect to root length, fresh and dry weight of root, and (iv) among T_3, T_4 and T_5 with respect to number of leaves, and number of fruits per plant.

The deleterious effect of intraspecific competition has also been observed by Srivastava (1963) in Malvastrum tricuspidatum, Singhal (1967) in Phyllanthus urinaria, Singh (1969) in Cassia tora, and Lavania (1971) in Melilotus indica.

9.5. Interspecific competition and growth performance

Experimental Procedure - The same procedure as that described under 6.3.2 in Chapter 6 was followed in this experiment. The following treatments were applied in the experiment :-

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

T_2 - Weeding was not practiced, so the plant had to undergo interspecific competition.

The duration of the experiment was about three months from September to December, 1979. The experimental data were analysed statistically and are presented in Table 9.5 and graphs 30 and 31.

Results and Discussion - It was observed that at the time of harvesting 13 to 22 individuals belonging to 5 to 9 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 E. geniculata. The values of the different parameters under T_2 are reduced upto approximately one-half to one-sixth of those under T_1. The deleterious effect of interspecific competition was more pronounced with respect to number of fruits per plant and fresh and dry weights of shoot and root as compared to the remaining parameters.

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, except root length and number of axillary branches where the level of significance is 5%.

Similar trend in results of interspecific competition has been observed by Srivastava (1963), Singhal (1967) and Lavania (1971).

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