

Public-private sector partnership in diversifying semi - arid tropical (SAT) systems through medicinal and aromatic plants

Ravinder Reddy Ch ¹, SP Wani¹ , Mohan Reddy L ¹, Thirupathy Reddy G ², Padma Koppula³
,and Ashok S Alur¹

Abstract

The broad objective of the project is to enhance and sustain the productivity of medium and high water-holding capacity soils in the intermediate rainfall eco-regions of the semi-arid tropics of Asia. International Crops Research Institute for Semi-Arid Tropics (ICRISAT) has been developing sustainable and economically productive livelihood opportunities in rural areas through crop diversification and value addition. Promising strategies for crop diversification to help small-scale farmers linking up with reliable partners to support them with production technology and market high-value medicinal and aromatic (MAP) in public-private partnership mode. the lead crops selected by the farmers are in the focus of this case study are lemongrass (*Cymbopogon flexuosus*), coleus (*Coleus forskolii*), and Aswagandga(*Withania somnifera*). The farmers in the project area were resource poor, facing constraints such as, poor infrastructure, unscrupulous middlemen, and absence of production technology and reliable market for their crops to increase their farm income. By introduction of medicinal and aromatic plants (MAP) through technical backstopping, capacity building, and marketing support from private industries partnership developed. As a result of this innovative partnership with private sector has increased their farm income of project farmers when compared to their conventional crops, in addition , rural employment was generated due to the need of post-harvest handling and processing of their crops, increased trade value of crop products by growing more profitable crops and adding product value through village level processing. This holistic participatory process oriented approach includes new science tools, linking on-station research to on-farm watersheds, thematic and technical backstopping through private partnership and consortium of institutions were tested successful on pilot scale in SAT districts of Andhra Pradesh, India under APRLP-ICRISAT Project.

¹ICRISAT Patancheru, Andhra Pradesh, India , ²APARD - NGO, Kurnool, Andhra Pradesh, and
³DWMA, Nalgonda, AP.

Public-private sector partnership in diversifying semi- arid tropical (SAT) systems through medicinal and aromatic plants

Background

In order to accomplish crop diversification with farmers participatory research and development activities, an innovative methodology has been adopted. It involves in taking up challenges of adapting, specifying and generating technologies appropriate to socio-economic situation in the region. With application of this methodology, identification and implementation of a new agro-industrial project - "growing aromatic crops and extraction of essential oils" and couple of herbs has emerged. This as well generates a technical and scientific base, which is unique in these watershed villages in addition to continuing with their traditional agricultural activity. The area which deserve more attention and which, at present, has a higher level of development, is the area of "natural products" (essential oils and extracts). Due to technological, and financial reasons, a base village in each district of the project area has been selected for introduction of new crops (Medicinal and Aromatic plants) and rural agro-industries development for value addition to the products in Karivemula village of Kurnool district and Padamatipalli in Nalgonda district of Andhra Pradesh (AP). The project was funded by Andhra Pradesh Rural Livelihoods program (APRLP)

Introduction

The overall objective of crop diversification through introduction of medicinal and aromatic crops is to help increase the income of small holders through new crops and market options for sustainable production and improve livelihoods.

A number of medicinal plants possess the ability to grow in poor soils and under low rainfall and moisture conditions, thereby assisting in the natural regeneration of these crops. Many species are shade tolerant while others are climbers, trees, shrubs and herbs that can be grown in different land-use and cropping systems. The entry of these MAPs into the world food and drug market as environmentally friendly (including organic and certified) botanical products is emerging as an important new opportunity for the small-farm community .

In general the public and private sector partnership in agriculture research organizations have predominantly engaged in research partnerships with other public agencies. An innovative partnership developed by ICRISAT for diversification of SAT systems by using medicinal and Aromatic plants and adds value to their products at village level. A collaborative private partnership between ICRISAT, patancheru and M/S MAK Royale Herbal Biosys Pvt. Ltd. company has signed MOU with a component of sharing of benefits and expenditure to develop a model MAP on-station-training center at ICRISAT and marketing of MAP products of farmers in project area.

Marketing of diversified crop products is a major constraint for resource poor farmers because, prevalence of uncertain and unorganized marketing system for medicinal crops. To harness the technical capabilities of private sector and to overcome the risks involved in marketing Medicinal and Aromatic Crops (MAP) products by small-scale farmers, International Crops Research Institute for Semi-Arid Tropics (ICRISAT) has signed an Memorandum of Understanding (MOU) with private sector to pool resources to harness advantage of complimentary skills, improve access to scientific and technical resources, infrastructure, and provide opportunities for cost sharing. The area of natural products deserves more attention due to technological, financial and marketing aspects. Hence, this crop diversification activity is based on the introduction of MAPs with production and processing technology and marketing buy-back system by involving private sector partnership.

This holistic approach includes new science tools, linking on-station research to on-farm watersheds, technical backstopping through consortium of institutions. The broad objectives of the project were to enhance and sustain the productivity of medium and high water-holding capacity soils in the intermediate rainfall eco-regions of the semi-arid tropics of AP. The Integrated development of promising strategies for crop diversification by introduction of medicinal and aromatic crops to increase the income of smallholders through new crops and market options and thus contribute to sustainable production.

Objectives:

- To diversify systems through integrated use of water resources in the sat
- To enhance the income generation activity through medicinal and aromatic plants system for improving livelihoods
- To develop a model for the value addition to medicinal plants systems at village level
- Fostering private partnership for technical backstopping and marketing linkages for new crop products
- Capacity building of stakeholders in adopting new crops (medicinal and aromatic crops) and production technologies.

The Approach:

For improving livelihoods through crop diversification and sustainable production activity, one watershed village in each of districts of the Kurnool, and Nalgonda, were selected based on the pro-active and willingness of farmers to the basic objectives of crop diversification. These two watershed villages were selected after visiting number of villages in the respective districts and conducting grama sabhas (meetings) with farmers and consultation with PIAs, DWMA staff members. Two to three follow-up meetings were conducted in villages where farmers showing willingness to participate in the crop diversification activity. The selection of watersheds was made based on the positive response of the stakeholders and pro-active nature of the PIAs to take-up the activity has also played an important role in

selection of watersheds. The selected farmers from each village were taken to exposure visit to other farmers fields and on-station training to ICRISAT. The selection of crops was left to participant farmers choice. Initially one aromatic crops viz., lemongrass and two medicinal herbs, coleus and ashwagandha were selected by the farmers which are market driven and having good demand in national and international markets. Farmers having waters sources, and good water holding capacity soils have selected lemongrass and coleus and some farmers selected ashwagandha to grow under rainfed conditions under low input regimes. ICRISAT facilitated buy-back agreement between farmer and industry for sale of essential oils extracted from lemongrass and raw products of herbs at village level through private partnership (figure 1).

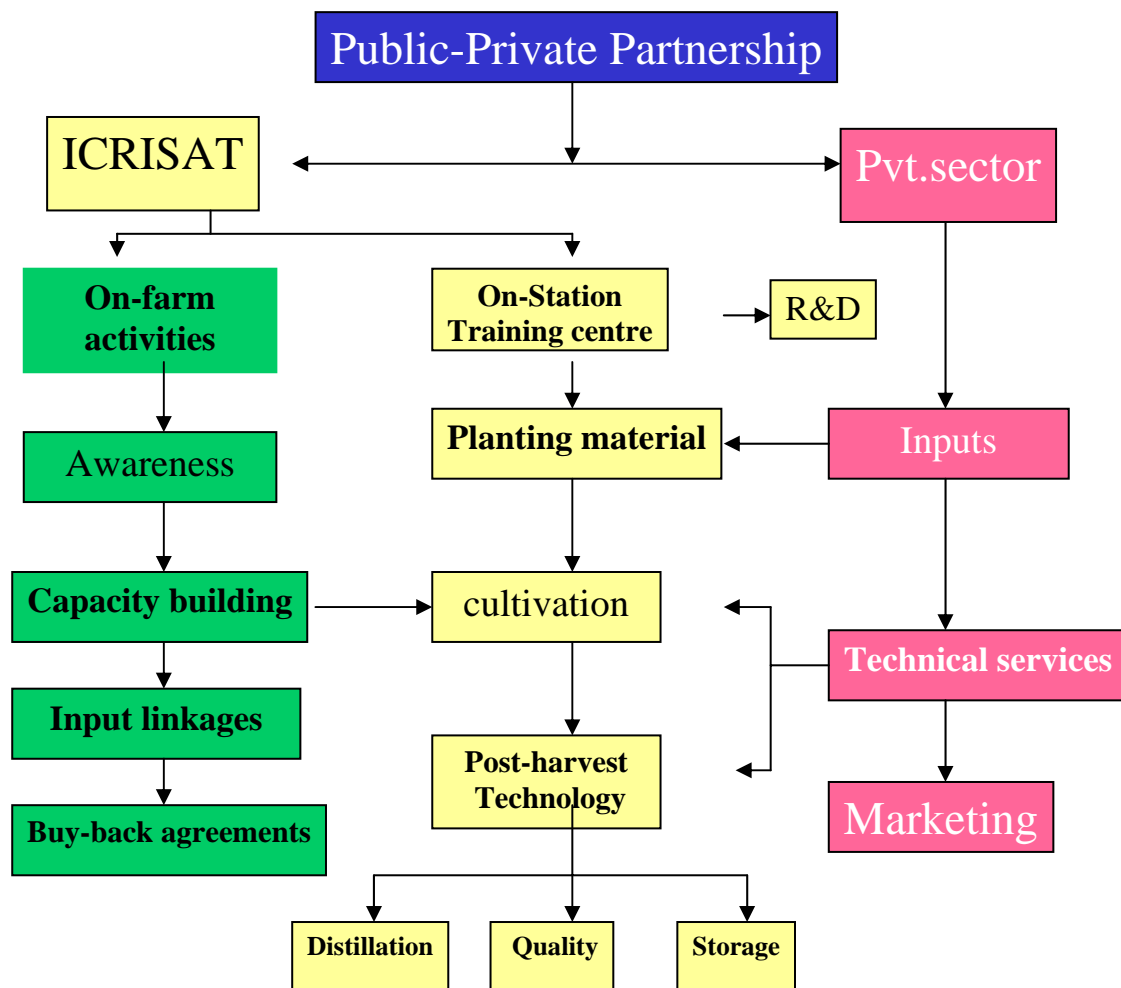


Figure 1. Partnership flow chart

The process

A. On-station activity:

The main objective of on-station activity to develop a model Medicinal and Aromatic plants centre at ICRISAT with technical support from partner institutions. Five Medicinal herbs (Table 1) and five Aromatic plants (Table 2) suitable to the area were identified and selected. These were initially grown on 20 ha of land. A multi-crop steam distillation plant was erected on the site to extract aromatic oils for value addition to MAP products. This facility was developed for demonstration and training of the farmers, NGOs, PIAs, village para-workers, WDTs, and other project related personells on cultivation, harvesting, handling and operation of distillation plant and extraction of oils from aromatic crops, including oil storage and precautions in handling oils and finally production economics of various oil yielding crops were developed. The private-sector company assisted in supply of genuine seed material and production technology.

1. Capacity building:

In order to build the capacity of the farmers to undertake cultivation and processing of medicinal and aromatic plants (MAP), on-station-training programs were conducted at ICRISAT. These trainings were able to make the farmers to understand the main objective of the training program is to demonstrate the potential of diversification of SAT systems through cultivation of medicinal and aromatic plants and value-



Figure 2. On- farm training of farmer groups in the host farmer field

addition products to increase the income of SAT farmers at village level.



Figure 3 On-station training of farmer groups; left: In the class room; right: In the field-distillation plant

Participants comprising of NGOs, WDTs, village para-workers and farmers from Nalgonda, Mahbubnagar, and Kurnool districts participated in these training programs. Usually these training programs had two sessions, in which the forenoon sessions were dedicated to presentation of themes or topics, lectures and interaction with participants including general discussions about crops cultivation aspects, and marketing problems. The afternoon session used to be on field demonstrations showing cultivation practices, harvesting, processing and extracting oil using steam distillation plant from aromatic crops like lemongrass and palmarosa, the participants were taught to operate the distillation unit and extracted oil from aromatic crops. The practical opportunities given to them build confidence in them in operation of distillation unit and collection of oil.

2. Crops:

Initially 5 medicinal herbs (Table 1) and 5 Aromatic crops (Table 2) were selected based on the market demand and agro-ecological suitability of crops. These crops were grown on the ICRISAT center. The seed material of crops varieties were selected and supplied by the partner organization.

Participants observed the MAPs growing on the ICRISAT center and made a note of their growth characteristics, and appearance. However, most of the farmers/participants are seeing the MAP for first time.

Table 1. Medicinal herbs grown at ICRISAT center

S.No	Common name	Scientific name	Family
1	Senna/swarna pathri	<i>Cassia angustifolia</i>	Caesalpiniaceae
2	Aswagandha	<i>Withania somnifera</i>	Solonaceae
3	Kalmegh	<i>Andrographis paniculata</i>	Acanthaceae
4	Bhuamlaki/nelavusiri	<i>Phyllanthus amarus</i>	Euphorbiaceae
5	Coleus	<i>Coleus forskolii</i>	Lamiaceae

Table 2. Aromatic plants grown at ICRISAT center

S.No	Common name	Scientific name	Family
1	Lemongrass	<i>Cymbopogon flexuosus</i>	gramineae
2	Vetiver	<i>Vetiveria zizanooides</i>	gramineae
3	Palmarosa	<i>Cymbopogon martini</i>	gramineae
4	Eucalyptus	<i>Eucalyptus citriodora</i>	myrtaceae
5	Citronella	<i>Cymbopogon winterianus</i>	gramineae



Figure 4. Lemongrass crop



Figure 5. coleus crop



Figure 6. coleus plant



Figure 7. Plamarosa crop



Figure 8. Aswagandha plant with dried berries

3. cultivation practices:

The overall requirements of a successful crop production were thought to the farmers in detail. The important areas of crop production and management which were covered in the training program included suitable climatic conditions, soils, varieties, crops grown under rainfed and irrigated conditions, sowing methods, nursery preparation, plant protection aspects etc, . these aspects were discussed in classroom sessions followed by field visits (BW 5 and 6) where they were able to practically observed all the cultivation practices learnt in the classroom and they could able to clarify their doubts with the experts.

4. Intercropping:

The main objective of intercropping, planting method and crops used for intercropping and economics were shown to the farmers practically on the field. Selection of crops and time of planting two different crops was demonstrated on the filed. Intercropping of coleus and *Eucalyptus citriodora* ; lemongrass and *Eucalyptus citriodora*, their planting method and cultivation aspects and economics of production were dealt in detail for the benefit of the farmers.

5. Harvesting:

Similar to field crops, MAP also have bio-indicators of maturity indicating right stage for harvest, such as flowering in coleus, change in fruit color from green to pink in ashwagandha etc, the farmers trained in identifying these indicators in respective crops. Since the economic plant part used in medicinal preparations varies from crop to crop the harvesting method also differs. The farmers were shown how to harvest and process them were shown practically in the field by involving the participating farmers in harvesting process.



Figure 9. processing (cutting into small pieces and shade drying) of coleus and ashwagandha roots after harvest

6. Distillation Process:

Value addition to MAP products is one of the objectives of crop diversification. Processing of aromatic plants by extraction of oil is value addition to lemongrass, palmarosa, vetiver, and *Eucalyptus citriodora* crops. The participating farmers were

taught the skills of processing aromatic plants, by using steam distillation plant, they were given opportunities to



Figure Farmers exposure visit to farmers field and interaction with host farmer

practically conduct distillation of lemongrass and operate distillation plant. The important operations like management of temperature of boiler and condensing unit and their affect on quantity and quality of oil was demonstrated. Affects of season, cultivation practices, time of harvest, and duration of crop growth and distillation process on oil output were told in detail and shown practically. Practical demonstration of “oil separator”

which condenses the oil along with water collected in an oil separating can. Subsequently oil is collected by decanting top water layer and stored.

The economic plant parts of coleus and aswagandha are roots, were demonstrated by pulling out the crop from the field and separation from the plant. The harvesting procedure, time of harvest and processing of roots (cutting into small pieces to remove moisture under shade) for market were demonstrated.

7. Storage:

Storage of MAP products were demonstrated, where aromatic oils which are to be stored in clean and air tight containers, kept in cool, dry and dark place.

8. Marketing:

Marketing of MAP products has been a tricky business and is a major constraint in successful implementation of crop diversification activity. Small and resource-poor farmers have no access to the market and market information about marketing trends. Hence, identification of potential markets proved to be a difficult task for small-scale farmers.



Figure 10. Buyback agreement between farmers and partner in Karivemula village

Most of the industries engage in procuring MAPs products involve inefficient, secretive, and somewhat opportunistic process of sourcing MAP produce. As a result, the trade in MAPs has been largely unorganized and carried out through a plethora of small-scale traders. The resource poor farmers are the victims of these middleman. To address these marketing constraints of project farmers, ICRISAT entered into an MOU with Private Sector Company for marketing of MAP products and facilitated buy-back arrangement (Annexure 1) of MAP products with minimum support price between farmer and buyer (partner) at village level.

The second supply chain for other crops, coleus and ashwagandha were identified. A meeting with MPGG members and the company was arranged in the village to discuss about quality standards that farmers must meet and to arrive at an indicate quantity that would be supplied. The company was interested in purchasing MAPs from the MPGGs but not willing to enter into a formal buy-back agreement, however the group members and the company had infoprml agreement regarding the quantity and quality to supply. Finally at the end of season the verbal

agreement was successfully executed and continued there after every year.

9. Training material

A detailed technical broucher in local language on MAP cultivation practices, economics of production, and medicinal values of plant parts were distributed to participants for information. Posters on each crop was prepared and displayed at village panchyaths for ready information to village farmers. These extension material enhanced farmers learning.

B. On-farm Activity:

1. Formation of Groups

The farmers have shown great enthusiasm in diversification activity after getting awareness on the crops and developed confidence after meeting farmers cultivating MAP during exposure visits and on-station training at ICRISAT. Those farmers who share common interest on growing MAPs grouped together in watershed villages, formed into Medicinal Plants Growers Group (MPGG) in the two districts. The farmer groups took up cultivation of

Aromatic plants and medicinal herbs. The farmers were given complete freedom in selecting the crop which they felt more suitable and confident of growing on their land in small areas in kharif 2004. Many medicinal and Aromatic plants are suitable for cultivation on marginal lands in project area, which are market driven and moreover MAP-based industries were introduced to the farmers and these crops had potential in creating many new rural employment opportunities for local people

The key idea in setting up these producer groups at the village level was to see that they grow further to block and district level and further get into the framework that could produce a substantial quantity of MAPs on a sustainable basis, thus making it economically viable for the company to continuing sourcing the material from the same groups of farmers. In addition, a substantial farmer base that could be mobilized to produce specific crops to specification would be highly beneficial in negotiating future contracts and in securing good financial returns for its members. It was assumed from the outset that even small and marginal farmers could participate in cultivation of MAPs if they are able to follow the group approach.

2. Assessing the potential for growing MAP in the watershed villages

In order to successfully produce MAP in the watershed villages, it was necessary to identify those crops which are suitable to the local agro-climatic conditions, and soils and rainfall pattern/ irrigation facility. The crops that were selected were in accordance to the above criteria and were having good market demand and well suited to small-scale farmers in the villages. The plant species selected by the farmers in different villages is given in table 4 and 5 and in their view points the cultivation of medicinal and aromatic plants was due to following reasons:

- Lemongrass and coleus can be grown on paddy fields with 1/3 water requirement of paddy crop
- Coleus and aswhagandha can be grown on less fertile and marginal red and sandy loam soils
- The damage due to animals, wild bore(is a problem in the area) was negligible as these animals avoid crop due to non-palatability and bitter in nature
- Less labor intensive
- Crop needs minimum supervision, little risk, less labour intensive when compared to other commercial crops.
- Simple harvesting procedures
- Products that are stable and can be stored for longer periods and occupy less storage space
- Export potential as well as local use
- Local employment generation
- Non-cumbersome post-harvest processing for value addition

Table 4. Cultivation of Ashwagandha at Karivemula village in Kurnool district

Farmer name	Sy.no.	Number of acres planted
B.Kautlaya	56	1.5
M.Vishnuvardhan reddy	302/1	1.0
M.Vanoorappa	47	1.0
k.Masthan	41	1.5
M.Vijaya mohan reddy	25	3.0

Table 5. Cultivation of coleus at Karivemula at in Kurnool district

Farmer name	Sy.no.	Number of acres planted
M. Vishnuvardhan reddy	366	2.0
B.Kaulutlya	366	1.5
K.Pullama	345	1.0
C.Ramulu	406	1.0
Ramakrishna Reddy	347	1.5
Venkat Reddy	124	2.0
Mohan Reddy	231	1.0
Md.Husain	295	1.0

Table 6. Cultivation of lemongrass at Padamatipalli village in Nalgonda district

Farmer name	Sy.no.	Number of acres planted
C. Madava Reddy	421	1.0
Narashima Reddy	423	1.5
Kishtaya	286	1.0
N. Maisaya	432/1	2.0
R. Vankanna	286/2	1.0

Ramulu	324	1.0
M. Venkat Reddy	432	1.5
Padma Reddy	432	2.0
C. Ratnaya.m	456	2.0
K. Ramakka.	465	1.5

3. Exposure visits:

The interaction between farmer to farmer were found to be the most effective knowledge sharing method and effective communication system, which gave opportunities to the other farmers to meet and share the experiences of fellow farmer and discuss wholeheartedly about difficulties and income realities in growing MAPs. More over they got on the spot first hand information from experienced farmers. This method enabled the farmers to ask some crucial questions to make decision by assessing their resources and capabilities to take up MAP cultivation. Selected farmers from different watershed villages were exposed to farmers fields who are already cultivating MAP in and around Mahaboobnagar, Nalgonda and Kurnool districts. These exposure visits had a very positive impact on the attitudes of farmer groups about the potential of MAPs. The visits increased their confidence and eliminated any doubts that they had regarding the financial viability of these crops.



Figure 11. Distillation of lemongrass in padmatipally village

4. Training group members

Group members were trained on different aspects of production and post-harvest technology needed for each crop, the anticipated market conditions for those crops, and the expected economic returns and possible risks associated with producing different MAPs were detailed to them. Initially, these training programs conducted by experts from partner institution, and consortium partners, but soon the training programs were organized on-station and carried out by the MAP specialist. In addition farmers who were

successfully in producing different MAPs were also used as trainers for new farmers groups producing MAPs for the first time.

5. Inputs

The quality seed material which is suitable for local agro-climatic conditions were selected and supplied to grow on ICRISAT training center is given in table 1 and 2 by the private partner company . the seed material was propagated on the center has following purposes

- 1) To produce large quantity and quality plating/seed material
- 2) To develop package of practices for each crop
- 3) These production nurseries serve as demonstration cum training center
- 4) Enable to workout cost of cultivation and economics of production of crop and value added products.

Finally inputs like seeds/ planting materials, were made available to farmer groups through the partner organization on cost sharing basis.

ICRISAT has facilitated financial linkages between farmer groups and state medicinal plant board. The board has a program to support cultivation of MAPs through subsidy up to 25% on the cost of cultivation. Farmers availing subsidy from medicinal plant board has reduced the burden to some extent on their investment. By adoption of this model efforts were made to sustain the partnerships will by selling the planting/ seed material to the farmer groups. .

Table 7. Yield and economics of MAP cultivating farmers in watershed villages

Crops*	Cost of production (in Rs.ha ⁻¹)* a	Yield in kg ha ⁻¹ *	Gross income in Rs. ha ⁻¹ *	Net income in Rs. ha ⁻¹ *
Aromatic Plant				
1. lemongrass	18750	187**	65450	46700
Medicinal Herbs				
1. Coleus	10750	1125	57625	46607
2. Ashwagandha	3312	614	19648	16336

* Average of all farmers

a = family labour input was not included in total cost

** oil

Selling price of oil Rs. 350 kg⁻¹

Selling price of coleus dried roots Rs. 51 kg⁻¹

Selling price of Aswagandha dried roots Rs. 32 kg⁻¹

Table 8. Yield and economics of conventional crops grown in the project area

Crops*	Cost of production (in Rs.ha ⁻¹)* a	Yield in kg ha ⁻¹ *	Gross income in Rs. ha ⁻¹ *	Net income in Rs. ha ⁻¹ *
Groundnut**	13500	2200	35200	21700
sunflower	9500	2000	38000	28500
Sorghum**	1800	8100	8100	6300

* Average of 10 farmers

a family labour input was not included in total cost

** Average fodder value was Rs.1500 ha⁻¹

Selling price of groundnut pod Rs. 16 kg⁻¹

Selling price of sunflower grain Rs.19kg⁻¹

6. Buy-back arrangement:

To facilitate farmers in selling their produce at reasonably good price without get cheated by the unscrupulous marketing agents and uncertain market demands of medicinal crops. ICRISAT developed a marketing buy-back agreement with minimum support price and procurement of produce at village

Figure 12. Buy-back agreement between farmers and partner company



level. NGO, VO and SHGs and farmers witnessed the signing of marketing agreement in the village between MPGG and buyer (Partner) in presence of DWMA (Funding agency) and WDT members. Farmers felt confident of risk free selling of their produce for reasonably good price through buy-back marketing arrangements thus removing the major constraint of marketing.

7. Farmers' response and Learnings

The feed back from farmers gave lot of insights to the facilitating partners to look into their needs for effective implementation of project activities.

- Information on other economically important medicinal plants suitable for a particular agro-ecological area is required
- List of MAPs having market demand along with buyers and procurement price
- Price and address list of suppliers of seed and planting materials of MAP
- Crop-wise brochure covering all aspects from seed to market will be very helpful
- Need more practical training courses on production and processing of different MAPs .
- One-day training is too short and hectic, two-days training course is ideal to learn better
- Training programs needs to be conducted in every village on MAP and exposure visits to other farmers' field will build confidence

Will ICRISAT take responsibility of implementing "buy-back arrangement" for the produce at village level, if buyer fails to procure the produce

Research and Development activity:

The ICRISAT and Partner has agreed to conduct research on by-products of distillation of aromatic crops. During the processing



of aromatic crops like lemongrass and palmarosa through steam distillation, give two byproducts, (Figure) de-oiled grass and

Figure 13. deoiled lemongrass was fed to cattle

waste water from the oil separator (after separating the oil from the condensed oil-water mixture).The waste water was analyzed for major nutrients like Nitrogen, phosphorus and potassium (N:P:K) and the details are given in the table 9, and its utilization as foliar spray on crops is under study. Experiments with the de-oiled grass for preparation of vermicompost, testing as fodder for livestock, fuel for boiler and soil mulch in orchards and plantation crops are under study.



Figure 14. Soil mulch with deoiled lemongrass in citroders plantation

Research & Development

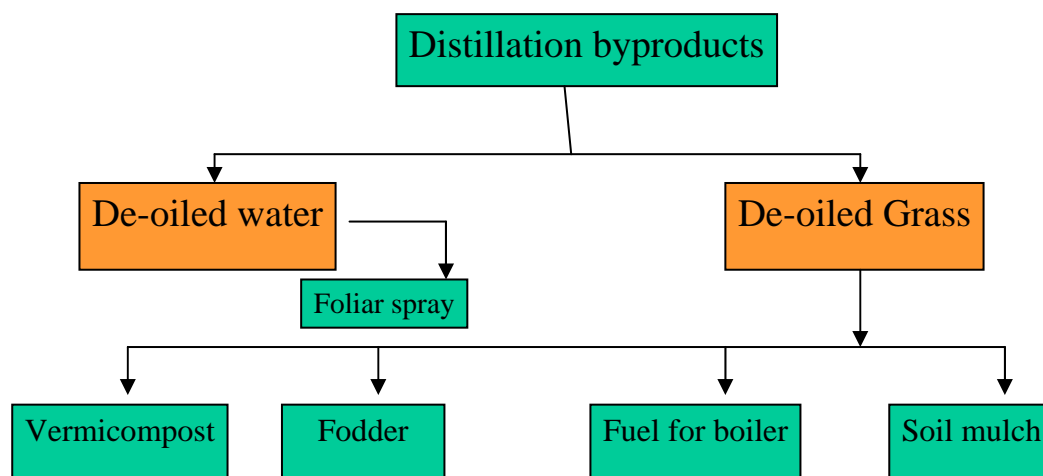


Figure 15. Flow chart showing byproducts of distillation of aromatic crops

Table 9. Analysis of de-oiled wastewater released from distillation of lemongrass

Contents	MIN-N	Soluble -P	Soluble-K
	3.7ppm	0.2ppm	1.6ppm

Constraints / problems

Major impediments in optimal exploitation of commercial value of medicinal plants through their cultivation and use in Andhra Pradesh were studied and summarized below:

- Unstained availability of quality raw material and medical products based on medicinal plants.
- Lack of location specific technologies for cultivation of medicinal plants.
- Poor extension services to popularize the cultivation of medicinal plants cultivation and use.
- Poor marketing network and awareness of marketing strategies.
- Non-availability improved seed material for sowing and lack of information on scientific cultivation practices.
- Lack of information on seasonal variations on the quality of plant products.
- Poor knowledge on harvesting practices, time of harvest and product storage and handling.
- Very low export market share.
- Low volumes of production does not permit small farmers entering the far away markets on solid basis
- MAPs market generally demand large volumes of production on regular basis
- Lack of quality analysis facilities and non approachable to small farmers and costs involved.
- Individual farmers can't grow high value medicinal crops because they play no role in pricing their products and approach to far away markets for sale

Conclusion:

A successful innovation partnership systems between ICRISAT and MAK Royale company has developed and established a model on-station MAP training center and replicated the same on pilot scale in Karivemula village in Kurnool district and padamatipally in Nalgonda district. This innovation

partnership has judged to be those where productive relationships have developed between research and non-research organizations or and between public and private organizations. These relationships are important as they facilitate the knowledge flows that underpin creativity. This analysis helps focus attention on the barriers to interaction and thus aids the development of measures that foster better integration of the system as a whole.

Integrated development of promising strategies for crop diversification by the introduction of medicinal and aromatic crops has increased the income of smallholders by 60 to 160% through new crops when compared to conventional crops like groundnut, sorghum and sunflower (Tables 7&8) and market options and thus contribute to livelihood options and sustainable production.

Marketing tie-up between private industry (Buyer) and farmers (producer) at village level has overcome the risks involved in marketing of MAP products, has increase trade value of crop products by growing more profitable crops and adding value through processing due to this innovative partnership.

The holistic approach includes new science tools, linking on-station research to on-farm watersheds, technical backstopping through partnership and consortium of institutions has successfully implemented the model developed for crop diversification activity in two villages. Research and development activity includes intercropping by Medicinal herbs like Ashwagandha, kalmeg, nelavesiri, nelavemu, coleus, and nelathsangedu, and aromatic crops like lemongrass and citronella crops with *Eucalyptus citriodora* are under study. Utilization of byproducts of distillation are showing some promising results in using de-oiled grass for fodder and vermicomposting and as soil mulch in reducing the number of irrigations in *Eucalyptus citriodora* plantations.

Annexure 1

BIPARTITE AGREEMENT

This Bipartite Agreement entered into between M/s. Mak Royale Herbel Biosys (p) Ltd. A company incorporated under the companies Act, 1956, having its registered office at 12-13-5, Mak Royale Chambers, Taranaka 'X' roads, Secunderabad – 500 017, A.P. and its farms at (i) a. Jalpally Village B. Mamidipally Village, R.R. District. (ii) Koniapally Village Mahbubnagar District duly represented by its Managing director Sri Mohd. Mujeeb Ali Khan.

AND

Medicinal plants growers association

Sri/Srimati/_____

S/o.D/o.W/o._____

Resident of _____ P.O. _____

Mandal _____ District _____ State _____

Hereinafter called the farmers association which expression shall, unless repugnant to the context or meaning, be deemed to include his/her legal representatives, successors in interest, administrators and heirs, assigns of the second part.

Preamble:

Where as the company is engaged in Research, Development, Production cultivation, extension and Awareness of Medicinal and Aromatic plants and offers: consultancy, technical know how, package of practices, Agrotechnologies and marketing end products of medicinal and aromatic plants.

And where as the farmer is desirous of cultivating lemon grass / citronella / palmarosa, / Eucalyptus citriodora plants for processing and selling oil of the same.

And where as for the purpose of cultivating the above mentioned Aromatic plants, the farmer does not possess requisite technical know how and expertise.

And where as the company possesses requisite knowledge and expertise in cultivation of medicinal and aromatic plants by modern and innovative methods and sophisticated technology as well as necessary inputs for a better healthy and economic crop production.

And where as the farmer has approached the company with a request to sell oil extracted from palmarosa / lemon grass / Citronella / Eucalyptus citriodora grown in his fields and the company render the farmers the requisite expertise for raising the crops on his / her land and; as quid pro quo therefore, the farmer has offered to sell the entire produce i.e. oil produced on the land, exclusively to the company on the terms and conditions hereinafter provided.

And where as the company, with a view to getting consistent supplies of the oils on sustained basis as assured by the farmer for meeting its supply commitment undertaken by the company with its clientele on the very basis of this purchase arrangement with the farmer. The company has agreed to sell to the Farmer good quality planting material of palmarosa/Lemongrass/ Citronella / E. citriodora at reasonable price.

And whereas the parties hereto have mutually agreed to reduce into writing the aforesaid arrangement and the terms and conditions thereof.

This Agreement witnesseth as follows:

ARTICLE – I

Farmers Obligation

1. Planting of Lemon Grass / E. Citriodora / Citronella / Palmarosa

The farmer shall at his / her cost plough the land and prepare the land according to the instructions of company personnel and plant the saplings / plant-lets/slips given to him / her by the company.

2. Payment for planting material:

The farmers shall purchase his entire requirement of planting material from the company. The company shall deliver the required planting material to the farmers at their villages from the nurseries raised at company owned farms or any other nursery. The cost of planting material and transportation charges has to be paid by the farmer after receiving the planting material.

3. Protection of plantation and aid to growth:

The farmer agrees fully to protect plants raised on his / her land from damage, remove weeds growth at suitable intervals, plough the land as may be required from time to time, provide need based irrigation, apply requisite doses of fertilizers at appropriate time and take all such steps as are warranted and necessary to aid a robust and healthy growth of the crop, in accordance with the package of practices recommended by the company.

4. Farmer to sell Palmarosa / Lemon Grass / Eucalyptus citriodora / citronella oils exclusively to the company:

In consideration of the company selling the planting material to the farmer at reasonable price and providing free technical services for planting and raising the crops, the farmer hereby irrevocably agrees, undertakes and declares that he / she shall sell the entire quantity of oils of the afore said crops exclusively to the company at the rates as agreed upon.

5. The farmer hereby covenants with and assures the company that as per the guidance, and appropriate training given to the farmers by the company technical experts, that the end product i.e. oil is susceptible to oxidation, impurities and evaporation, he/she shall follow the steam distillation process, packaging and handling meticulously for the purpose of ensuring optimum yield and also to minimize losses by way of oxidation, evaporation and loss in transit etc. on account of faulty packaging.

6. Intimation of schedule of Harvesting and processing:

The farmer shall intimate the progress of the cultivation and the commencement of distillation and status of production well in advance.

7. Inspection of the farm by the company:

The farmer agrees to permit the company representatives, visitors and Nominees Free access to the 'land; during the currency of the agreement for assessment of the growth of the crop by observation or by any means or for study or for giving advice to the farmer in relation to the growth and maintenance of the crop.

ARTICLE – II

Company's Obligation

Supply of Planting material of Palmarosa/ Lemongrass / Citronella / Eucalyptus citriodora.

1. The company agrees to sell the farmer the required quantity of planting material.
2. **The company agrees to provide:**
 - (i) Free technical advices for planting and monitoring of the crop during the currency of this agreement.
 - (ii) Recommend package of practices to be adopted by the farmer.
 - (iii) The company promise to supply high quality planting material and timely supply of planting material, i.e. After receiving the first manson rain in the month of JUNE – JULY 2004, to enable the farmers to plant at right time for good crop establishment
 - (iv) The company agrees to sell the planting material at a reasonable price to the farmers as given below, excluding transport charges.

1. Lemongrass	-----/slip
2. Palmarosa	-----/kg seed
3. E.ctriodora	-----/plant
4. Citronella	-----/slip

3. Procurement Price:

The company shall procure the oil from the farmers by paying the Minimum support price (MSP) given below, in case the prevailing price of the oil in the market is above the MSP, the company and the farmers will negotiate the procurement price of the oil, such negotiated oil price will have 5 % marketing surcharge payable to company.

(i)	Lemon Grass Oil	-	Rs300/kg.
(ii)	Citronella Oil	-	Rs.300/Kg.
(iii)	Eucalyptus Citriodora	-	Rs.290/Kg.
(iv)	Palmarosa	-	Rs.400/kg

4. The oil produced by the farmers shall be accepted by the company subject to inspection of the consignment at the village site or village panchayath office. The company will have its own packing system and containers for transportation of oil from the village site. The company will issue specific acceptance note/receipt on the spot after procuring the oil from the farmers. This receipt/note shall alone constitute acceptance of the delivered material and conclusive sale in all respects.
5. The company hereby convenants with and assures the farmer of minimum support price(MSP) (as stated in clause No.3) or the negotiated prices of the oil on existing higher market price of the oil at that time.

6. **Payments:** 25% of the total oil sale price will be paid on the spot and the balance 75% sale price payment shall be made by the company to the farmer within 15 (fifteen) days of receipt of the oil from the farmer at the village panchayath office.
7. **Harvesting and processing:** The company technical staff will be monitoring the crop development, impart technical advise from time to time and advise the farmers about the correct stage of harvest and train the farmers in distillation processing and oil extraction method without any charges.

ARTICLE-III

1. Period of Agreement:

This agreement shall be valid and effective in the first instance for a period of one year commencing from 1st September, 2004 to August 30th 2005, After signing of these presents by both parties hereafter the very same commitment may be renewed, failing which the company shall purchase the oil from the farmer as per the prevailing market prices by charging 5% towards services charges.

2. Jurisdiction:

It is hereby mutually agreed that all or, any disputes arising out of these presents shall be subject to jurisdiction of the courts established at Secunderabad, alone.

In witness where of signed, sealed and delivered by the within named parties on this the _____ day of _____ at _____ in the presence of following.

SRI. MOHD. MUJEEB ALI KHAN M.D.
Mak Royale Herbal Bio Sys. (P) Ltd.

Farmer Representative

WITNESS:

- 1.
- 2.