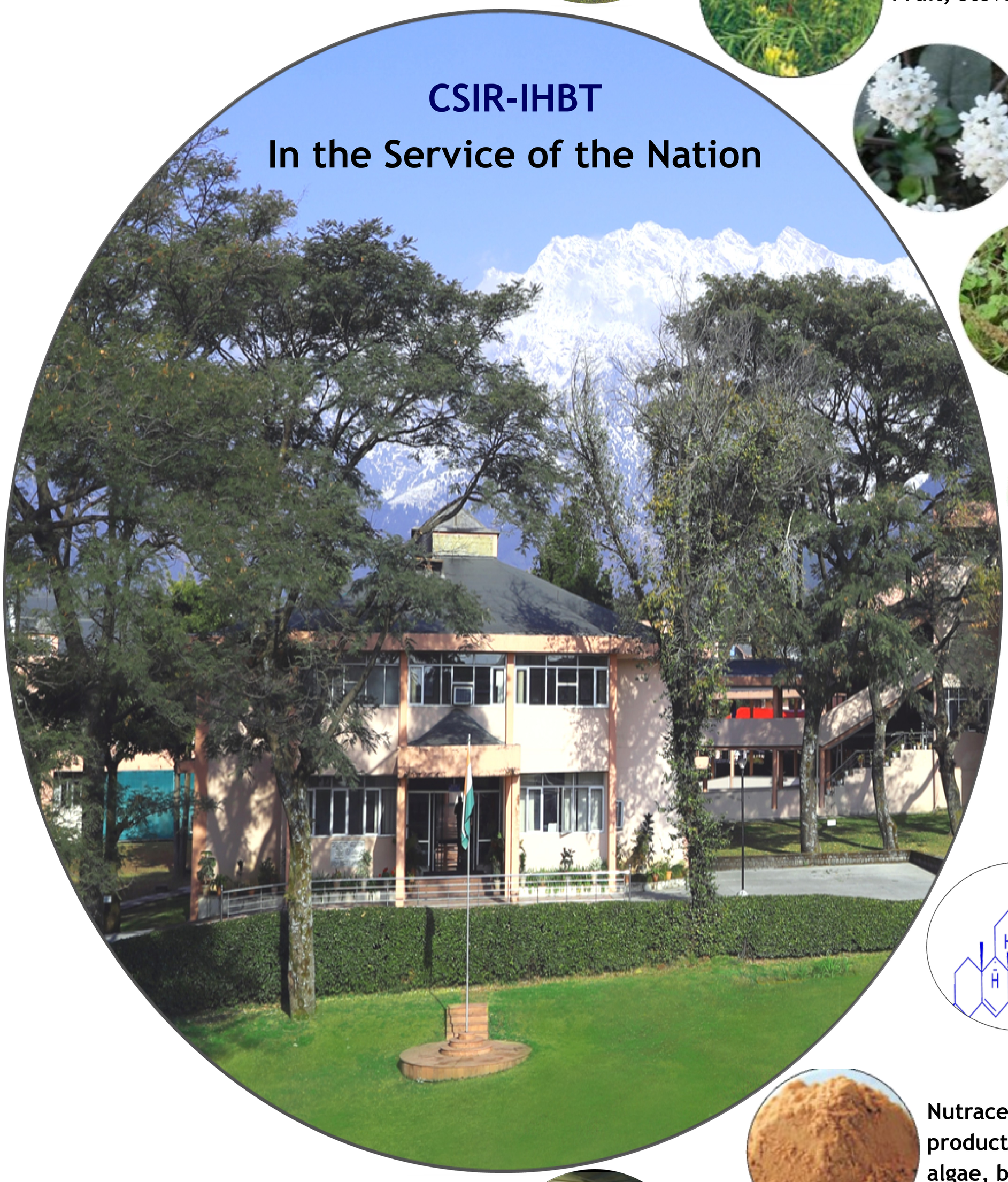
RESEARCH AND DEVELOPMENT ACTIVITES AT CSIR-IHBT, PALAMPUR

VISION: To be a global leader on technologies for boosting bioeconomy through sustainable utilization of Himalayan bioresources

MISSION: To discover, develop and commercialize processes and products from Himalayan bioresources using cutting-edge science and technology for societal, industrial and environmental benefits

Survey, mapping & database development

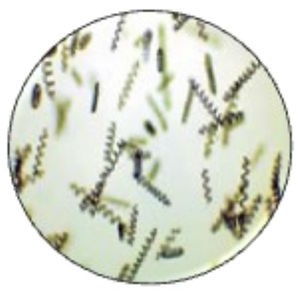
Industrial crops (Saffron, Heeng, Monk Fruit, Stevia & Tea)



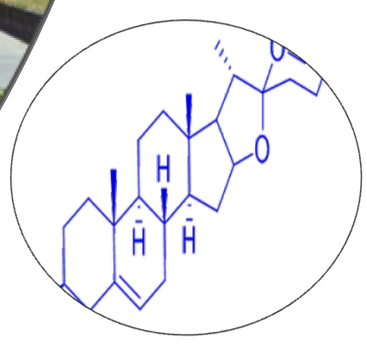
Aromatic crops (German chamomile, Rosemary, Lavender & Rose)

Medicinal crops (Kutki, Bankakdi, Naag Chhatri & Jangli Lahsun)

Floriculture (Calla lily, Gerbera, Lilium & Tulip)



Biotechnology for prospection of bioresources and waste management



Natural and synthetic chemistry (fibre, colours, biomolecules, biodiesel, furan compounds)

Nutraceuticals & value added food products from mushrooms, fungi, algae, bacteria and other bioresources

Start-up, incubation and entrepreneurship development

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COMBATING MALNUTRITION

Buckwheat
(*Fagopyrum tartaricum*)
for gluten free foods

Iron rich candies

Iron and Calcium
Rich Fruit Bars

- Targeting protein, energy and micronutrient deficiencies by fortification with local bioresources
- Meets 25—30 % recommended dietary allowances (RDA) of protein and Iron, zinc and calcium per serving
- Gluten free products
- 100 % natural and nutrient dense ingredients- Pulses, Millets, Cereals and Pseudo-cereals
- Preservative and additives free

Vitamin D enriched
Shiitake mushroom

Iron and Zinc rich
Spirulina bars

Protein & Energy Drink

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READY TO EAT FOODS

FOR SOCIETY AND INDUSTRY

- Hygienic and convenient
- Preservatives and additives free
- Technology for traditional and ethnic foods-Kangri Dham, curries & sweets, high energy & protein bars
- Shelf life > 1yr

Defence Services

Natural calamities

Hospitals

Railways

Dhaba/ Hotels/Homes

Road Transport

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CSIR-IHBT

SELECTED TECHNOLOGIES AVAILABLE

Agrotechnology

1. Stevia: agro- and processing technology
2. Monk fruit (*Siraitia grosvenorii*): low calorie natural sweetner
3. Heeng (*Ferula assa-foetida*): agrotechnology
4. China hybrid tea (*Camellia sinensis*): agrotechnology pacakage
5. Damask rose (*Rosa damascene*): agro-and processing technology
6. Wild marigold (*Tagetus minuta*): agro-and processing technology
7. Lilium: agrotechnology
8. Calla lily: agrotechnology
9. Gerbera: agrotechnology
10. Micropropagation protocols: industrially important crop plants
11. Micropropagation protocols for *Picrorhiza kurroa*
12. Production technology for quality root-stock for apple
13. Biofertilizers

Food Technology

1. Shiitake mushroom: vitamin D2 enriched
2. Gluten-Free foods from buckwheat
3. Iron and Zinc enriched spirulina based bars
4. Iron enriched fruit bars and candies
5. Multigrain high protein mix
6. Protein & fibre enriched cereal bars
7. Tea catechins
8. Tea wine
9. Ready to serve tea concentrates
10. Ready to eat crispy fruits & vegetables
11. Canning technology for ready to eat (RTE) foods
12. Food products from bamboo
13. Technology for dietary fibre extraction from apple pomace

Biotechnology

1. Superoxide dismutase: an enzyme for diversified industrial applications
2. L-Asparaginase (HimAsnase™): an enzyme with no glutaminase activity
3. DNA barcode technology for plant authentication (GEPROTED)™: gel processing and transfer device
4. iRIS™: a solution for easy isolation of RNA
5. Steriflow™: mini laminar flow unit
6. Culture vessel for rooting of microshoots
7. In vitro production system for naphthoquinones from *Arnebia euchroma*

Chemical Technology

1. Technology for the production of aescin from horse-chestnut
2. Process for cyclohexane-1, 3- dione synthesis
3. Process for 5-hydroxymethylfurfural (5-HMF) production from biomass
4. Natural colours from plants and vegetables sources
5. Green process for nanocurcumin synthesis with increased solubility
6. Bamboo charcoal
7. Formulation of herbal incense cones from herbs and flowers

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STEVIA - A NATURAL ZERO CALORIE SWEETENER

Global stevia market: 490.1 million USD with Compound Annual Growth Rate (CAGR) of 9.5 %

- Stevia leaf has steviosides, which are 300 times sweeter than sucrose
- Steviosides preferred by diabetics and weight watchers
- Developed and released 'Him Stevia'(CSIR -IHBT-ST-01) cultivar which has high re-baudioside- A (~7.4 %)

Large scale nursery and cultivation in farmers field

Economics and social impact

Yield of dry leaf	:	35- 40 q/ha/yr
Net return	:	Rs. 2.40- 3.00 lakhs/ha/yr
Revenue generated	:	Rs. 10.50 crore
Man-days generated	:	65,500

Process Technology:

- Green process for converting dry stevia leaf into steviol glycoside powder
- Purity more than 95 %


Extraction


Stevia powder


Sachet

Liquid drop

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BRIDGING THE EAST-WEST HIMALAYAS

Sohiong (*Prunus nepalensis*)

- Underutilized fruit crop of Meghalaya
- Developed cost effective technologies for value added food products
- Rich source of polyphenols, anthocyanins and beta-carotene

Seabuckthorn (*Hippophae rhamnoides*)

- Market potential: 37 million USD/yr
- Protects body against aging and has immunomodulatory & hepatoprotective activities
- Introduced Russian varieties of seabuckthorn

Introduction of Apple in North East Region

- Joining hand with North Eastern Region Community Resource Management Project: Training and Capacity building on cultivation of low chilling varieties of apple and its post harvest management

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TECHNOLOGY FOR DIETARY FIBRE EXTRACTION FROM APPLE POMACE

- The dietary fibre market is ever increasing (more than USD 6.0 billions) at a CAGR of 13.7%
- Apple pomace, a residue obtained after juice extraction from apple beverage industries
- Generated in about 3000-5000 MT per annum in Himachal Pradesh
- Technology developed for extraction of dietary fibre from apple pomace

Industrial Pomace

Apple dietary fibre

Prototype developed by CSIR-IHBT
(Patent granted: 9011952/US/2015; 2591465/RU/2016)

Salient features of the technology:

- Fibre content recovery up to 60%
- Extracted fibre is light in colour and bland in taste
- Fibre obtained has free flowing texture

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CSIR-INSTITUTE OF HIMALAYAN BIORESOURCE TECHNOLOGY

In the Service of the Nation

Himalayan May Apple

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Bioresource

- Survey
- Mapping
- Status
- Conservation
- Propagation
- Prospection
- Novel Crops
- Databases

Technology

- Agrotechnology
- Biotechnology
- Chemical technology
- Food technology

Bioeconomy

- Aroma
- Floriculture
- Food
- Horticulture
- Enzymes
- Pharma

Plantation of Monk fruit at CSIR-IHBT

Superoxide dismutase (SOD) protein

Ready to Eat Food Products

Extraction unit

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NEW CROPS INTRODUCED IN INDIA

HEENG (*FERULA ASSAFOETIDA*)
Family: Umbelliferae

Import of Heeng in the country: 1145 t/yr (USD 77 million/year)

Heeng seeds

Sprouting stage

Seedling

Nursery raising

- CSIR-IHBT introduced Heeng (six accessions) from Iran (Import Permit Nos. 318/2018 & 409/2018) for cold desert region of Lahaul & Spiti and Ladakh etc.

MONK FRUIT *(SIRAITIA GROSVENORII)*
Family: Cucurbitaceae

Global natural sweetener market : ~ USD 39,100 million

- CSIR-IHBT introduced monk fruit (Import Permit No.168/2017)
- Low-calorie natural sweetener (~300 times sweeter than sucrose)

Plantation at CSIR-IHBT

Dried monk fruit

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CRISPY FRUIT TECHNOLOGY

Introduction

The food processing industry is one of the largest industry in India, it is ranked fifth in terms of production, consumption, export and expected growth. The Indian food market is estimated at over $ 200 billion likely to grow from around $ 70 billion in 2008 to $ 150 billion by 2025

Source: UN FAO SAVE FOOD Initiative 2012

Nutritional facts

Composition in (%)	Banana	Apple	Papaya	Mango
Moisture	69.65±0.32	84.3±0.44	89.56±1.02	80.66 ±1.11
Protein	1.72±0.40	0.43±0.21	0.81±0.33	0.77 ±0.29
Fat	0.32±0.02	0.26±0.04	0.65±0.05	0.51 ±0.01
Minerals Matter (%)	0.86 ±0.09	0.34±0.05	0.56±0.07	0.46 ±0.09
Dietary Fiber (%)	0.49 ±0.07	0.26±0.04	0.85±0.05	0.73 ±0.01
Vitamin C (mg/100g)	8.0	1.50	66.9	18.5
Carotene (mg/100g)	79	9	452	2447
Calories Kcal	116	59	32	75

Drying techniques

Technique	Approximate Nutrients loss %
Sun Drying	45-50%
Tray Drying	35-40%
Our Technology	12-15%

Advantages of the product /technology

- Fruits & vegetables can be dried at low temperature without damaging their physical and nutritional value
- Not need to be refrigerated after processing
- Preserved without chemicals
- Can be reconstituted quickly
- Shelf life up to six months

Crispy Apple

Crispy Banana

Crispy Sapota

Crispy Orange

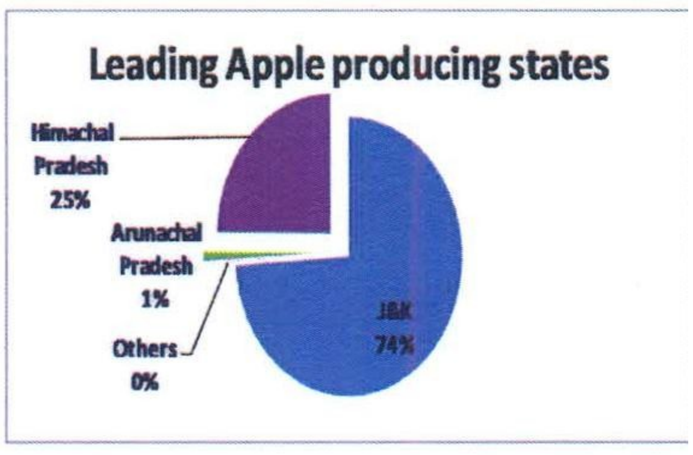
Crispy Mango

Crispy Corn

Major production of Turmeric & Ginger in India

Major producing State	Ginger	Turmeric
Assam	1,22,310 MT	15,000 MT
Karnatka	50,710 MT	65,410 MT
Kerala	21,250 MT	6,910 MT
Meghalaya	62,990 MT	12,530 MT
West Bengal	25,000 MT	42,000 MT

Freeze dried Ginger & Turmeric



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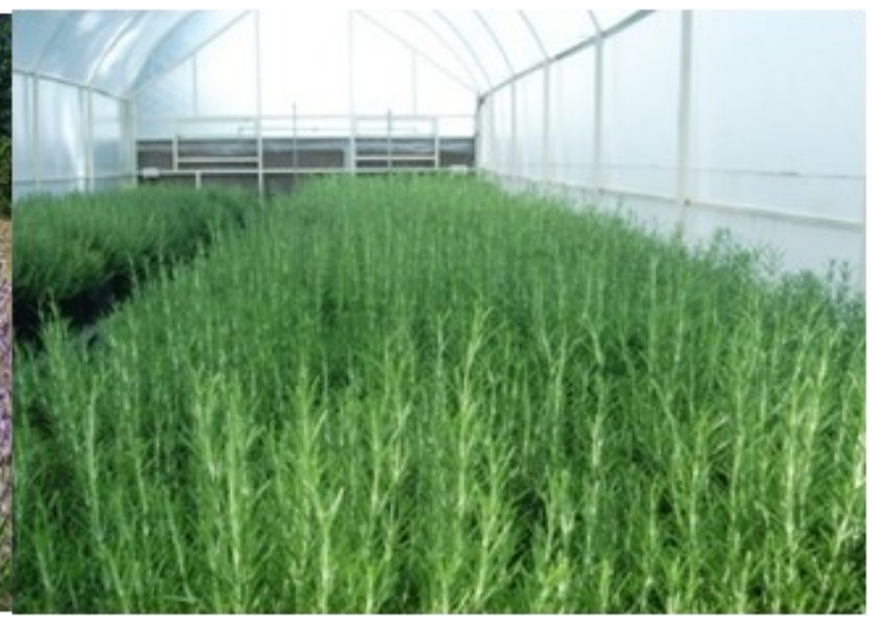
AROMATIC CROPS EMPOWERING FARMERS OF THE HIMALAYAN STATES

- Himachal Pradesh ranked No. 1 in the country in production of wild marigold essential oil
- Resulted in 2.5 to 3 times higher income over traditional crops
- Generated 1,13,700 man-days employment
- Helped in mitigating the human-wildlife (monkey, wild boar, blue bull etc.) conflicts
- Led to rejuvenation of unutilized land
- Net return: Rs. 1.50—2.00 lakhs/ ha/ yr

Introduction of New Aromatic Crops

Lavender

(Net return: Rs. 2.5 lakhs/ ha/ yr)



Rosemary

(Net return: Rs. 2.0 lakhs/ ha/ yr)

German chamomile

(Net return: Rs. 2.7 lakhs/ ha/ yr)

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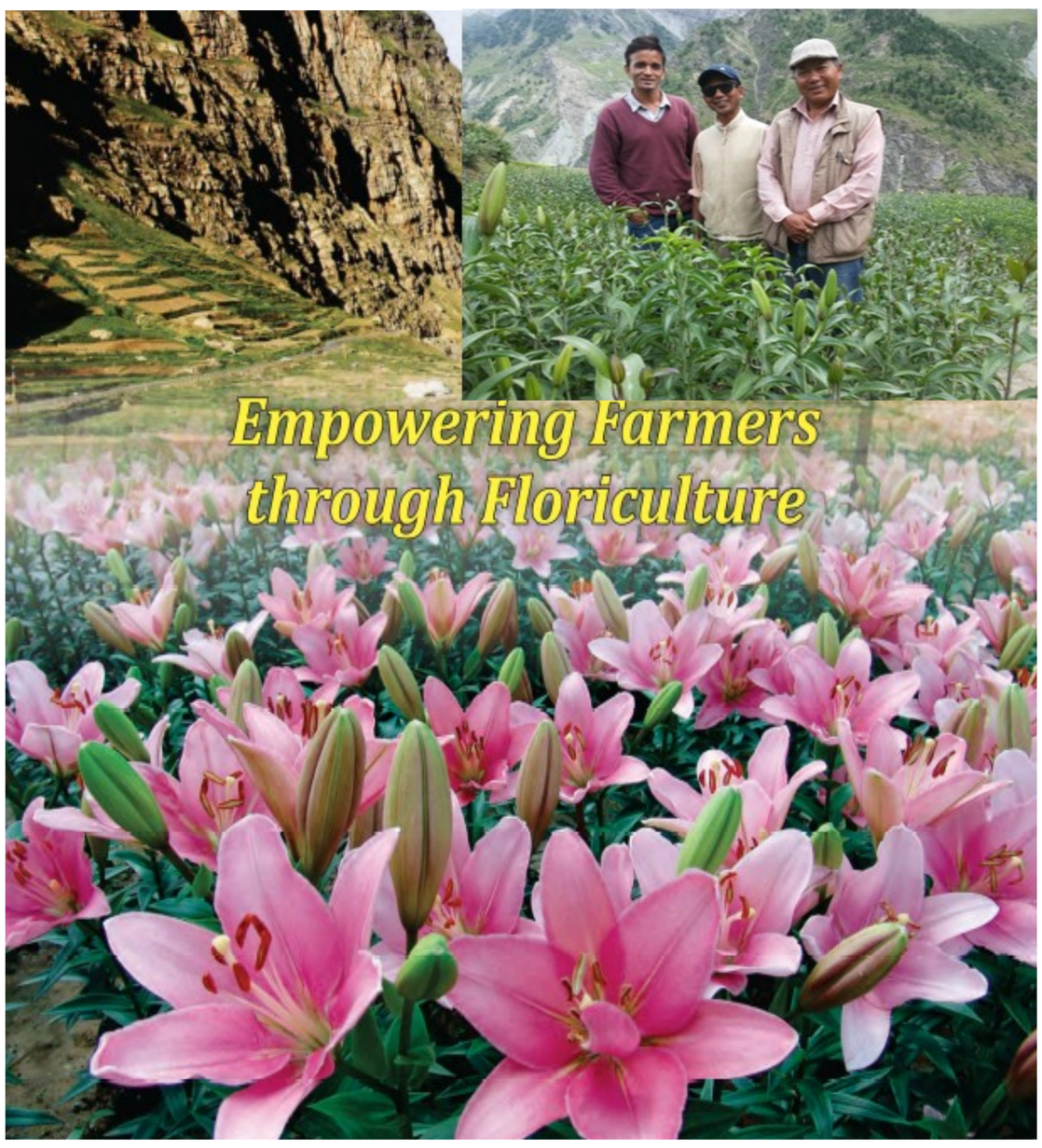
FLORICULTURE CHANGING THE LIVELIHOOD LANDSCAPE OF HIMACHAL PRADESH

- More than 2500 farmers are involved in floriculture in H.P.
- Generated 99,61,000 man-days employment
- Net Income generated: Rs. 118.52 Crore
- Resulted in 5-6 times higher income over traditional crops



Introduction of New Floricultural Crops

Gerbera

Calla lily

Calla lily and Gerbera varieties released by Hon'ble PM on 26.10.2016

Lilium (60 days flowering cycle)

Year round flower production under hydroponics

Tulips (30 days flowering cycle)

Areca Palm

Spider Plant

Pollution Abatement Plants

Money Plant

Boston Fern

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POCKET PERFUMES

- Blends of natural essential oils
- Water based formulations
- Cost effective process

Classy Woody Earthy Pleasant

No elegance is possible without perfume

Natural Blending

Citrus Fresh Floral Fresh

Salient Features

- Travel sized and pocket perfumes
- Useful, efficient and ideal for carrying around
- More than 1000 sprays
- Keep fresh and chilled whole day around
- Get rid of anxiety and depression

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