Summary and Conclusion

CHAPTER VI

SUMMARY **AND** CONCLUSION

Aloe vera, a succulent belonging to the family Liliaceae is used for its thick fleshy leaves from which many useful substances are obtained. The yellow sap that exudes from the cut leaves has been used as laxative or purgative since ancient times. Though it has acquired greater commercial importance there is no regular and systematic cultivation due to the lack of improved cultivars, agronomic management and processing technologies. The area under *Aloe vera* cultivation worldwide is 23589 ha, but India's share in area and production is negligible.

Based on the experiences gained in the Integrated Plant Nutrient System (IPNS), Food and Agricultural Organization (FAO) has taken the pioneering initiative with the conceptual programmes like identifying the main organic and biological sources and their integrated use.

The studies on the assessment of existing genetic variability for designing crop improvement programmes, standardization of crop management practices like spacing, nutrient requirements, plant protection measures etc. are scanty worldwide. To fill this lacuna, the present study was contemplated and conducted to evaluate the performance of twenty one accessions of *Aloe vera* collected across South India and the effect of different spacing levels and forms of manures along with bioinoculants.

The study was undertaken at Gandhigram Rural Institute (Deemed University), Dindigul district, Tamilandu, India in two phases. The first phase study was conducted in Randomized Block Design (RBD) during August, 2005 to January, 2007. The presence of variability, mean performance of accessions, genetic divergence was worked out and the best suited accessions for gel and' aloin yield was screened. The second phase study was conducted in split-plot design keeping three

spacing levels as main plot treatments and different forms of manures viz., FYM, vermicompost, poultry manure and coir pith compost with and/or without bioinoculants such as *Azospirillum* and Phosphobacteria as sub plot treatments. There were twenty seven treatment combinations including control and the field experiments were carried out during August, 2007 to January, 2009. The data collected on growth, physiological, yield, quality, drought related parameters were subjected to the statistical scrutiny before drawing the conclusions.

The salient findings of the present study are summarized as below.

Phase – I.

1. Striking variation was noticed among the 21 accessions evaluated for qualitative attributes like plant stature, leaf orientation, leaf colour, blotches on young leaves, spine colour, branching pattern of flower stalk, flower colour and latex colour.
2. The highest plant height and plant spread was registered by the accessions AV_{17}, AV_{16} and AV_6.
3. The accessions AV_6 collected from Indian Institute of Horticultural Research, Bangalore possessed the highest number of suckers plant^{-1} throughout the study period. AV_{17} was shy in sucker production and AV_{16} produced optimum number of suckers plant^{-1}.
4. The growth parameters viz., number of leaves plant^{-1}, leaf length, leaf width were the highest in AV_{17} and AV_{16} but leaf thickness and leaf volume were the highest in AV_{16}.
5. The accessions AV_{17} and AV_{16} maintained its prime position in respect of number of leaves harvested from four harvests, pooled yield plant^{-1}, leaf yield plot^{-1} and estimated leaf yield ha^{-1}.

6. The accession AV_{16} collected in wild state from Thiruvannamalai district and AV_7 collected from Gandhigram, Tamilnadu showed its superiority in terms of gel yield.
7. Latex yield and barbaloin content are important traits determining the suitability of accessions to medical industry. Accessions AV_{17} surpassed all others in terms of latex yield and AV_6 and AV_{17} were superior for barbaloin content.
8. The accessions AV_{16} and AV_7 expressed the best gel quality parameters viz., p^H, soluble solids and reducing sugar content.
9. The accessions AV_{16} and AV_7 registered the higher chlorophyll, chlorophyll stability index, lower stomatal index and stomatal frequency. The accessions AV_{16}, AV_7, AV_6 and AV_{17} recorded the high relative water content, more accumulation of proline and less water saturation deficit.
10. The characters viz., leaf volume, gel yield $plot^{-1}$, latex yield $plant^{-1}$, number of leaves $plant^{-1}$, leaf yield $plant^{-1}$ and plant spread showed high degree of both phenotypic coefficient of variation and genotypic coefficient of variation.
11. High heritability coupled with high genetic advance was observed for leaf volume, number of leaves $plant^{-1}$, leaf yield $plant^{-1}$, plant spread, leaf width, leaf weight and plant height and these characters could be improved upon by exercising selection.
12. The characters viz., plant height, plant spread, numbers of leaves $plant^{-1}$, leaf length, leaf width, leaf thickness, leaf volume and leaf width were positively correlated with leaf yield $plant^{-1}$, gel yield $plant^{-1}$ and barbaloin content.
13. The characters such as leaf weight, leaf length, plant height, number of leaves $plant^{-1}$, leaf width had significant positive correlation coefficients and positive

direct effects on leaf yield plant^{-1} which forms reliable indices for selection of genotypes for higher yield.

14. The twenty one *Aloe vera* accessions subjected to D^2 analysis fit into five groups and AV_{16} and AV_{17} formed separate groups. The maximum intercluster divergence and cluster means were also obtained.

Phase – II.

1. Among the three different spacing levels tested, the medium level of spacing (75 x 75cm) (M_2) exerted the positive influence on most of the growth characters viz., plant height, number of leaves plant^{-1}, leaf length, leaf width, leaf thickness and leaf volume.
2. Application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (S_4) surpassed the other treatments in respect of growth characters except leaf thickness. The highest leaf thickness was observed from the plants treated with coir pith compost @ 5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (S_8).
3. The interaction effect of medium level of spacing and vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (M_2S_4) showed it superiority for all the growth parameters studied.
4. Adoption of medium level of spacing (75 x 75cm)(M_2) resulted in higher leaf area and leaf area index, total chlorophyll content, shoot fresh and dry weight, root fresh and dry weight and total dry matter production. The higher Crop Growth Rate (CGR) was estimated from closer spacing level (75 x 60cm) and Relative Growth Rate (RGR) from medium level of spacing while Net Assimilation Rate (NAR) from high (90 x 75cm) and medium level of spacing (75 x 75cm).

5. The beneficial effect of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (S_4) was evident as this treatment (S_4) was superior in expression of physiological parameters and growth analytical parameters.
6. The plants spaced at 75 x 75cm and received vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (M_2S_4) registered the maximum values for all the physiological parameters studied.
7. The medium level of spacing (M_2) expressed the highest mean leaf weight, leaf yield $plant^{-1}$, leaf yield $plot^{-1}$ and estimated leaf yield ha^{-1}. It also resulted in higher gel and latex yield $plant^{-1}$, plot and ha^{-1}.
8. The yield parameters viz., leaf weight, number of leaves harvested $plant^{-1}$ and plot, leaf yield gel yield and latex yield were positively influenced by the application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (S_4).
9. An espacement of 75 x 75 cm and application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (M_2S_4) resulted in better yield contributing parameters and yield in terms of leaf, gel and latex yield.
10. Gel quality parameters viz., gel p^H, moisture content, total and soluble solids, fibre contents were not influenced by spacing levels.
11. Application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum and* Phosphobacteria @ 2 kg each ha^{-1} (S_4) resulted in desirable gel quality characters like gel p^H, higher total and soluble solids, reducing sugar and the lowest barbaloin content in latex.
12. The interaction effect of spacing levels and forms of manures were insignificant for all the quality characters except reducing sugar content.

13. Plants spaced at 75 x 75 cm (M_2), application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} (S_4) and the interaction effect of M_2 x S_4 (M_2S_4) revealed high leaf N, P and K status.
14. Application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} resulted in better soil total microbial population and Azospirillum population in rhizosphere and non-rhizosphere soils of *Aloe vera*.
15. The highest net income and cost benefit ratio was arrived from the treatments comprised of medium level of spacing (75x75cm) and plots applied with vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1}

From the above summary, the following conclusions / recommendations are drawn,

1. While planning a breeding strategy for higher leaf and gel yield in *Aloe vera*, the characters viz., leaf volume, number of leaves $plant^{-1}$, leaf yield $plant^{-1}$, plant spread, leaf width, leaf weight and plant height should be given due consideration.
2. The accession AV_{16} collected from Thiruvannamalai district of Tamilnadu found to be the best for its leaf yield, gel yield and quality besides drought tolerant abilities. Hence, it can be directly utilized as a cultivar after conducting Multi Location Trials (MLT) or in breeding programmes for the development of promising cultivars suitable to meet the demand of cosmetics industry.
3. The accession AV_{17} collected from Trichy district of Tamilnadu found to be the best for latex yield and barbaloin content and it could be better utilized for medical industry.
4. Planting of *Aloe* suckers at 75 x 75 cm spacing and application of vermicompost @ 2.5 t ha^{-1} + *Azospirillum* and Phosphobacteria @ 2 kg each ha^{-1} found to be the best agronomic practice for higher productivity and quality of gel besides providing higher net returns per unit area.