Chapter 6
Summary
SUMMARY

The proposed investigations were carried out on morphological, ecological, physiological and biochemical behaviour of *Leucaena* variants (S24, S22, S14, S10 and K8) to understand their growth behaviour, contributing to the biomass production partitioning and energetics on a rainfed degraded land. These variants were from the final evaluation trial where K8 was used as control. The studies for growth and biomass production of selected *Leucaena* variants were carried out at Central Research Farm (Military Padav area) of the IGFRI, Jhansi (75.35°E longitude, 25.27°N latitude and 275 m above mean sea level altitude). For early growth, morphological, physiological and biochemical characters the pot culture experiments were conducted at pot culture / experimental house of the Plant Physiology and Biochemistry Section, IGFRI, Jhansi. The salient findings are as under:

1. All the five *Leucaena* varieties were found to be statistically significant for morphological characters like leaf length, number of pinna pairs, length of pinna, number of flower per head and mimosine percentage in leaf.

2. The summer and winter produced pods and seeds have shown significant variation between the varieties and season. The summer produced seeds were lighter than the winter produced seeds. In winter and summer S22 and S10 produced heaviest seeds.

3. In seasonal study the extension growth was maximum from July to October. The rate of relative extension growth was found to be highest at seedling stage. On an average extension growth was maximum in S10 and lowest in K8 variety.

4. The radial growth was found to be maximum in the month of November and
again during January to March. On an average the stem diameter growth of K8 and S24 exceeded to those of S10 and S14. This shows the superiority of K8 and S24 for wood production over S10 and S14.

5. The growth of all the varieties was synchronized with the shoot elongation. The root growth was maximum during favourable growth period (July to October) and minimum in between February and March. K8 attained maximum root length followed by S14.

6. As the plants grow the production of nodule was also found to increase. But in winter it showed decline which may be ascribed to dormancy. S24 and S22 produced maximum number of nodules.

7. The higher leaf turn over rate was in S22, S24, and S14 indicating their higher fodder production than S10 and K8. In winter leaf production was low and in summer it increased showing its dependency over seasonal temperature.

8. The production of branch increased up to March. From April it showed decline due to seasonal dryness. Profuse branching was observed in K8 which led to higher biomass production.

9. The rate of photosynthesis (PN) and stomatal conductance (CS) were higher in S24 exhibiting its higher productivity potential. In general, PN, CS, were highest in rainy season and lowest in summer months.

10. The rate of transpiration was maximum in summer and minimum in winter. The variety S24 had minimum rate of transpiration predicting its suitability for dry and arid environmental conditions.
11. Intercellular CO₂ concentration was low in peak growing months exhibiting fast fixation of CO₂ in the course of photosynthesis leading to enhanced productivity.

12. Water use efficiency (ratio of PN/TR) was lowest in summer due to high loss of water vapour. On average S24 had shown its highest water use efficiency indicating its better productivity in dry environment.

13. The carboxylation efficiency (ratio of PN/CINT) was highest in rainy season and was lowest in summer. The maximum carboxylation efficiency of S24 and K8 exhibited their higher productivity potential over other varieties.

14. The total biomass production in term of fresh weight and dry weight was found to increase with the age of plant. Maximum dry matter accumulation was between October-January. Variety K8 had maximum biomass accumulation followed by S24, S10 and S22 as confirmed by relative growth rate of there varieties.

15. Dry matter partitioning was maximum in stem than roots and leaves in all varieties. In early stages of plant growth leaves had maximum biomass accumulation which was decreased with the age of plant. Varieties S24 and S22 partitioned maximum biomass to stem indicating the better wood production potential. This is also evidenced by their Root: Shoot ratio.

16. Leaf area increased with the age of plant. This parameter was found to be closely related with all morphological parameters as evidenced by positive and significant correlation co-efficient with other growth and morphological characters.

17. Specific Leaf Weight (SLW) was found to be related more to seasonal changes. SLW was maximum in S24, S22 and s14 than K8 showing their superiority for higher production. Specific leaf area was maximum during early seedling stage representing
its more contribution in the establishment phase.

18. Leaf Weight Ratio (LWR) and Leaf Area Ratio (LAR) were maximum in the early stage of growth but declined as the leaves attained maturity. Overall selections showed higher LWR over K8 indicating their superiority in foliage biomass production.

19. The photosynthetic pigments in all the varieties were highest in peak growing season and also from April-June, when the flushing of new leaves occurred. Maximum accumulation of chlorophyll content was exhibited by selections than K8 exhibiting their higher photosynthetic efficiency.

20. Nitrate reductase activity (NRA) was found to increase with the age of leaves and as the leaves attained maturity there was a decline. Seasonal influence was more prominent on NRA activity.

21. The carbohydrate content (Sugar and Starch) was influenced with the age of plant and season. The sugar and starch accumulation in stem and roots was more in all the selections than K8 indicating that this stored carbohydrates can be made available for fast coppicing / regeneration. Therefore, these selections were having higher coppicing potentiality.

22. Crude protein content was maximum during growing season in all the varieties. Leaves and root had maximum accumulation of crude protein content than the stem. However, varietal difference were statistically insignificant.

23. Coppice growth was influenced by the season. All varieties had peak growth during June-September (rainy season). The first one year coppice growth was faster as compared to second year. In the coppice growth, lowest Leaf / Stem ratio was in June (end of dry phase) while it was maximum in November, December and March in all the
24. The biomass productivity of coppice stands at first, second and third year of growth have shown maximum in second year and minimum in the first year. The mean productivity of coppice stands was found to be more than that of pure stands on same dry land.

25. *Leucaena* continued to drop leaf litter throughout the year. To this, flower litter are added during October-November and March-April and pod, seed and branch litter during December-March and May - June respectively. In the present study peak production was during March followed by May and November.

26. The ratio between wood and bark was found to increase with the age. Maximum ratio was in variety K8 showing its superiority for wood production.

27. Energy storage in different plant parts over 3 years showed maximum allocation to bole during all the three years followed by below ground + stump. S24 and S10 and S14. However S24 and S10 contributed their higher wood biomass production potential and may be suitable for plantation in semi-arid environment.

28. During the first year of coppice growth the minimum allocation was to litter biomass while in years 2 and 3 it was to leaf. Allocation to bole increased in 2nd year after which there was a decline.

29. On comparison for energy storage with other plantations, the *Leucaena* coppice plantation had more capacity for energy storage. S24 and S10 had contributed maximum portion of energy to the total net production indicating their high wood biomass production potential and may be suitable for plantation in semi-arid environment for woody biomass production.
Chapter 7

Literature Cited