

## 5. Conclusion of the study

Following are some of the major achievements obtained from the present study.

- In the present study, planting time, cultivation practices and harvesting schedule have been optimized to obtain maximum artemisinin yield in different locations and seasons.
- Good agricultural practices like nursery development, transplantation, optimum plant population density, fertilizer management, micro nutrients, irrigation, weeds, pest and diseases to get good biomass of dry leaves per hectare land and Artemisinin content.
- Effect of different fertilizer doses were checked on different parameters like plant height, fresh herb yield, dry stem yield, dry leaves yield and artemisinin content. NPK: 100:60:40 Kg/ha and NPKS: 100:60:40:40 Kg/ha showed good results.
- Effect of plant population density on plant growth and artemisinin content was seen. Plant height, fresh and dry biomass was seen to increase in spacing of 45X45 cm while the artemisinin content was more in spacing of 60X60 cm.
- Studies were done to establish plant survival, growth attributes and yield attributes of *A. annua* with different transplanting months in all three selected regions in India. During study it was observed that the artemisinin yield was maximum (34.03 T/ha) in the plants which were transplanted in month of December and minimum (17.93 T/ha) in the February transplanted plants. It is recommended that the crop transplanted in the December is more profitable, as it is having more artemisinin content. December transplanting of *A. annua* is suitable for Gujarat and Madhya Pradesh region, but for Uttarakhand late January transplant was found suitable. It also opens new areas for cultivation of this crop in the country. *A. annua*

contractual cultivation is already adopted by the farmers in Gujarat, MP, Rajasthan, Uttar Pradesh, Uttarakhand and other states.

- To increase the artemisinin production by treating the plant with Abscisic acid, Gibberellic acid, Methyl jasmonate, acetyl salicylic acid, lead acetate, sodium chloride, and a combination of GA<sub>3</sub>+IAA (gibberellic acid+indole acetic acid). The leaves of treated plants were examined and more trichome density was found in methyl jasmonate and also the artemisinin content was more in this sample. The substantial increase in artemisinin yield following the applications of elicitors to plants after 20 weeks transplanting may be attributed to the favourable effect of these chemicals and growth regulators on the growth and trichome formation.
- Post harvest studies were done for better quality of dry leaves for processing. Artemisinin content decreased when the plants were oven dried while in shade dried plants the content is much more. *A. annua* is an aromatic plant, which loses its active compound artemisinin at higher temperature. So shade drying is the effective measure for retaining the artemisinin content. The main purpose of drying medicinal plants is to extend product shelf life, minimize packaging requirements and reduce shipping weights.
- Briquettes were manufactured by the waste produced by the Artemisia leaves after extraction of artemisinin. This can be used in boilers as a replacement to coal. Also from the waste sample, a compound Scopoletin was isolated and analysed.
- Optimization of culture medium for high frequency callus induction, the whole leaves was cultured with their adaxial surface touching the callus induction medium.

- The cultivation done by the farmers of different regions of the country had a better health, employment generation in rural sector and it is environment friendly.
- The study has observed that cultivation of *A.annua* is highly return duration four month crop. However, it is imperative to incorporate suitable cropping pattern to further augment the per unit area return and make the cultivation of these crop a preferred option in the study area without affecting the production of food crops.