TECHNOLOGY AND RURAL ENTREPRENEURIAL NETWORK FOR PLANT BASED HEALTH CARE SYSTEM

by

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CERTIFICATE

This is to certify that the thesis entitled, **"TECHNOLOGY AND RURAL ENTREPRENEURIAL NETWORK FOR PLANT BASED HEALTH CARE SYSTEM"** being submitted by **Mr. Dharmendra Kumar Mishra** to the Indian Institute of Technology, Delhi for the award of Doctor of Philosophy is a record of bonafide research work carried out by him under our guidance and supervision in confirmity with the rules and regulations of Indian Institute of Technology, Delhi.

The research report and results presented in this thesis have not been submitted, in part or full, to any other university or Institute for the award of any degree or diploma.

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ABSTRACT

Health, a basic need for human development has been among the top priority areas in our country. The traditional system of herbal health-care was fully in practice till the beginning of 20th century. When the British rule was established, the cure oriented, hospital based western system of allopathic medicine was introduced, but it couldn't meet the health needs of masses especilly rural people. Hence, restrengthening of the plant based health care system is the only viable way through which the health status of people can be improved and maintained.

The gaps (between the prevailing and that required for establishment of plant based health-care system) identified through the literature survey can be broadly divided into two categories i.e. technological and entrepreneurial. Most of the researchers have observed that, technological gaps exist for cultivation, post harvest operations, including suitable equipment for processing. In India the cultivable land resource is limited. On the other hand, there is huge amount of cultivable wasteland. Some researchers have suggested that, wastelands should be brought under cultivation of medicinal and aromatic crops and suitable crop husbandry should also be developed for the same. Researchers also feel that, processing and product making from medicinal and aromatic crops should be carried out in rural areas itself which would generate some more income and create a series of employment opportunities.

To meet the health-need of masses it has been realised that the existing herbal system should be made scientifically effective and adaptable involving local people including *Vaids, folk practitioners, gatherers, cultivators, artisans, agricultural labourers etc..*

Keeping the above in view, it was felt necessary to examine the feasibility for building a herbal-health care system, which would make physically, mentally, and socially healthy individuals.

To assess the prevailing situation, field survey has been done in Bishunpur (a block in Gumla district of Bihar, India) area and it was observed that,

i. the existing modern health care facilities like Public Health Centres and Sub-centres are insufficient to meet the health needs of masses.

ii. the practitioners of traditional system of medicine are available in almost all villages.

iii. the common diseases (like malaria, cold, fever etc.) prevailing in the area are mostly preventable while a some diseases need cure.

iv. *vaids, folk practitioners* and *gathrers* are the main actors in the existing system, but they are working in isolation.

v. the gatherers hardly collect herbs during 80 to 150 days in a year.

vi. large quantities of herbs are collected from the forest and are sold to the traders in the local market.

vii. there exists some demand for herbal-health products like, *triphala chooran, tooth powder, digestive chooran, ark, hair oil, natural pesticide, mosquito repellent, baby massage oil* etc. for day to day needs. But to meet the demand cultivation and processing of medicinal and aromatic plant is not done in this area.

In the light of the understanding of demand for this system, it was felt that cultivation and processing of medicinal and aromatic crops are very much desirable. It was not feasible to conduct the experimental studies in the field area itself. Hence, it was

decided to conduct the relevant experiments on the salt affected culturable wastelands in the micro-model complex at Indian Institute of Technology, Delhi.

Trials on Experimental plot:

Crops were chosen for field trials on the basis of their edaphic suitability and the demand of products for which they could be used. Information on cultivation of medicinal and aromatic crops and their inter-cropping are limited. Hence, cultivation experiments were conducted to evaluate the suitability of standard package of practices and inter-cropping of certain medicinal and aromatic crops on salt affected culturable wastelands.

Crops and crop combinations were evaluated on the basis of their suitability, yield, economics and employment potential. It was observed that, *Abelmoschus moschatus* crop inter cropped with *T. patula* (during *kharif-rabi* season), *F. vulgare* with *M. chamomilla* and sole crop of *Cichorium intibus* (during *rabi* season) can be selected for cultivation on salt affected culturable wastelands. Fibre extraction from *Abelmoschus moschatus* has also been done.

Laboratory experiments

To assess the quality of cultivated herbs obtained from salt affected culturable wastelands, following experiments were carried out:

- Drying of above mentioned crops.

⇒ Seeds of crops like *Foeniculum vulgare, Anethum sowa, Abelmoschus moschatus, Cichorium intibus* etc. dried in shade for 4 -5 days retain a moisture level of 8 to 10 per cent. While, flowers of *M. chamomilla* and *Tagetes. spp.* need an average of 2 - 3 days and 8 - 10 days respectively for sun drying. They need 10 - 12 days and 15 days respectively for when dried in shade.

- Extraction of essential oil from the cultivated crops through hydro distillation method. In addition to seed, essential oil was also extracted from pedicile and straw of *Anethum sowa*.

⇒ the crops cultivated during the present study contained essential oil in the same range as reported in literature.

- **Solvent extraction**,

  * cold extraction of *Tagetes patula* (flower) and *Abelmoschus moschatus* (seed) using n-Hexane and alcohol respectively to determine the per cent crude extract.

  * through Soxhlet apparatus for *Matricaria chamomilla* (flower), *Abelmoschus moschatus* (seed), and *Cichorium intibus* (seed), using Alcohol and n-Hexane.

⇒ Cold extraction of *Tagetes patula* using n-hexane yielded an average of 0.22% concrete.

⇒ Cold extraction of *A. moschatus* using alcohol yielded 14.16% crude extract.

⇒ Solvent extraction through Soxhlet apparatus using Alcohol recorded an average of 30.04%, 13.21% and 16.66% extract of *M. chamomilla, A. moschatus* and *C. intibus* respectively, while that using n-Hexane have recorded 3.27%, 0.62% and 6.50% extracts respectively.

◊ **Water extract:** C. intibus have recorded about 9.54% of crude extract when extracted with water.

Analysis:

- TLC (Thin Layer Chromatography) and column chromatography of extracts to determine the active constituents.
- Gas chromatography analysis of essential oils obtained after hydro distillation.

⇒ TLC and Gas chromatography analysis have revealed that composition of oils grown on cultivable wastelands were in the range as reported by earlier workers, but in certain cases it was close to the lower limits of the range. In case of *Matricaria chamomilla,* sun dried flowers contain higher percentage of useful components like bisabolol and chamazulene.

⇒ Seed oil of *Anethum sowa* contain higher percentage of carvone than the pedicile and straw. But the pedicile oil contain *d-limolene, carvone,* and also an unknown compound. Further analysis would be needed to identify the compound.

⇒ Medium quality fibres can be obtained from Ambretee stem.

- Formulation and testing of herbal drink

⇒ Herbal drink have been prepared using *M. chamomilla, C. intibus, F. vulgare, Mentha spp., Cassia angustifolia* etc.

⇒ Steam distillation unit (still made in clay) has been designed and fabricated.

Based on the survey and experimental findings an economically viable operational system has been proposed for the establishment of enterprises in plant based health care system in rural areas.

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