BEAP-2007

'Employ contract farming to boost area under cultivation for essential oil bearing crops'

The Medicinal and Aromatic Plants Society of India (MAPSI) – a non-profit national scientific society dedicated to medicinal and aromatic plants (MAPs) – organized its first annual meet and national convention on 'Business Enabling of Aromatic Plants & Products' (BEAP 2007), jointly with the Herbal Research and Development Institute (HRDI), Centre for Aromatic Plants (Dehradun) on November 21-22 at Dehradun (Uttarakhand).

HRDI, an autonomous institution of the Uttarakhand Government and the nodal agency of the Uttarakhand Medicinal Plants Board, has its headquarters at Gopeshwar (Chamoli) and the 'Centre of Aromatic Plants' (CAP) at Dehradun. It is dedicated to the conservation, development and sustainable utilization of medicinal and aromatic plants in Uttarakhand.

'BEAP 2007' brought together industry representatives, academicians, scientists and government officials on a single platform to discuss opportunities, prospects and strategies for the future. The topics covered in the convention included emerging technologies, development of resources, framework of policies and public-private partnership.

Dr. S.P.S. Khanuja, President, MAPSI and Director, CIMAP, delivering his address

Major essential oils produced in India

Speaking at the inauguration of the conference, Dr. S.P.S. Khanuja, President, MAPSI and Director, Central Institute of Medicinal and Aromatic Plants (CIMAP), a CSIR laboratory, pointed out that the ten top cultivated aromatic crops in India are menthol mint, peppermint, spearmint, basil, citronella, lemongrass, palmarosa, geranium, rose and vetiver.

He touched upon the role played by CIMAP, in developing the mint industry to its current position as global leader. Mint is now cultivated in 160,000-hectares of land in the country, and of the global annual production of 22,000-tons of mentha oil, as much as 16,000-tons is produced by India alone. Exports of menthol mint from India meets around 80% of global demand. Similarly, peppermint is grown in above 1,000-hectares and spearmint in almost 1,800-hectares; with production levels of the essential oils estimated at 100-tons and 150-tons, respectively. "India is a leader in menthol mint, mainly due to the efforts of CIMAP," Dr. Khanuja claimed, and added the crop is immensely profitable for farmers – giving a net profit of around Rs. 40,000 per hectare.

Maj. Gen. (Retd.) Bhuwan Chandra Khanduri, Chief Minister of Uttarakhand, lighting the lamp at the inauguration of the conference

Other aroma crops cultivated on a relatively large scale include: basil (3,000-hectares), citronella java (500-hectares), lemongrass (750-hectares), palmarosa (800-hectares), geranium (250-hectares), Damask rose (2,000-hectare) and vetiver (30-hectare). These yield varying levels of essential oils: ranging from vetiver (175-tons), basil (150-tons), citronella java (80-tons), lemongrass (70-tons), palmarosa (60-tons), geranium (5-tons), and Damask rose (22-kg).

Although the success of mint crops in India has not been duplicated to other essential oils, Dr. Khanuja pointed to the moderate success achieved in the case of patchouli oil. Although Indonesia produces 550-tons of the oil, accounting for more than 80% of world production, he termed India's output of 30-tons as a noteworthy achievement. "India's domestic requirement is met by importing about 50-tons of pure patchouli oil and 100-tons of formulated oil, which is not a bad scenario, considering introduction of patchouli in India occurred only during the last century."

In all, India produced 18,840-tons of

essential oils in 2004-05, of which 6,230-tons were used for internal consumption and 10,128-tons were exported. To increase the area under cultivation of aromatic plants, Dr. Khanuja urged industry to look at contract farming opportunities across the country. "For example, in the case of rose, flowers can be purchased from registered growers at a price of Rs. 30-50 per kg, depending on the oil content, and after processing and value addition a healthy profit of Rs. 20,000-30,000 per ton of rose flower can be earned, with a marketing volume of 250-300-gm rose oil," he observed. Pointing to another opportunity, Dr. Khanuja added that many aromatic grasses are not under commercial exploitation and a majority of them are not even cultivated in the country.

Conservation of threatened plant species

The CIMAP Director also urged the essential oil and aromatic raw materials industry to take steps to ensure conservation of threatened plant species.

Species that face a precarious existence in the country, he pointed out, include Orchid oil (like those from *Vanilla spp*.), *Arnica montana* (Mountain tobacco), *Saussurea lappa* (or Costus), Rosewood oil (*Aniba rosaedora*, *A. amazonica*, *A. parviflora* etc.), *Amyris balsamifera*, Sandalwood oil (*Santalum album*), Jatamansi (*Nardostachys jatamansi*), Chaulmoogra oil (*Hydnocarpus spp*.), Gentiana species (*Juniperus procea)*, Agarwood (*Artemisia gracilis)*, Anise scented myrtle oil (*Backhousia anisata*), Hinoki wood oil (*Chamaecyparis obtusa*), Havozo tree oil (*Ravensara anisata*), Siam Wood oil (*Fokiena hodginsi*), Mulanje cedarwood (*Widdringtonia whyte*), Origanum oil (*Origanum spp*.), Himalayan cedarwood oil (*Cedrus deodara*), Cedrus atlantica commodities, Thymus oil (*T. moroderi*, *T. baeticus* and *T. zygis subsp. gracilis*), Buchu oils (*Agathosma betulina* and *A. crenulata*) and Cinnamomum oil.

Lack of availability: Causes

According to Dr. Khanuja, aromatic plants become unavailable due to a number of reasons. These include:

- Low demand (e.g., Backhousia citriodora oil, which has been unable for many years, after introduction of cheap synthetic citral, but is now having a fairly good comeback due to the thrust on natural perfumes);
- Products go out of fashion, but could be obtained with difficulty (e.g., reseda absolute from *Reseda odorata*, woodruff absolute from *Galium odorata*);
- Huge demand (e.g., vanilla oleoresin from *vanilla spp*.); and
- Temporary lack of availability due to environmental factors (e.g., Chinese geranium oil from *Pelargonium graveolens* in 2002).

"Despite the existence of commodity shortages in the aroma industry, production and marketing strategies that are sustainable in the long-term are driven more by consumers and organizations concerned about conservation, than by raw material producers and resellers," he added.

'Choice of right plant source important'

Dr. Khanuja also observed that the choice of the plant source for a particular aroma-chemical is very crucial. For example, the phenylpropanoid eugenol makes up 70-90% of the essential oil and 15% of the dry weight of clove buds, but the plant is not readily amenable for biochemical studies, due to its slow growth. On the contrary, *Ocimum spp*. are small annual or perennial herbs that are easily cultivated and contain up to 90% of phenylpropenes in their essential oils (*O. basilicum*).

He also urged the industry to explore the commercial possibilities of essential oils from new plants, such as *curcuma angustifolia* and 'Celantro' (*Eryngium foetidum*). "The latter is rich in trans-2-dodecental, dodecanal and mesitaldehyde, which are also found in *Coriandum sativum* leaves. This also provides another example of creating a new option to isolate the same phyto-constituents from an alternative plant source." Development of aromatherapy kits, he felt, is another area in which significant opportunities exist, but where entrepreneurship is required.

Table 1
World market for some aromatic plants
[US$ Million]

Species	Market size
Mentha arvensis	34.4
Mentha spicata	28.4
Mentha cardiaca	10.6
Cymbopogon spp.	10.8
Pogostemon patchouli	6.8
Damask Rose	16.7
Ocimum spp.	3.6

Table 2
Annual global production of essential oils

	Production [Tons]	Value [US$ Million]
Brazil	42,000	70
USA	21,500	240
India	16,000	195
Total [all countries]	**105,500**	**922**

Table 3
Prices of essential oil-bearing crops/ aroma chemicals [2007]
[Rs. per kg.]

Crop/Essential oil	Price range
Essential oil bearing crop	
North Indian Vetiver	12,000-20,000
Chamomile blue oil	3,000-16,000
Coriander seed oil	14,000-15,000
Cardamom oil	6,000-7,000
Davana oil	5,500-7,000
Aroma chemical	
Vetiveryl acetate	8,300
Vetiverol	7,800
Geraniol (ex Palmarosa oil)	1,500

Table 4
Success story of aromatic plants in Uttarakhand

	2003-04	2006-07
No. of farmers	301	2,714
Area under cultivation [hectares]	34	382
Production of essential oils [quintals]	12	128
Revenues generated [Rs. lakh]	4.07	35.35
Employment provided	170	1,910
Farmers benefiting through training	279	3,050

Source: HRDI

MARKET TRENDS

Blends expected to grow faster than aroma chemicals & essential oils

Global flavor and fragrance demand is projected to reach US$18.6-bn in 2008 with demand from developing countries continuing to outpace industrialized regions.

Demand for blends is expected to grow faster than aroma chemicals and essential oils.

Flavour blends will remain dominant, driven by demand emerging from soft drinks and convenience foods that require higher flavour loadings than basic foodstuffs.

Table 5
Projected demand for plant derived aromatic products [2008]

Category	Market demand
Phytochemicals	4,495
Essential oils	1,054
Extracts	1,990
Gums/gels/polymers	660
Others	791

TECHNOLOGY DEVELOPMENT

New CIMAP method quickly determines major constituents of menthol

CIMAP has developed a method by which one can determine the major constituents in menthol mint by knowing its congealing point. This allows manufacturers and users to get an idea of the menthol content, without doing GLC analysis – saving time and money. This is an important development considering the price of mentha oil is generally quoted with reference to its congealing point.

During 2006-07, CIMAP licensed 11 technologies to industry and set new models of Public-Private Partnership (PPP), involving rural and urban beneficiaries equally. The institute also launched value-added products for industry, including a geranium-based bioactive shampoo for controlling dandruff, floor cleaners, surface disinfectant, mosquito repellants/sprays etc. – all based on essential oils.

Novel agrotechnologies

Among the novel agrotechnologies developed recently, very successful one was for Vetiver (*Khus*), whereby the crop that was earlier harvested during 18-24 months after planting, has been developed for early harvesting within a year. "This finding is going to play an important role in increasing the productivity of the Vetiver crop in India in terms of oil production, as well as land usage and crop economics," Dr. Khanuja said. The productivity may be further enhanced by adopting intercropping of vetiver with menthol mint, he added.

Similarly, in the case of *Ocimum basilicum*, an important short duration aromatic crop, which grows during the rainy season, the crop cycle has been reduced from 80-85 days to 40-60 days with double harvesting. "This harvesting procedure gives 20% higher oil yield, without compromising oil quality, compared to traditional harvesting, which yielded 148.8-litre per hectare oil," Dr. Khanuja observed.

LIMITATIONS

'Genetic engineering of aroma crops lagging behind food crops'

Although the ultimate aim of aroma-genomics is to produce designer plants with novel aroma properties, presently, the genetic engineering of aroma crops is lagging behind food crops, due to lack of efficient transformation systems for ornamental plants. The genetic engineering experiments, which have been carried out to tailor aroma composition of plants (for research, as well as commercial purposes) have been fairly successful, but they have also revealed limitations that result from inadequate knowledge of the metabolic pathways responsible for scents and their regulation. As an example, transgenic petunia plants harbouring the (S)-linalool synthase gene from *Clarkia brewery* were found to express the transgene ubiquitously and biosynthesize linalool, but no linalool was emitted, as all of it was present as a non-volatile conjugate, linalool-D-glucopyranoside.