

## CHAPTER SIX

### Conclusion and Recommendations

#### 6.1 Conclusion

- Highly significant variation in seeds morphometric characteristics among provenances of *Azadirachta indica*, may reflect both environmental and genetic variation and adaptation to different environmental conditions and soil type.
- Neem is a species of broad phenotypic plasticity expressed in the wide spread occurrence of the tree in the different climate zones and habitats, therefore it can be concluded that significant differences among provenances of neem in seeds characters are direct responses of differences in their natural habitats.
- Cool and normal storage conditions decreased seed germinability by increased storage time for neem provenances.
- Neem seed can be classified as recalcitrant and cannot be stored successfully for long periods. The seed of neem seems to sensitive to low temperature, chilling damage and death may occur if stored in low temperatures.
- Differences in growth between provenances show the successful adaptation of plants. Therefore, it is always advisable to identify the best seed sources adapted to different ecological regions and to breed them for efficient uses.

- The results of the present work seem to be insufficient to evaluate neem growth performance as it was limited to only one site and for a very limited time and only at the nursery stage.
- From the results of the present work and based on several comments and observations furnished by researchers in the field of ecology, it can be concluded that neem tree, which was supposed to have a narrow genetic base in the Sudan, have fully naturalized in different eco-climatic habitats in the various parts of the country.
- The studied provenances exhibited significant variations especially in root length and root collar diameter variables, showing its great adaptability to different edaphic and moisture regimes of the different climatic zones of the Sudan.
- It has been shown by the results that seedlings of provenances from Western Sudan have generally bigger root collar diameter as compared to the remainder of the provenances from Central and Eastern Sudan. It is important to ascertain here that Elfasher provenance is the most adapted provenance as it was significantly superior in root collar diameter, root length and other variables.
- Senga provenance seemed more adapted to higher moisture conditions thus producing longer shoots compared to the remainder of the provenances. The Gedaref provenance in this trial seems to be the least in most of the growth attributes examined. It has been suggested by (Kundu, 1998) that eco-climatic attributes play an important role in the differentiation of neem populations and thereby affect their growth during the early growth stages. Based on these agreements we may attribute the lower ranking of Gedaref provenance to its inability to adapt to the cumulative environmental conditions prevailing there perhaps including the heavy cracking clay soils of the area.

- Senga provenance produced the biggest seedlings root collar diameter, indicating that Senga provenance is enjoying the best growth requirements (water, soil) while on the other hand Gedaref is somewhat suffering from harsh or short growth conditions that lead the plant to minimize seedling size towards the economy of water and/or materials. The other two provenances have moderate growth conditions.
- Elfasher provenance had the greatest root collar diameter than the other provenances as an effect of irrigation. Senga provenance seedlings had greater collar diameter at 75, 50, 25% field capacity.
- Elfasher had greater root length compared to the other provenances at the four irrigation regimes. Gedaref, provenance seedlings had greater root length for 100% field capacity indicating that the provenance is well adapted to more humid environments prevailing the area where it grows.
- In this study it was obviously found that the neem tree in Sudan, although it is generated from one tree (in Shambat), it established in different provenances in various geographical locations and ecotype over Sudan, due to its adaptation ability.

## 6.2 **Recommendations**

- Adoption and encouraging of establishment and plantation of Neem trees over Sudan.
- More studies on seed longevity, optimal temperature for storage of seeds, soil type.
- Well connected field trails are needed with more reliable scientific methods for matching of provenances with new sites.
- Seed transfer should be avoided wherever possible since seed of the different provenances showed significant differences in their characteristics.

- Long time storage trails are needed to show the effect of both cold and normal and add deep storage condition on seed viability.
- The similarity in most morphological growth parameters between seven provenances may be attributed to the short duration of the study and consequently, more studies on physiological and genetic characters are needed for provenances.