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The Role of Medicinal Plants Industry In Fostering Biodiversity Conservation and Rural Development

Editors

Madhav Karki and Radhika Johari

Medicinal and Aromatic
Plants Program in Asia (MAPPA)
IDRC/SARO

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The Role of Medicinal Plants Industry In Fostering Biodiversity Conservation and Rural Development

A Combined Report On The Proceedings of a National Colloquium Held on December 16 - 17, 1997, in New Delhi, India and A Workshop on Medicinal Plants as the Basis for the Relationship Between Industries and Rural Communities Held on February 17, 1998, in Bangalore, India.

Editors

Madhav Karki
Radhika Johari

The Medicinal and Aromatic Plants Program in Asia (MAPPA)
International Development Research Centre (IDRC), Canada
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1999

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Foreword

Interest in medicinal plants has been rapidly growing in the South Asian region due to increasing recognition of their commercial, socio-economic and ecological values. The realization that medicinal plants-based ecosytems harbour a high degree of biodiversity has also led policy makers, donors and development agencies to devote greater attention to the potential of these plants. The growing popularity of natural products as solutions to human health problems, both within as well as outside India, has important implications for local communities, especially tribals. This importance can be linked to the potential for income generation and poverty alleviation through the wise use of the medicinal plant resource base.

Indian medicinal plant industries are still, however, being managed on the basis of the traditional ethos and practices. Industries lack a proactive and socially responsible outlook. There is a general perception that middlemen and agents are exploiting poor collectors and small scale producers in the management of their raw materials. As a result, the raw material supply situation is unsound and unsustainable. It is therefore in the best interests of the industry to develop a long term "social contract" with the producers, collectors and suppliers of medicinal plants.

Fully cognizant of the commercial, biodiversity and socio-economic potential of the medicinal plants sector, IDRC's Medicinal and Aromatic Plants Program in Asia (MAPPA), formerly known as the Medicinal Plants Network (IMPN), sought to address the issues described above by organizing a two day National Colloquium from December 16 - 17, 1997 in New Delhi. The Colloquium, which was attended by representatives from major medicinal plants industrial groups and associations, government agencies and select NGOs, was co-sponsored by the Ford Foundation, New Delhi, the Zandu Foundation, Mumbai; and the Dabur Foundation, Mumbai together with the Indian Association for the Study of Traditional Asian Medicine (IASTAM), Mumbai; the Ayurvedic Drug Manufacturers Association (ADMA), Mumbai; and the Indian Drug Manufacturers Association (IDMA), Mumbai.

The deliberations and recommendations of the Colloquium formed the starting point and focus of a Workshop on medicinal plants as the basis for the relationship between industries and rural communities, which was organized by MAPPA as part of the International Conference on Medicinal Plants held in Bangalore on February 17, 1998.

This report summarizes the proceedings and recommendations of both of these gatherings, and brings together the main issues relating to this very important subject. These issues must be addressed in order to ensure the conservation and sustainable use of the medicinal plants resource base for the benefit of economically disadvantaged groups as well as medicinal plant industries within the South Asian region.

New Delhi
November, 1999

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The Medicinal Plants Industry in India: Issues, Constraints and Opportunities

Emerging Global Markets in Medicinal Plant Products: Challenges and Opportunities for Indian Herbal Drug Industries

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Abstract:

This paper provides a broad-based perspective on the emerging global market for medicinal plants, pointing to the increasing demand for systems of alternative or complementary medicine in the global market. It highlights some of the opportunities and challenges that lie ahead for the medicinal plant industry (MPI) in India, where the market demand for medicinal plants is closely linked to the growth and expansion of Ayurvedic as well as non-Ayurvedic - based pharmaceutical companies which use them in their products. The paper raises some of the salient issues relating to the commercialization of the MPI, and highlights important elements of international marketing strategy. At the same time, it emphasizes the necessity of ensuring the conservation and sustainable utilization of medicinal plants in the face of growing demands for these resources. Finally, it raises some pertinent socio-economic issues related to the building up of partnerships with the various stakeholders, particularly the village and tribal communities which have been traditionally involved in the collection of medicinal plants. Suggestions are made relating to improved management of the MPI and the marketing of its products.

Background and Overview:

In the competitive global market of today, information technology is creating revolutionary changes and is transforming whole industries. The very nature of competition has undergone a drastic change in a variety of industrial sectors, with leading industries having either disappeared from the scenario or having lost their positions of leadership to newcomers. General Motors of the USA, for example, was the unquestioned leader in the automobile industry for many years, but this is no longer the case. Similar examples can be provided from a number of other industries, where the incumbents did not heed or comprehend the strong market signals and trends that were beginning to emerge.

At this juncture, it would be wise for India's medicinal plant industry (MPI) to anticipate and participate in future opportunities, bearing in mind that we are talking about a future, which, as pointed out by management guru, Peter Drucker, has already arrived and is already here. The future has to be sharply distinguished from the past since it is not an extrapolation of the past. It has been suggested that a far wiser strategy would be to look for opportunity shares instead of being constantly focused on market shares. Just imagine a scenario in which some of the large foreign or multi-national pharmaceutical companies also became producers of Ayurvedic drugs and began to compete in the Indian domestic market. How would Indian firms face this challenge? What would be the impact of this on the various stakeholders and agencies involved in the supply chain?

It would be interesting to speculate on these rather frightening questions, which cannot be altogether dismissed as the fantasies of a wild imagination. Organizations usually find it difficult to imagine or conceptualize their futures. The problem, however, is not the unknowability of the future, but rather it is the lack of vision of senior managers who tend to look at the future through a set of activities and programs. As a result, innovative approaches needed to tackle new areas and scenarios are either ignored or neglected. In business parlance, this is known as myopia of the served market. It results in both technical as well as human resources not being utilized profitably to their full potential. Instead of pursuing traditional sets of activities, managers should therefore look towards new opportunity horizons. Most organizations, which face the challenge of change, will have to reassess their resource capabilities and core competencies. They will also have to evolve new creative approaches for leveraging existing resources. In order to develop this strategic focus, they must, however, have a sense of direction and foresight about the future shape of things to come.

The global demand for medicinal plants has already attracted the attention of some of the largest pharmaceutical and drug manufacturing companies in the world, which are seriously investigating the opportunities provided by this industry. Global research on neem *(Azadirachta indica)* is just one example of this trend. In addition foreign pharmaceutical companies are already involved in buying bulk quantities of certain medicinal plants and plant products from India. Proctor & Gamble, for example, as well as other small and medium-sized firms import Isabgol *(Psyllium)* from India. These companies are formidable potential competitors to Indian companies, which rely heavily on medicinal plants. Furthermore, serious attempts are being made to develop local production and farming of some important medicinal plants in North America.

Traditional Systems of Medicine

While there is a definite need to examine some of the complex issues relating to conservation, cultivation and the sustainable utilization of medicinal plants, emerging challenges and opportunities in the global market require a critical look at the needs of commercialization in this industry. Although India's medicinal plants industry has been involved in the export of raw materials for a long time now, recent developments in the global market place have created new opportunities and challenges for Indian industry. The benefits of traditional systems of medicine have forced upon the policy-makers and practitioners, a new awareness and realization of the efficacy of these systems. The important role played by medicinal plants in the health care systems of any country are well recognized and supported by the World Health Organization (WHO). In the case of India, the rich cultural heritage and traditions of classical systems of medicine - Ayurveda, Siddha and Unani - have co-existed with folk medicinal traditions, which have generally involved the oral transmission of extensive knowledge regarding the medicinal properties of local plants, for thousands of years. All of these systems, including Homeopathy, which is also very popular both in India as well as abroad, derive their formulations and products from medicinal plants, which constitute the core raw materials.

A Paradigm Shift in Medicine

A serious debate has been going on in the West for some time now with regard to the use of alternative systems of medicine, or complementary alternative medicine. Practitioners, professional medical associations and government regulating agencies have generally regarded these systems as being unscientific and not of proven reliability. However, there is now an increasing awareness in many parts of the world, of the efficacy of the traditional systems of medicine. In the USA, for example, the past five years have seen alternative medicine making inroads into the mainstream. A new medical paradigm has emerged and is likely to have an enormous impact on human health. The dynamics and size of the market for these medicines, which was worth US$ 13 billion in 1993, have impelled investors and

government agencies to consider it seriously. In Germany, the market size for herbal medicines was estimated at US$ 1.1 billion in 1996. While there is a serious lack of reliable estimates of this market, it is thought to be growing at an annual rate of 15 - 20 per cent.

An International Marketing Perspective

Within the Indian context, although some of the Ayurvedic pharmaceutical companies are already engaged in exporting Ayurvedic formulations and brand name products in the global market, they are still at a very preliminary stage of entry into the arena of international marketing. Most of them do not have the necessary approval of government agencies, are suspect, and do not find easy acceptance on the shelves of pharmacies and drug stores in North America. Thus there is a great need for rethinking of strategy to achieve a broadening of vision regarding marketing of Indian medicinal plant products in the global market place.

International marketing issues regarding the redefining, repositioning and reinventing of the medicinal plants industry, and of the Ayurvedic pharmaceutical industry in particular, would require a strong commitment to developing the industry's image in the international market. Some meaningful lessons relating to the positioning and building up of product image in the global market can be learned from the experiences of some of the leading successful corporations.

The issue of supply chain management in the marketing channels of the medicinal plants industry, from the earliest stage of collection from the wild to processing in modern factories, requires a critical analysis of the roles of the various actors involved in the whole process. In order to achieve managerial and marketing effectiveness, a new vision and a redefined marketing strategy for the medicinal plants industry and Ayurvedic pharmaceutical concerns would be required. It is important to note that a new industrial policy focus has been developed and has existed for some time with regard to the role of small and medium sized firms.

An issue of great importance involves assessing the impact of commercialization of the medicinal plants industry and its various ramifications on the economic well-being of its various stakeholders. The aim is to find an equitable balance between the needs of the industry on one hand, and the needs of biodiversity, sustainability and indigenous communities on the other. Of particular significance in this context are tribal communities, whose lives are most likely to be affected by commercialization policies. It is therefore vital to build up imaginative policies based on the concept of flexible specialization, which is well recognized and has been found very useful for indigenous communities in many parts of the world, in order to improve the socio-economic conditions of tribal and village communities involved in the MPI. A network of various kinds of middle level agencies and institutions is usually active in the entire process of collecting, storing, grading and marketing medicinal plants. It is therefore quite conceivable that collaborative relationships could be developed between the manufacturers of Ayurvedic pharmaceuticals and the various intermediaries in the supply chain for more effective logistical management and marketing. Subcontracting of various operations along the lines of the Japanese pattern could be developed. On the supply side, training and transfer of intermediate technology could help enormously in developing a stable and sustainable supply of raw materials. Manufacturers could build up trust and develop co-operative relationships with suppliers, thus contributing to the development of a process which recognizes and makes use of the strengths of local culturally-embedded values.

This paper does not pretend to offer solutions to a very complex problem and set of issues. It does, however, attempt to raise awareness of the opportunities and challenges facing the medicinal plants industry in India within a global context.

Key Issues and Problems Faced by the Medicinal Plants Industry in India.

K.M. Parikh
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The limitations of allopathy and awareness of its side effects (iatrogenic diseases), along with the inability of governments to economically and safely cater to the needs of their growing populations, are matters of increasing concern. These, coupled with increased demands for alternative medicine (the global market for natural health care products has been estimated at US$ 14 billion), provide considerable scope for the development of the medicinal plants industry, both within and outside of India. However, there are several issues, which need to be addressed in order to ensure the successful growth of this industry. These are highlighted below:

Quality considerations: these involve accurate botanical and chemical identification with regard to medicinal plants as well as ensuring regular and sustainable supplies through cultivation techniques.

Safety considerations: these require the implementation of a large-scale survey of the user populations of traditional plant-based systems of medicine which use these plants, as well as LD 50 and acute and chronic toxicity studies to validate various claims.

Efficacy considerations: as with the above, a survey of the user population is required, along with Ayurvedic and combined clinical trials.

In order to effectively address the above considerations, it is necessary to assess the usefulness and modes of action of Ayurveda using the following approach. Research and development activities would have to be carried out on a few selected medicinal plants using a multi-disciplinary team approach. This would involve specialists in Botany, Chemistry, cultivation techniques, processing, clinical and pharmaco-kinetics and pharmacology.

While there are large numbers of manufacturers in the medicinal plants industry in developed countries, the proportion of exporters is miniscule. Within India too, it would be unreasonable to expect manufacturers and entrepreneurs, however capable, to undergo the huge costs involved in developing Ayurvedic products. However, by exporting low quality non-standard products, the country's name and reputation would be at stake. It is therefore recommended that the following activities be pursued in order to develop a successful and sustainable medicinal plants industry in India, which is capable of contributing substantially to the global market for herbal medicinal products.

1. Regular supplies of plants identified for their high botanical quality, at reasonable prices, should be available to the medicinal plants industry.

2. These plants, which occur under different climatic conditions, should be taken up for cultivation, either as annuals and biennials or as trees in farms, or within the forests, in different states within the country.

3. High quality planting materials such as seeds, stolons etc. should be developed for cultivation.

4. Farmers and other entrepreneurs should be provided with cultivation technologies and planting materials.

5. Industries and entrepreneurs should be provided with suitable land, infrastructure and facilities in the concerned states.

6. Once the required (high quality) medicinal plant species are available, their chemical composition can be studied in order to achieve standardization.

7. Standardized materials should undergo safety and efficacy studies according to both the Ayurvedic as well as the allopathic systems of medicine.

8. Simultaneously, processing technologies of Ayurvedic plant-based drugs should be approached from the perspective of modern scientific parameters.

The first five sets of activities mentioned above are crucial with regard to avoiding over exploitation of the resource base and helping to maintain biodiversity, and should be developed and implemented immediately.

The Indian medicinal plants industry is capable of capturing a sizeable portion of the expected global market in herbal products, which is estimated to reach US$ 38 million by the year 2010. However for this to occur, the industry must collaborate with and establish partnerships with Central and State Government Ministries of Environment and Health; University departments and national laboratories and NGOs, with financial assistance being provided by some of the numerous international funding agencies. Additionally, the socio-economic aspects of the medicinal plants industry should be considered, with village-based enterprises being established for the extraction and cultivation of medicinal plants. These would provide important sources of income and would help to curb the current exodus from rural to urban areas. By adopting the measures described above, which are tailored to the industry's requirements, the goals of sustainable utilization of medicinal plants and a flourishing medicinal plants industry in India could be achieved within a very short period of time, possibly 5 to 10 years.

Research and Development Issues

Interface Between Industry and R & D Communities: The North American Perspective

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Introduction

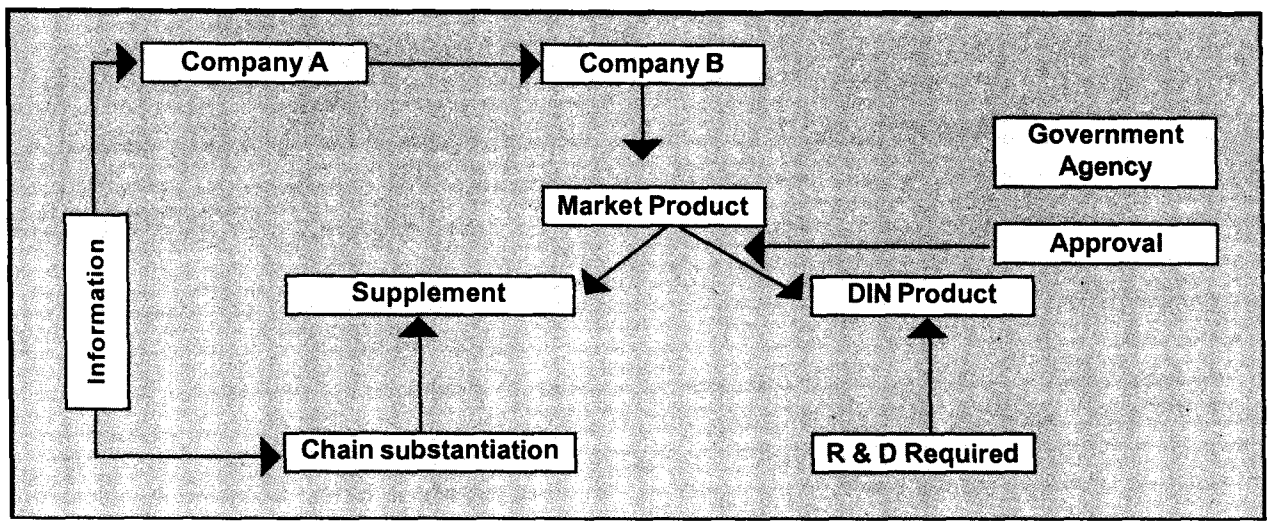
By all accounts, the medicinal plants industry is a substantial industry, and one that is growing at a very fast rate, especially in North America, due to the interest that people have in using natural products derived from plants in their health management. I have been asked to address the subject of interfacing between industries and R & D communities, as applicable to the medicinal plants industry, with particular reference to the North American perspective. A brief explanation of my background may help to clarify my suitability for this task.

While my basic academic background is in the area of agriculture, I have been working in the field of health sciences for the past 30 years and have found a strong synergism between these two disciplines. People in North America have increasingly begun to recognize that diet is a crucial determinant of health. The concept of using medicinal plants in the management of health is thus a logical extension of the diet hypothesis. During the past three decades, I have also worked closely with the agro-food and health industries in initiating in-house and government-assisted science and technology related R & D projects. To an outsider, all of North America may appear the same. However, with respect to industrial R & D activities, Canada occupies a unique position. On the one hand, companies are encouraged to undertake R & D activities by being offered tax incentives, and on the other, funds are provided in the form of grants and loans. Increasingly, government-funding agencies are encouraging the formation of partnerships between academia and industries. Such collaborations include the University-Industry partnership programs established by the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Medical Research Council of Canada (MRC). Nowhere is the impact of this partnership approach more evident than in the small to medium size sectors of the industries. These are the companies, which have the greatest potential for applying the outcomes of R & D for the purpose of regulatory compliance, claim validation and technology development. However, these are the same companies which are in the greatest need of support from the R & D communities due to the lack of in-house scientific expertise. I would like to focus my presentation on the mechanisms by which these companies can and have successfully interfaced with R & D communities in Canada. I would like to illustrate the success of this approach through the use of three working examples, two of which are drawn from the area of medicinal plants and one from outside it.

Areas of the Medicinal Plants Industry Requiring an R & D Interface

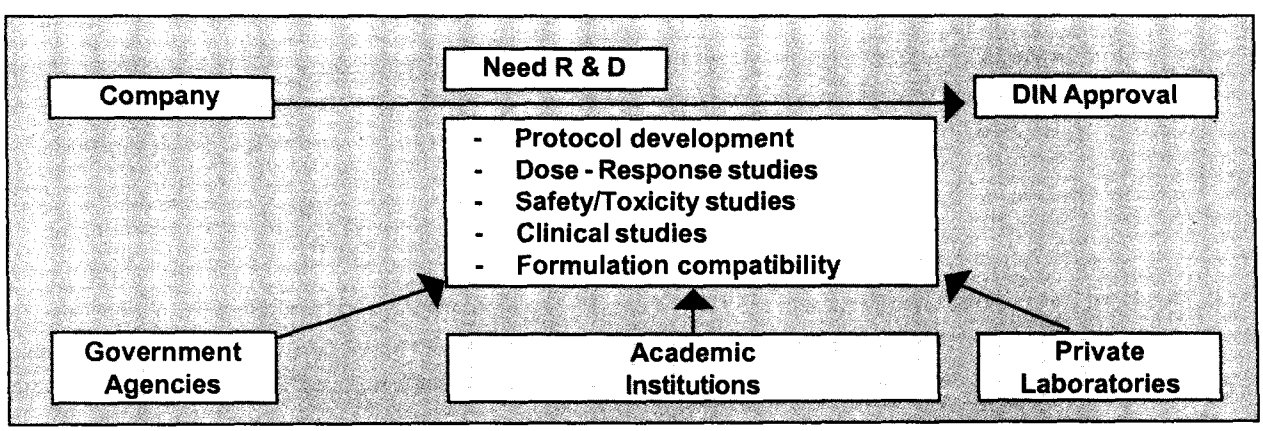
There are three basic areas where the medicinal plant industry would require an R & D interface: formulations; claims validation and value-added components. An example of such an interface is illustrated in Figure 1.

Figure 1 - R & D Interface Between Companies



Company A located in India would perhaps like to export their products to other countries. It would then establish contacts with Company B in the country where the products are to be marketed. However, several issues would have to be addressed before the products could be marketed. First of all, it has to be established if the product is categorized as a supplement or as a product requiring a Drug Identification Number (DIN). If the product is considered a supplement, then information relevant to the health claims being made must be compiled. This would require scientific and technological information exchange between the two companies. However, if a DIN is required, then a systematic set of R& D activities has to be initiated to generate the information required by the regulatory agencies prior to their approval.

Figure 2 - DIN Approval: R & D Input

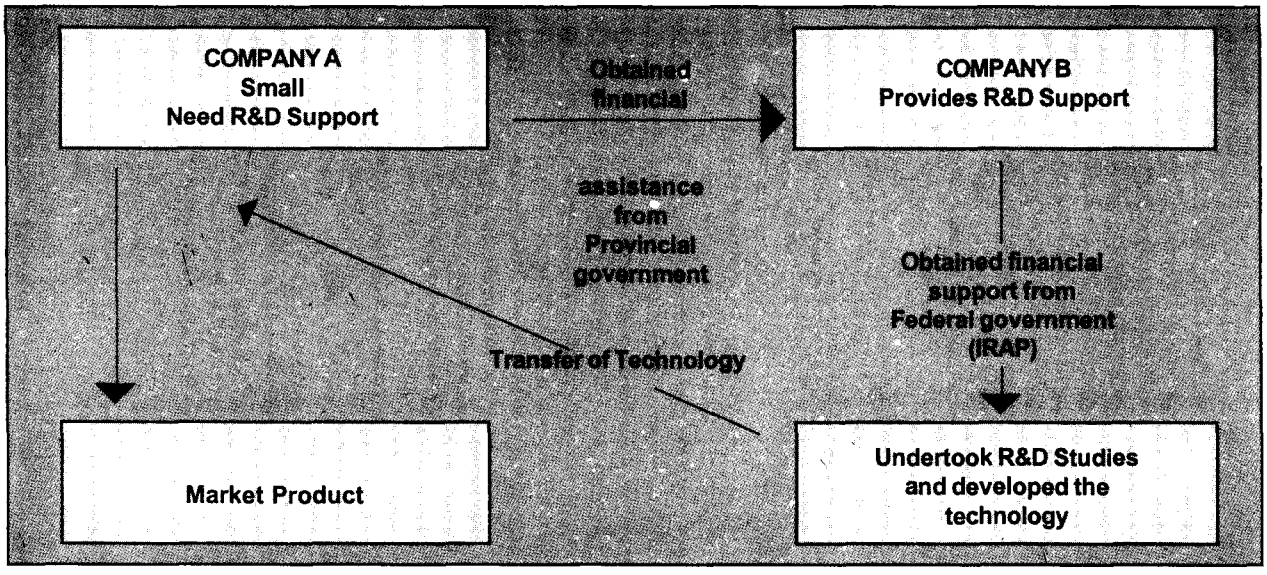


The nature of the required R & D input is shown in Figure 2. This includes development of protocols, undertaking dose-response, safety and clinical studies and product formulation work. To generate this information, the company must interface with the R & D community, which includes provincial and federal government agencies, academic institutions and private laboratories. The company's in-house resources may also be utilized for this purpose.

Working Example 1 - Feverfew

My first working example is of a small company in Canada, which was traditionally involved in growing and processing tobacco plants as shown in Figure 3 below.

Figure 3 - Working Example 1 - Feverfew: A Canadian Experience



However, in view of the declining demand for tobacco products, the company started looking for an alternative crop which could be grown on their land, and which would have market potential, both domestically as well as globally. At the same time, the provincial government was also encouraging tobacco farmers to grow alternative cash crops and initiated a farm subsidy program to provide financial assistance to farmers. After undertaking extensive market research, the company made the decision to go into the medicinal plants arena and took advantage of the government program to develop agronomic operations to organically grow Feverfew plants *(Tanecetum parthenium)*. This plant contains the active ingredient Parthenolide and is used in the prevention of migraines. Field trials were undertaken to develop optimum conditions for maximizing yields and to identify the ideal time of harvesting to obtain maximum levels of parthenolide. Armed with this knowledge, the company then approached a local R & D company to help them in developing an analytical methodology and technologies for drying, grinding, achieving product stability and tabletting. A further area of interface between the companies involved a review of all the scientific data and the preparation of a DIN approval application for the product. To undertake this phase of the R & D process, financial assistance from the Federal Government (Industrial Research Aid Program - IRAP) was obtained. The technology developed by the R & D company was eventually transferred to the original company, which is now successfully marketing their product in Canada, and is beginning to export the product to Europe. As a result of this success, the company has now expanded its scope with regard to medicinal plants and is also growing, processing and marketing other products such as Acanesia. This entire process, from the conceptual stage through R & D, and finally the market stage took nearly three years for completion.

Working Example 2 - Neem

The second working example I would like to use relates to Neem, which is very familiar to Indians. Neem has several beneficial biological properties - antibacterial, antifungal, insecticidal and antifeedant.

In addition, it is used for immune modulation and endocrine and metabolic regulation. The active ingredients of Neem are nimbin and its derivatives, present in the leaves, and azadirachtin and its derivatives, present in the seeds. In addition to these, several other active compounds having specific biological properties are also present in Neem, as shown in Figure 4.

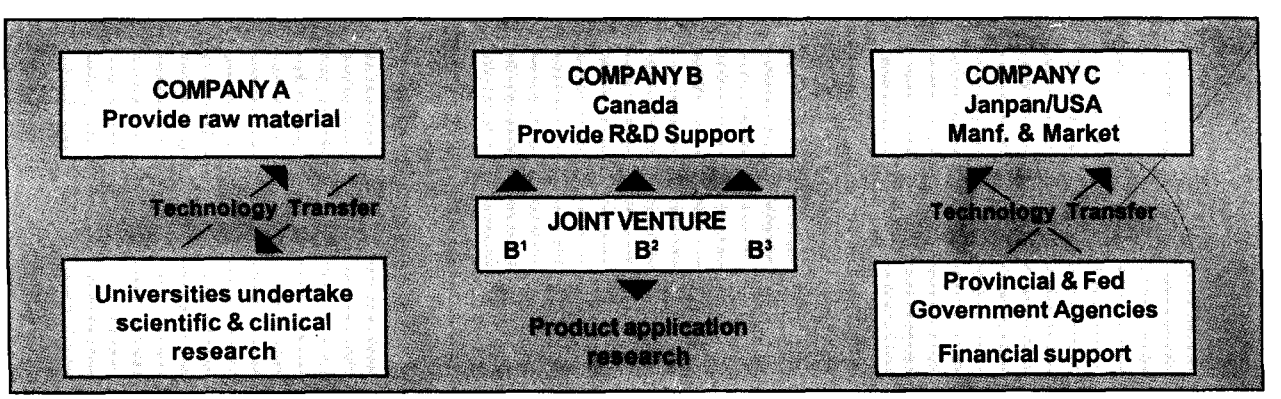
Figure 4 - Composition of Neem Oil

Compound	% By Weight	Ratio (Limonid/Azadirachtin)
Azadirachtin	0.01	1
6-Acetylnimbandiol	0.06	6
Nimbandiol	0.27	27
Unknown Fraction A	1.30	130
Unknown Fraction B	1.60	160
Deacetylnimbin	1.70	170
Nimbin	2.20	220
Salannin	4.50	450

Some examples of the technological challenges facing a company which wishes to work with neem include: selective extraction and concentration of active fractions from neem oil; maintaining full biological activity of fractions through the process; recovery of active fractions in high yields and cost-efficient process development.

Figure 5 shows an example of a company in Japan, having subsidiary operations in the USA, which was interested in developing and marketing a series of natural oral hygiene and household pest control products based on Neem. On the basis of previous collaborations, they approached an R & D company in Canada to work with them in developing the required technological, scientific and clinical knowledge. A company in India was contacted for the purpose of supplying the raw material. The Canadian company then raised matching funds to support R & D activity through joint ventures and government programs. The University of Toronto was subsequently contacted to undertake R & D activity on behalf of the company in the areas of technology development and clinical studies to establish the efficacy of the products. At the same time, the company carried out in-house product development research work.

Figure 5 - Working Example 2 - Neem: An International Experience

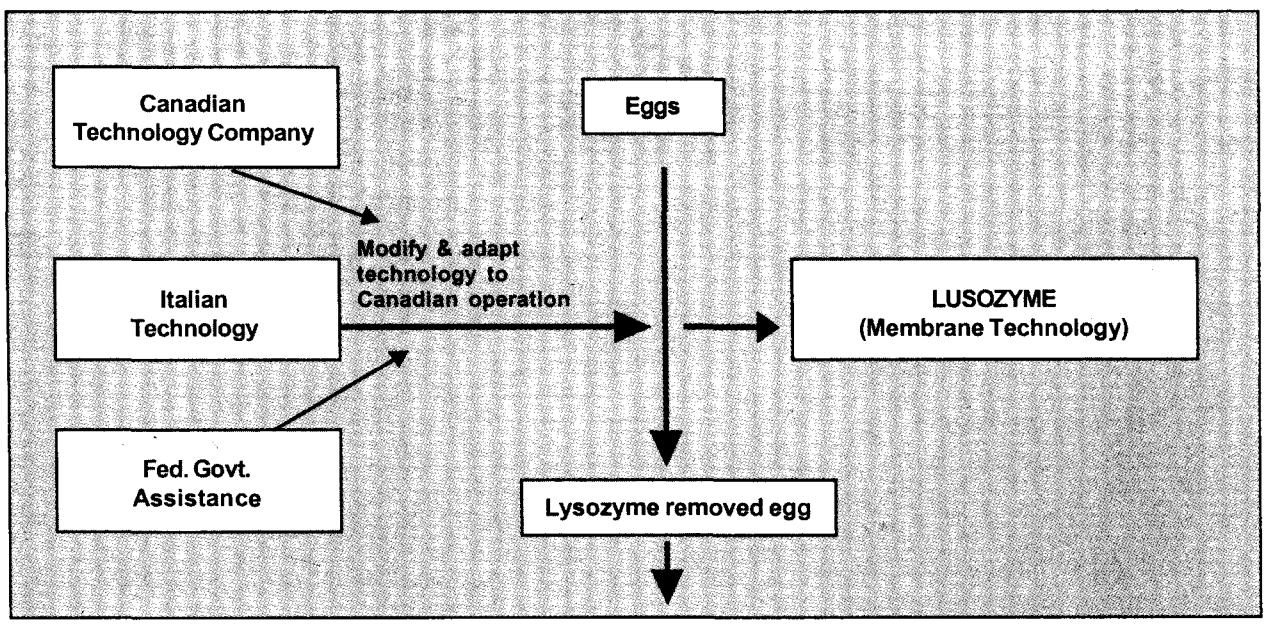


The R & D activity involved in this model includes: a comprehensive review of literature and a patent search; developing process technology to isolate and purify active fractions; establishing the stability of active fractions; conducting clinical studies for the validation of medicinal applications, and specifically, for the validation of oral hygiene applications and product development research. The technology will eventually be transferred from the university to the Canadian company, and from there, to the Japanese company. It is estimated that a minimum of three to five years will be required for this project to be completed. This working example shows the international scope for companies to interface with each other to achieve their goals.

Working Example 3 - Eggs: Value Added Technology

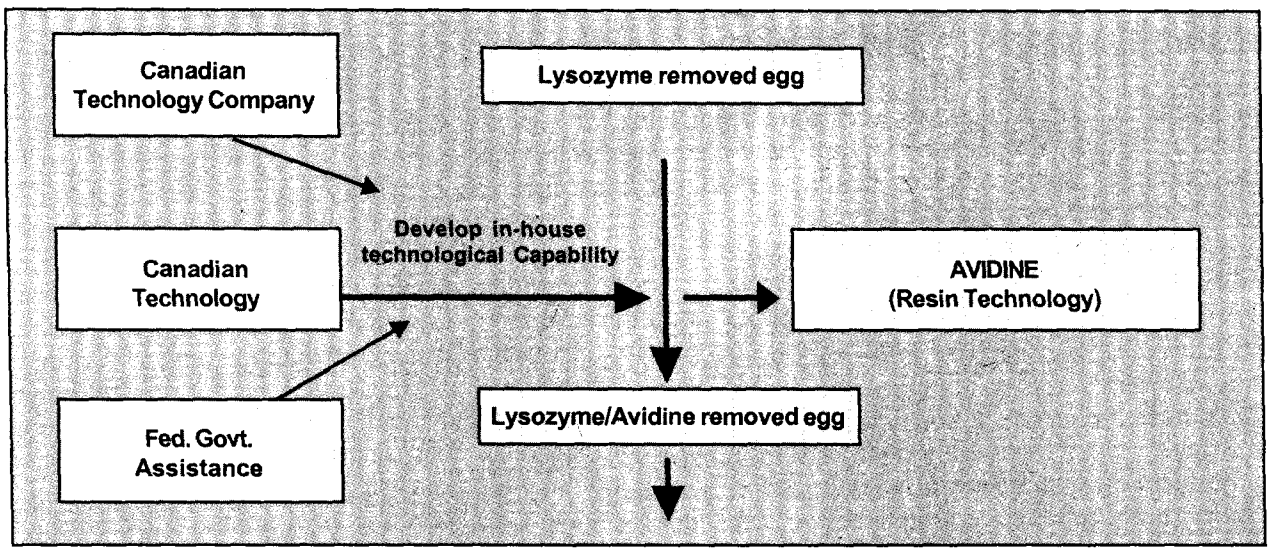
Although my third working example has been taken from outside of the medicinal plants arena, I am using it to illustrate how R & D interface can be used by companies to bring about incrementality and value addition. The example is that of a Canadian company that was traditionally involved in processing eggs. For many years, they operated a successful drying operation for the manufacture of powdered egg white and yolk. In addition to egg white and egg yolk, eggs also contain many valuable biochemicals with industrial applications. One such compound is lysozyme, which is used extensively as a preservative in the food and pharmaceutical industries. Another compound is avidine, which is used in many diagnostic products based on the ELISA technique because of its high affinity for biotin. The high temperatures that the company was using in the manufacture of their egg powder were in effect completely destroying both the lysozyme and the avidine. A company in Italy developed a process for selectively extracting and purifying the lysozyme from egg white. This technology was licensed under contractual agreements to the Canadian company. However, for this technology to be used, modifications had to be made to adapt it to Canadian conditions. This was accomplished by obtaining government financial assistance that allowed the company to interface with another R & D company. In the process of transferring the lysozyme technology, the company was able to develop a whole new membrane technology for the concentration of egg white and the removal of undesirable sugars. This process is depicted in Figure 6.

Figure 6 - Working Example 3 - Eggs: Value Added Technology - The Canadian Experience.



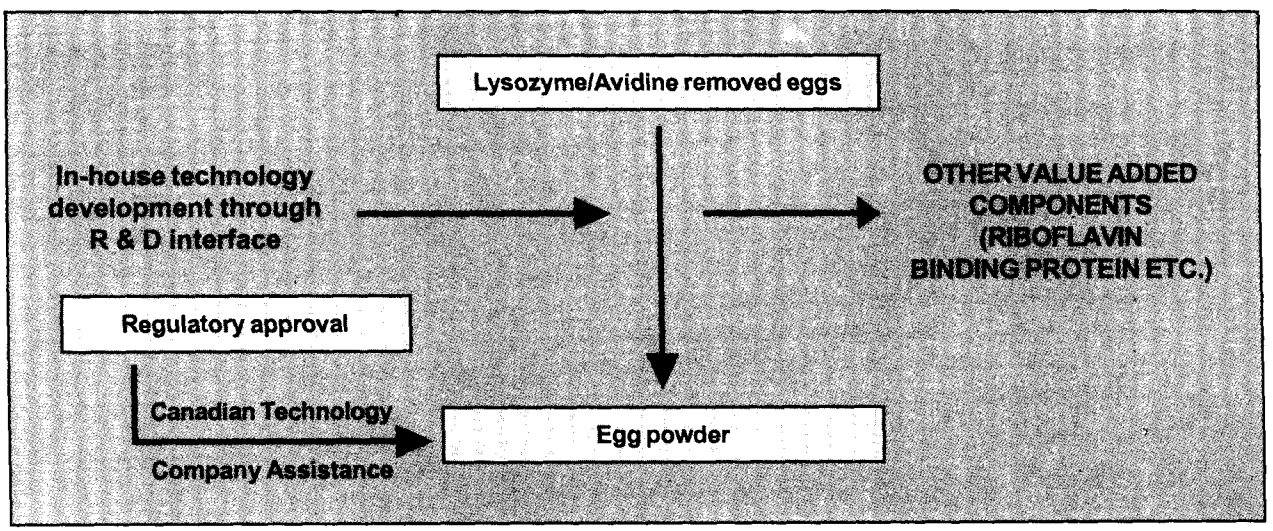
The company realized that the egg white from which lysozome had been removed must still contain avidine and other biochemicals, which could be recovered if technology could be developed to extract and purify them. Once again, through the use of government-assisted R & D programs, and the involvement of other R & D communities, in-house technology was developed for the extraction of avidine, as shown in Figure 7.

Figure 7



The lysozyme and avidine removed egg was now being processed in the traditional way for the manufacture of egg powder, as shown in Figure 8.

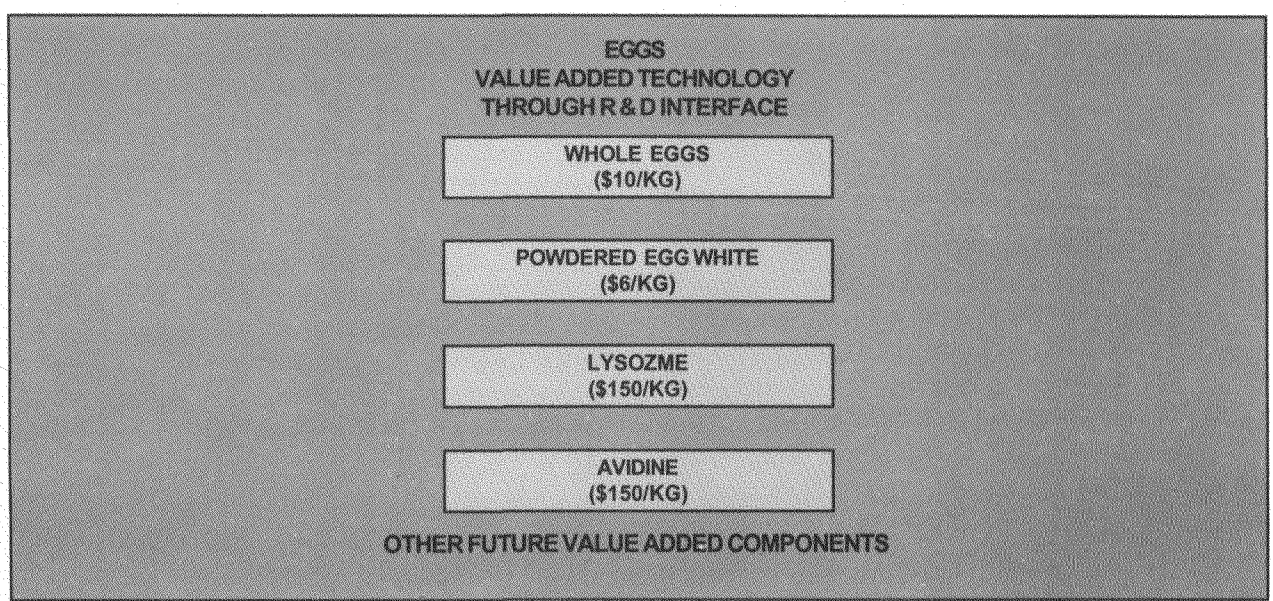
Figure 8



However, since components of the egg white were being removed, the company had to convince government regulatory agencies that the composition of the egg white powder was essentially unaltered

in order to obtain their approval. The services of the R & D company were recruited to accomplish this task. The company was also undertaking R & D activity to develop in-house capabilities for the extraction of other value-added components such as riboflavin binding protein (RBP). The company is still selling its traditional egg powder, but as a result of the R & D activity, it gradually developed value- added products from the egg, which contributed substantially to its profits. The incremental value added aspect of egg processing is shown in Figure 9.

Figure 9



Several government programs and other R & D resources were used over a period of almost 10 years to generate the company's success. I can clearly see a parallel between this example and that of the medicinal plants industry, where a substantial value added component can be achieved through R & D activity.

Conclusion

In my presentation, I selected only three examples from many to show how companies can interface with R & D communities in order to accomplish their goals of increased sales and rapid growth. I am aware that these examples represent only the North American perspective. However, I do believe that this model can serve as an example to the Indian medicinal plants industry to integrate R & D activity for its successful growth.

Quality Specifications for Ayurvedic Herbal Raw Materials: A Review of the Current Status of Standardization of Herbs With Special Reference to Marker Compound Analysis

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Abstract

Increasing demands for herbal medicines have inevitably raised the issues of how they are obtained and maintenance of their quality. There has been tremendous quality consciousness of herbal formulations in countries like the USA, member countries of the European Union, Australia, etc. Unfortunately, however, in India, the concept of quality has not received much attention. In this paper, an attempt has been made to review the current status of standardization of medicinal plant species, with special reference to marker compound analysis.

Introduction

The World Health Organization (WHO) estimates that about 80 per cent of people living in developing countries rely almost exclusively on traditional medicines for their primary health needs. Since medicinal plants form the backbone of traditional systems of medicine, the implication is that 3,300 million people in under-developed and developing countries utilize medicinal plants on a regular basis. This assumption does not include developed countries, where interest in herbal medicines and dietary food supplements has increased dramatically in the last decade. In order to maintain this ever-increasing trend, it is imperative to obtain and maintain the quality and purity of the herbal raw materials and finished products, based on internationally recognized guidelines. Therefore the need of the hour is to subject these medicinal plant species to rigorous modern scientific testing methods in order to regulate and guarantee their quality and purity.

Current Status of Standardization

In a number of resolutions, WHO has emphasized the need to ensure the quality control of herbs and herbal formulations through the use of modern scientific techniques. Internationally, as well as domestically, several pharmacopoeia from various countries, including Britain, Japan, the United States, Germany and India have provided monographs stating quality parameters and standards for a number of medicinal herbs and herbal products in their respective countries. More recently, the European Scientific Co-operation for Phytotherapy (ESCOP) has brought out a series of monographs on medicinal herbs.

The British Herbal Pharmacopoeia (BHP), brought out by the British Herbal Medical Association in 1971, and re-published in 1983, contains 233 monographs and quality control tests for common herbs used in the United Kingdom. These parameters include: synonyms; macroscopic and microscopic descriptions; physico-chemical parameters (organoleptic tests, moisture content, content of ash/acid

insoluble ash/water soluble ash, foreign organic matter and extractive water/alcohol); chemical parameters (identification tests and contents of alkaloids/volatile oil), and therapeutics (action, indication, specific indication, combinations used, precautions, toxicity, incompatibilities, contraindications and side effects).

The British Herbal Compendium (BHC), published in 1992, contains monographs on 84 medicinal plant species. BHC has brought together a wide range of scientific and regulatory information. In fact, it is basically an extensive compilation of various categories of scientific information on therapeutics, pharmacology, safety, toxicity etc., on widely used drugs. It also includes the regulatory status of herbs, though it does not lay down any quality tests of its own.

Published by the Department of Health, Government of India, in 1989, the Ayurvedic Pharmacopoeia of India contains monographs for 80 commonly used herbs in the Ayurvedic system of health care. These monographs recommend basic physico-chemical parameters for quality maintenance, but since this has been the first initiative by the Government towards laying down standards for Ayurvedic herbal drugs, the monographs do not include tests based on modern scientific techniques such as chromatography, electrophoreses etc. Nor is marker compound analysis on a quantitative or qualitative basis recommended. The key parameters covered in the Ayurvedic Pharmacopoeia are: an introduction (the scientific name, habit and habitat, occurrence and distribution of the species); macroscopic and microscopic descriptions; identity, purity and strength (the presence of foreign matter, total ash, acid insoluble ash, alcohol soluble extractive and water soluble extractive); constituents (a few important compounds); Ayurvedic properties and actions; important formulations and therapeutic uses.

The Chinese Herbal Pharmacopoeia (CHP) has been published in two volumes containing 1751 monographs of substances and articles. A total of 784 monographs, including 509 monographs on Chinese traditional medicaments and 275 monographs on Chinese patented preparations and single ingredient preparations are contained in Volume I.Volume II contains 967 monographs of chemicals, biochemicals, antibiotics, radiopharmaceuticals, biological and pharmaceutical preparations. CHP recommends the use of identification tests such as physico-chemical and microscopical characterization, and also contains provisions for gravimetric and titrimetric tests for a number of herbs. It further recommends chromatographic finger printing for a number of herbs. The key parameters covered are: an introduction (the source of the drug); identification (histology, powder microscopy, content of total ash and acid insoluble ash, and chromatography); assay (for volatile oil, alkaloids, glycosides, glucosides, saponins etc.); processing of the drug; action; indications; dosage and storage.

In the United States too, with increasing interest being shown in herbal products, the process of developing the monographs has picked up steam. The United States Pharmacopoeia (USP) passed a resolution in March 1995 to consider the development of monographs for herbs. Based on this resolution, USP is now formulating monographs on botanicals. Around 8 exhaustive monographs have been published by USP and others are being currently developed. The monographs covered by USP are very detailed and contain provisions for establishing the botanical identity of the herbs, as well as their chemical sanctity. USP recommends that marker compound analysis be carried out on a quantitative basis and lays down their limits. The key parameters incorporated in the latest USP National Formulary Supplement-7 are: an introduction; packaging and storage; labeling; USP Reference Standards; botanic characteristics (macroscopic and histiology); identification; contents of total ash, acid insoluble ash, water soluble ash, water, alcohol soluble extractive, foreign organic matter, heavy metals, pesticide residue, volatile oil, microbial limits, starch and gingerol).

There are a few other compilations of herbal monographs in other parts of the world, including the European Scientific Co-operative for Phytotherapy (ESCOP) monographs, the WHO monographs and the Japanese Standard for Herbal Medicines. However, the most widely acknowledged monographs are those produced by the German Commission E, a division of the German Federal Health Authority. It has published 330 monographs for herbs used in German folk remedies.

A review of all of these Pharmacopoeia and monographs reveals that while most of the herbal monographs compiled and brought into effect, generally recommend compound testing, Indian Pharmacopoeias such as the Ayurvedic Pharmacopoeia of India, the Indian Pharmacopoeia etc., do not recommend the same. The review has thus shown that the practice of standardization of herbs on the basis of sophisticated tools such as chromatography is not much in vogue in India.

However, one of the most significant efforts to bring out herbal monographs in tune with modern scientific testing methods in India is currently being pursued by the Indian Drug Manufacturers Association (IDMA), in coordination with various renowned scientists in the field and in Herbal Industry. The Pharmacopoeia, the first volume of which is likely to be released soon, will focus on microscopical identity as well as marker compound analysis of the herbs, in addition to the other routine tests such as physico-chemical parameters and information such as therapeutic categories, pharmacology, safety and dosage form. In general, the monographs will cover almost all of the desirable parameters for quality assessment. The key parameters covered are: synonyms; an introduction (family, part used and distribution in nature); macroscopic and microscopic descriptions; chemical constituents (major as well as minor compounds); TLC identity tests; assay/analytical methods (HPLC analysis for marker compounds); quantitative standards (foreign matter, content of total ash, acid insoluble ash, alcohol soluble extractive and water soluble extractive); adulterants/substitutes; pharmacology; therapeutic category; safety aspects; dosage and references.

Standardization of Herbs Using Marker Compound Analysis

One of the best methods of standardizing herbs and herbal formulations, based on modern scientific tools is chromatography. It not only helps in establishing the correct botanical identity of the herbs, but also helps in regulating the chemical sanctity of the herbs. One such technique is marker compound testing and finger print analysis.

Every herb has a range of secondary metabolites, which are produced as a result of metabolic activities occurring in the plants. These compounds, either alone or in combination with others, are reported to be primarily responsible for the specific physiological changes or therapeutic action in the human body when administered as a medicament or health supplement. Hence it would be more practical to subject the individual herb to testing for the presence of these compounds. Thus, for example, Aswagandha *(Withania somnifera)* can be assayed for withanolides; Guggulu *(Commiphora mukul)* for guggulusterones; Neem *(Azadirachta indica)* for Azadirachtin or Nimbidine; Haridra *(Curcuma longa)* for curcuminoids etc. For testing purposes, these compounds are referred to as marker compounds. On the other hand, in cases where the chemical composition of the herb has been studied, but it is not clearly established as to whether these chemical entities are responsible for some particular action, any compound which is predominantly present in the herb can be utilized as a marker compound for the purpose of standardization. This group represents compounds like Aegelin in Bilva *(Aegle marmelos)*; Shatawarine in Shatawari *(Asparagus racemosus)*; Fistulin in Aragvadha *(Cassia fistula)* etc. Though the activities of these compounds are not linked with the therapeutic purposes of the herbs, they can be used for standardization purposes since their presence has been well established.

Different chromatographic methods are used to analyze the marker compounds in herbs with the help of modern scientific tools. High Performance Thin Layer Chromatography (HPTLC) is most frequently used where only finger printing of the herbs is required, without quantifying the compounds, though the same can be quantified with the help of a densitometer. For quantitative analysis, High performance Liquid Chromatography (HPLC) is generally preferred. However, the method of standardization used in this technique is a tedious exercise as the availability of literature for individual compound analysis is too sparse. The Gas Chromatograph is used mainly for volatile material such as essential oils and perfumes.

Currently, there are a few herbs like Ashwagandha *(Withania somnifera)*, Mentha *(Mentha sp.)*, Kalmegh *(Andrographis paniculata)* and Senna *(Cassia angustifolia)* which are being standardized on the basis of marker compound analysis or chromatographic finger printing. However, there are few industrial units or laboratories to undertake such testing. As far as phytochemical studies are concerned, the medicinal plants of India have been substantially investigated, and at least the major components have been identified. Hence there exists an opportunity to select the compounds which can be used for standardization purposes, based on the method of isolation of these compounds.

A Summary of the Marker Work Achieved and Required, and Current Status of Standardization for Selected Species, Based on Their Therapeutic Importance

Table 1 provides a summary of the current status of standardization efforts with regard to 48 medicinal plants which have been selected on the basis of their therapeutic importance. An analysis of the availability of monographs for these species, which is included in the Table, reveals that while herbs such as Yastimadhu *(Glycyrrhiza glabra)*, Senna *(Cassia angustifolia)*, Tagar *(Valeriana wallichi)* and Shunthi *(Zinziber officinale)* are covered by most of the Pharmacopoeia referred to in this paper, there are others, which besides their importance in Indian Systems of Medicine, have not received much attention as far as standardization is concerned. The Table shows that a number of species, including Shatawari *(Asparagus racemosus)*, Salaiguggul *(Boswellia serrata)*, Keshar *(Crocus sativus)*, Mustak *(Cyperus rotundus)*, Brihati *(Solanum indicum)*, Arjun *(Terminalia arjuna)* etc., are not represented in any of the Pharmacopoeia described. The Table also shows the current status of marker testing for these species, and lists those for which these tests should be carried out in order to ascertain their quality and purity.

Table 1. Marker Work Achieved and Required, and Current Status of Standardization for Selected Species, Based on Their Therapeutic Importance.

Sl. No.	Name of Species	Marker Compounds	Availability of Mono grams
1	*Acadia arabica*	Arabic Acid	1
2	*Acasia catechu*	Catechin	1,3
3	*Aconitum Heterophyllum*	Aconitin	1
4	*Aegle marmelos*	Aegelin	1
5	*Asparagus recemosus*	Shatawarine	
7	*Boerhaavia diffusa*	Punarnavine	1,5
8	*Boswellia serrata*	Boswellic Acids	
9	*Cassia angustifalia*	Sennosides	1,2,3,4,6,8
10	*Cassia fistula*	Fintuline	1

Table 1. Marker Work Achieved and Required, and Current Status of Standardization for Selected Species, Based on Their Therapeutic Importance.

Sl. No.	Name of Species	Marker Compounds	Availability of Mono grams
11	*Centetta asiatica*	Aiaticoside	3,5,8
12	*Cinnamomum tamala*	Eugenol	1
13	*Commiphora mukul*	Guggulu sterones	1
14	*Crocus sativus*	Crocetin	
15	*Circuligo orchiodes*	Lycorine	4
16	*Curcuma longa*	Curcummoides	1,4,5,8
17	*Cyperus rotundus*	Cypeerotundone	
18	*Embelia ribes*	Embelin	1
19	*Eugenia caryophylata*	Eugenol	1,4
20	*Evolvulus alsinoides*	Evolvine	
22	*Glycyrrhiza glabra*	Glycyrrhzin	1,2,3,4,5,8
23	*Hollarrhena antidysenterica*	Kurchine/Kurchicine	1
24	*Hyoscyamus niger*	Hyoscyamine	1
25	***Ipomoeia digitata***		
26	*Melia azadirachta*	Nimbidine	
27	*Mentha arvensis*	Menthol	2,6
28	*Ocimum basilicum*	Eugenol29	Phyllanthus embalica 29
29	*Phyllanthus embalica*	Phylembelin	1,4
30	*Phyllanthus noruri*	Phyllanthin	1
31	*Picrorrhiza kurroa*	Kutkin	4,5
32	*Piper longum*	Puiperine	4
33	*Piper nigrum*	Piperine	4
34	***Plantago ovata***		**2,3**
35	*Santalum album*	Santalol	4
36	***Saraca asoca***		**1**
37	*Saussurea lappa*	Saussurine	1
38	*Solanum indicum*	Solanocarpine	1,5
40	*Swetia chirata*	Chiratin	1,3,5
41	*Terminalia arjuna*	Arjunini	
42	*Terminalia chebula*	Chebulinic Acid	1,4
43	*Tinospora cordifolia*	Giloin	1,5
44	*Trigonella foenum-gracum*	Trigonalline	4
45	*Valeriana walliehi*	Valerine	1,2,3,6,7,8
46	*Withma somnifera*	Withnolids	1,5
47	***Woodfordia fruticosa***		**1**
48	*Zinziber officinale*	Gingerol	1,2,3,4,6,7,8

Note: Shaded herbs are those for which marker work has been achieved ones represent those for which further chemical studies are required to establish the chemical profile of the herbs. Regarding the remaining species, though marker compounds can be designated on the basis of exhaustive chemical studies done on the species, the tests have not been carried out extensively due to the existence of various bottlenecks.

1. Ayurvedic Pharmacopoeia; 2. British Herbal Compendium; 3. British Pharmacopoeia; 4. Chinese Pharmacepoeia; 5. Herbal Pharmacopoeia (likely to come); 6. ESCOP Monographs; 7. United States Pharmacopoeia (to be included); 8. WHO Guidelines

Hence it is clear that chromatographic testing methods, such as finger printing and marker compound analysis can play a vital role in accurately standardizing herbs and herbal formulations, and should be adopted by various laboratories and industrial houses to maintain the quality of these products. Marker testing is, however, in no way a substitute for other tests related to areas such as physico-chemical parameters, microscopic characterization etc. It is instead an efficient means of ensuring the identity and purity of herbal materials. Before concluding, a summary of some of the constraints relating to the adoption of these techniques for regular testing of herbs and herbal formulations are provided below.

1. Non-availability of library or marker compounds isolated from herbs in their pure state, for use in analysis. Isolating every marker compound for testing purposes is thus a tedious process.
2. Lack of proper communication and the will for quality assurance which is necessary to undertake the tedious process of testing.
3. Non-availability of a system which produces standards or proper identification of herbs in the industry.
4. Poor availability of public testing laboratories to support industry in routine analysis.
5. The high costs involved in the procurement of sophisticated imported instruments such as HPTLC.

The Resource Base: Cultivation and Processing Technologies

Opportunities and Constraints for the Production and Development of Medicinal Plants in India.

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Introduction

Geographically, India is situated in the tropical zone and is home to a variety of environments ranging from high snow-capped mountains to tropical forests, and from hot as well as cold deserts and scrub land to lush fertile plains and valleys, mangroves and coastal areas. These diverse climates and ecological conditions have resulted in a tremendous diversity of habitats for India's rich plant resources and a very enviable natural asset with regard to biodiversity, equalled only by a small portion of China and certain sections of Central America and Brazil. It has been reported that almost every plant family in the world is represented in India's rich flora.

Given her rich natural heritage, India is faced with two options: she can either ignore and exploit her resources or she can conserve and develop them in a sustainable manner. If she adopts the latter option, she can realistically expect to become a veritable global "garden" of medicinal plants in the near future.

In addition to her biodiversity, India is also home to the Ayurvedic science of health care, which has existed for over 5000 years in the country. Ayurveda is perhaps the only organized scientific system in the world which advocates a comprehensive approach with regard to medicinal plants, involving ecological development, cultivation of species, use of specific parts of particular plants, specified harvesting, processing and preservation techniques, and diagnosis and treatment of diseases. India thus possesses a unique treasure - rich flora as well as the science for its rational and sustainable utilization.

Utilization of Medicinal Plants in India

A world-wide comparison of patronization of modern and alternative medicinal systems has shown that 75 per cent of the world's population utilizes alternative systems of medicine, which are generally cheaper and safer than allopathy, and which are more easily available in rural areas (source: Director, RRL, Jammu). However, within the Indian context, herbal medicines constitute approximately Rs. 1 000 crores out of a total of Rs. 12 000 crores, the balance being constituted by allopathic pharmaceutical industries, according to an Organization and Industry guesstimate. Furthermore, India's share of the world market in natural health products is miniscule, with her exports constituting just 0.57 per cent of the market, as compared to 3.6 per cent for Chinese exports in 1997 (source: APEDA). This is largely due to neglect, and the description of Indians as "donkeys carrying sacks of gold on their backs, not knowing that they are full of gold" contains a large measure of truth.

Table 1 shows the scenario with regard to usage and classification of medicinal plants in India, while Table 2 provides an analysis of the medicinal plant parts used in the Ayurvedic industry.

Table 1: The Scenario of Medicinal Plants in India

a). General scenario:

Total number of plants known in India	45 000
No. of plants used in Ayurveda	1 000
No. of wild species of plants used by tribals	9 5000

b) Further classification of the 9 500 species mentioned above :

No. of plants with direct medicinal use	7 5000
No. of plants having edible utility	3 9000
No. of plants related to new leads and claims	950
No. of plants providing fiber	525
No. of plants used by tribals as pesticieds	300
No. of plants used as bio-pesticedes	175

Source: IDMA Bulletin - Vol. XXVII (16) 1996 - pp. 469 -70

Table 2: An Analysis of Medicinal Plant Parts Used in the Ayurvedic Industry

Part Used	Percentage (%)
Roots	29.6
Rhizome	4
Leaves	5.8
Flowers	5.2
Fruits	10.3
Seeds	6.6
Stems	5.5
Bark	13.5
Wood	2.8
Whole Plant	16.5

Source: FRLHT, Research Department, August 1997

Within South India alone, a total of 1079 species of medicinal plants have been identified, of which 344 are herbs; 220 are shrubs; 354 are trees and 127 are climbers (source: FRLHT Research Dept., 1997).

Table 3 shows the Alphonso-Ratnagiri Matching of medicinal plants in Maharashtra, which has been prepared according to Ayurvedic guidelines for the classification of medicinal plants by ecological zones. Ayurveda classifies ecological zones/habitats according to soil conditions, and identifies the source of a particular medicinal plant from a specific ecological zone. It thus distinguishes and attaches significance to the natural habitat of a particular species. This knowledge, which has not been contradicted by modern phytochemical findings, can be used to avoid both under-utilization as well as over-exploitation of medicinal plants.

Table 3: ALPHONSO-RATNAGIRI Matching of Medicinal Plants in Maharashtra

ANUP DESH Coastal regions of Maharashtra: Thane, Raigad, Ratnagiri and Sindhudurg Districts; coastal lands and plains	**JANGAL DESH** Western Ghats, including hills of Konka and West Maharashtra, Satpuda Hills and Mahadeo Mountains	**SADHARAN DESH** Deccan Plateau, including plains of west Maharashtra, North Maharashtra, Marathwada and Vidarbha
Examples: 1. *Eclipta alba* Bhringraj) 2. *Cyperus Rotundus* (Musta) 3. *Piper longum* (Pippali)	**Examples:** 1. *Acacia catechu* (Khadir) 2. *Terminalia belerica* (Bibhitaki) 3. *Terminalia chebula* (Haritaki)	**Examples:** 1. *Aloe vera* (Kumari) 2. *Withania somnifera* (Ashwagandha) 3. *Ocimum sanctum* (Tulsi)

Reference: Charak Samhita, Kalpa-Sthana, Chapter 1, SDARF Interpretation

Constraints and Suggested Solutions

While there are numerous difficulties associated with cultivating medicinal plants, the opportunities and prospects in this field are concomitantly bright. Given the use of a rational and systematic approach and a sincerity and commitment of purpose, it is possible to embark on this endeavour without foreign technology and/or collaboration since the expertise exists within the country.

Table 4 provides a summary of some of the most salient problems with regard to cultivation of medicinal plants in India, with suggested solutions.

Table 4: Problems and Suggested Solutions Regarding Cultivation of Medicinal Plants

Problems	Suggested Solutions
1. Non-availability of verifiable data on avaiability and consumption of medicinal plants	National survey by a professional group
2. Absince/ignorance of cultivation technology	Survey of the avialability of cultivation technologies at different centres and imparting of these to prospective cultivators
3. Ignorance of cultivation economics	Study commissioned on economics of cultivation in roder of priority
4. Land availability : a) Land Ceiling Act b) State Forest Act	Release of suitable land
5. Inadequate irrigation facilities	Provision of attractive incentives for developing inovative methods of irrigation.
6. Non-availability of planting materials	a) Encourage nurseries in appropriate ecological zoned to make available planting materials. b) Develop tissue culture wherever required.
7. Lack of knowledge & training in post-harvest handling of medicinal plants.	Development and imparting of proper training in processing, warehousing, handling and preservation techniques.
8. Lack of quality assurance and standardization of medicinal plants	a) Develop standardization, quality control and finger printing techniques and impart training to cultivators. b) Develop decentralised public testing laboratories for quality assurance available to small farmers.
9. Inadequate marketing set-up for selling cultivated medicinal plants	a) Develop appropriate links between cultivators and consumers. b) Encourage appropriate buy-back arrangements.

It is evident from the table above that the most critical problem concerns the lack of reliable/verifiable data on availability and consumption of medicinal plants. A systematic survey should therefore be conducted on a national scale in order to review the consumption as well as availability patterns of medicinal plants within the country, both from the wild as well as from cultivated sources. This task should be carried out by a professional surveying agency and should include all licensed manufacturers of Ayurvedic medicines as well as other consumers of herbal products, both in the formal as well as

the informal sectors. This national inventory is of critical importance as it will provide the foundation for national-level planning, and it should be implemented at the earliest. The resulting data will facilitate the systematic channeling of available resources and inputs forward sustainable development within a given time frame.

Other areas of concern highlighted in the table include availability of land and irrigation facilities for cultivation of medicinal plants. The provision of land is a priority activity, while expeditious development of cultivation cannot be achieved through sole dependence on natural sources of irrigation such as rain and floods. It is therefore necessary to channelize perennial sources of water through dams, bore-wells, drip-irrigation and other innovative measures aimed at the conservation, preservation, storage and off-season utilization of water.

Finally, issues relating to standardization and quality control are of great importance in this area and must be addressed at the centralized or decentralized levels by the Government or by NGOs. Finger-printing techniques relating to phyto-chemical markers need to be developed to guarantee quality assurance.

Recommendations

In view of the opportunities outlined in this chapter, and the required efforts and inputs discussed above, the establishment of a coordinating agency, the National Herbal Development Board (NHDB) is essential. This would be an autonomous Board, similar in nature to bodies such CHEMEXIL and NDDB, which would be responsible for coordinating the efforts of the different Ministries as well as channelizing resources to different operating agencies in order to achieve optimal results. By functioning as an advisory body to the Ministries of Environment and Commerce, it would aim to achieve a balance with respect to conservation and preservation of the environment and economic growth. Some of the key objectives of the proposed NHDB are summarized below:

1. To conduct surveys through a competent agency in order to assess the availability of and demand for medicinal plants, both from the wild as well as from cultivated sources.

2. In view of the above, to evolve and periodically update an appropriate Alphonso-Ratnagiri Matching, nation-wide, for cultivation, marketing and export of medicinal plants in order to match supply with demand, and also to match particular species with appropriate ecological zones.

3. To identify and devote special attention to endangered species and to evolve a phased ban on their collection from the wild, taking into consideration the gestation period required to replace the collected plants with the cultivated plants.

4. To offer, either directly or through appropriate sources, financial assistance and/or incentives to agencies interested in cultivating medicinal plants.

5. To impart information on cultivation practices to interested parties through training courses, printed material or any other suitable media.

6. To support research on all aspects of medicinal plants, with special emphasis on improving quality and availability of these plants.

7. To coordinate the activities of different bodies to avoid duplication of work and to prevent neglect of any significant aspect of research, cultivation, processing, trade and export of medicinal plants.

8. To stimulate and coordinate multi-locational research in developing cultivation technologies for medicinal plants.

9. To act in general as a body representing the interests of all persons and organizations engaged in cultivation, trade and processing of medicinal plants; to mediate between the growers and the users; to develop buy-back arrangements for the cultivated material, and to advise policy-makers in the Government and in Industry regarding matters related to medicinal plants.

10. To create facilities for certification of medicinal plants as being organic or otherwise.

11. To encourage NGOs, industry and farmers to undertake cultivation of medicinal plants as per the blue print outlined above, in order to bring about the "Green Herbal Revolution" involving exports worth Rupees 10 000 crores by the year 2010, which is its ultimate objective.

To conclude, if the proposed NHDB is set up and is able to achieve the objectives described above, India can realistically hope to become a global garden for medicinal plants in the near future.

Technology and Infrastructure Needs for Cultivation, Processing and Preservation of Medicinal Plants

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Introduction

Medicinal plants constitute the oldest known health care products used by human beings throughout the world, and while the state of the resource base varies from country to country, depending on ethnological, medical and historical backgrounds, their importance in providing health care continues to grow in a global context.

Medicinal plants also contribute significantly to pharmacological research and drug development, not only in situations where plant constituents are used directly as therapeutic agents, but also when they are used as the raw materials for the synthesis of drugs, or as models for pharmacologically active compounds with regard to drug synthesis. Prevention of exploitation and regulation of exports are therefore necessary for the conservation of medicinal plants in order to ensure their availability in the long term. This is an issue which has been addressed in the United Nations Convention on Biological Diversity, which states that conservation and sustainable use of biological diversity is of critical importance for meeting food, health and other vital needs of the growing world population, and for which purpose, access to and sharing both of genetic resources and technologies is essential.

Legislative controls with respect to medicinal plants have not evolved around a structured control model. Different countries have adopted different definitions of medicinal plants as well as different approaches with regard to licensing, dispensing, manufacturing and trading with the aim of ensuring safety, quality and efficacy of products derived from medicinal plants.

In India, there is an extensive body of folk knowledge regarding the traditional uses of herbal medicines, mostly based on Ayurveda which is concerned not only with curative measures but also preventative measures against various ailments and preservation of life. This is what makes Ayurveda one of the most complete systems of medicine and health care in the world. Ayurvedic formulations generally involve the use of several herbs which work in conjunction with each other, diluting each other's toxicity and enhancing their therapeutic values. It is difficult to quantify the market size for Ayurvedic medicines since a large number of practitioners devise their own medicinal formulations. It is however estimated that the present annual turnover of herbal products manufactured by large companies is approximately US$ 300 million.

The Siddha system of medicine closely resembles Ayurveda in terms of its principles and practices, and is widely practised in Southern India. As with Ayurveda, it is predominantly based on the use of herbal medicines. Similarly, the Unani system, which is practised by a certain section of the Indian population, uses medicinal plants as the major ingredients of formulations.

Issues Relating to Identification and Collection of Medicinal Plants and Plant Products

The majority of the medicinal plants used by Ayurvedic physicians and by the manufacturers of Ayurvedic products are collected from the wild, mainly from forest regions. As a result, uniform quality cannot be guaranteed, thus creating serious constraints regarding verification of authenticity. The situation is further aggravated by what amounts to almost an absence of standard methods for evaluating the botanical origins, especially of dried raw material. Further confusion results from the identification of plant materials when a particular drug is constituted from more than one species which may have significant differences in morphological and taxonomic characteristics. Adulteration is rampant in cases where the identity of the plant source is not confirmed, or is still unknown, and the substituted material is obtained from an altogether different source.

The botanical identities of the majority of plants mentioned in the pharmacopoeias of various indigenous systems of medicine have been established due to the introduction of the modern system of plant classification in India. There are, however, a number of crude drugs for which the identity of the plant source has not been confirmed or is doubtful. *Boerrhavia diffusa* and *Trianthema portulacastrum*, for example, are considered to be the sources of "Punarnava," and "Sariva," whereas in fact four other species - *Hemidesmus indicus, Cryptolepis buchanani, Decalepis hamiltonii* and *Ichnocarpus fruitscens* constitute the source. In such cases, the actual source of the crude drug can only be identified after conducting detailed chemical and pharmacological studies. Such studies, which have been conducted in a number of cases, have yielded some very interesting results. Thus, for example, detailed chemical investigations of *Bacopa monnieri* and *Centella asiatica*, the two plants variously ascribed the name, "Brahmi," have revealed entirely different phyto-chemical compositions. The former species contains the alkaloids brahmine, herpestine, gamma amino butyric acid and bacoside A and B, which have been found to have a significant effect on brain function, while the latter species contains asiaticoside, brahmoside, hydrocotyline etc., whose properties bear a negligible resemblance to the properties ascribed to the drug, "Brahmi," in the available literature.

The effect of agroclimatic conditions on the chemical composition and therapeutic properties of a medicinal plant species are well known and are also recognized in Ayurveda. "Haritaki" (the fruit of *Terminalia chebula)* can be cited as an example - seven varieties of the species originating in different parts of India are known to have different therapeutic properties.

The concentrations of the required chemical constituents in a plant are strongly influenced by the stage of growth of the plant, as well as the season. Classical Ayurvedic literature accords great importance to the period of collection and the stage of growth of a required plant or plant part. In a majority of cases, stress is laid on the collection of ripe parts. A study of the total alkaloidal content of the leaves of "Vasaka," (*Adhatoda vasica*) during different periods of the year revealed that the highest yield (2.5%) is obtained during the months between July and October when the flowering period is over and the fruits are at different stages of maturation. Similarly, studies on "Kutaja" (the bark of *Hollarrhena antidysenterica)* revealed a maximum concentration of total alkaloids (3.2 - 3.9%) during the two flowering seasons, that is, one during the months of March, April and May, and another from September to October, when a second flowering occurs. The stage of maturation of the plant part to be collected is also an important factor. The fruits of *Terminalia chebula* are collected when these obtain optimum size but are still green. The roots of *Withania ashwagandha* are dug out just 8 to 10 months after planting, while the stem of *Tinospora cordifolia* is collected at full maturity.

It is thus evident that the quality of medicinal plants is related to the geographical origins, time and stage of growth when collected and the post-harvest handling procedures used. The raw material presently available in the Indian Medicinal Plants Industry is procured from more than one geographical region, with collection in most cases being done by villagers or tribals residing in the vicinity of forests. Plant parts are collected without considering their stage of maturity, and are dried haphazardly and stored for long periods of time under unsuitable conditions. Considering the gravity of the situation, immediate steps should be taken to ensure the quality of plant-based crude drugs employed in the manufacture of drugs based on traditional systems of medicine. This paper addresses this issue by focusing on suitable cultivation practices, post-harvest requirements and the drying and storage conditions required for ensuring the quality of these drugs.

Cultivation - Benefits and Practices

In order to avoid some of the anomalies described above, organized cultivation of select species should be adopted. This would play an important role in preserving a number of endangered species which are being threatened due to exploitation and rapid deforestation. Some of the more specific advantages of introducing cultivation of medicinal plant species are mentioned below:

1. Utilization of cultivable wastelands.
2. Availability of improved quality raw materials in substantial amounts to meet the requirements of industry, thereby reducing costs.
3. Further cost reduction can be achieved in some cases through inter-cropping practices.
4. Increased percentage of active constituents in the plant material through the use of tissue culture techniques.
5. Development of insect-resistant and improved varieties through genetic engineering
6. Creation of additional sources of income for economically disadvantaged people in rural areas.
7. Contribution to the overall economic growth of the industry in particular and the country in general.

The above measures would contribute to enhancing bioefficacy of medicinal plant species and would ensure consistent quality for every commercial batch produced. Ultimately, this would lead to an improvement in the global image of Ayurvedic medicines.

Some of the ideal cultivation practices which should be adopted are given below:

1. Development of agrotechnology involving:
   a) Selection of the right kind of planting material.
   b) Selection and control of growth promoting factors.
   c) Use of appropriate fertilizers and pesticides.
   d) Harvesting of the correct plant part during the right season and at the right time.
2. Application of these techniques through organized cultivation in field trials.
3. Appropriate training imparted to farmers.

4. Control and regulation of post-harvest processes such as drying, and application of controlled drying conditions as per the requirements of individual species.
5. Proper storage and transportation of crude drugs.

Post-Harvest Requirements

Most of the medicinal plants collected from the wild or through organized cultivation need to be properly processed not only to retain their chemical constituents, which are responsible for their biological activity, but also for their proper storage and transportation. Appropriate drying, which is dependant on the particular plant material being handled has to be undertaken before the material reaches the ultimate consumer via the manufacturer. Medicinal plants are very rarely used in the fresh state soon after harvesting - the majority of plants require partial or complete drying for proper storage so that there is no microbial growth or fungal contamination.

Parameters affecting drying process

A dry climate is most conducive to efficient and quick drying as compared to temperate and tropical climates.

Crude drugs are liable to develop moulds, and hence the drying apparatus should be positioned near the fields. As a result, the chances of decomposition of the material are considerably reduced.

The freshly harvested plant material should not be stored in piles for a long duration of time, but should be spread evenly in thin layers in order to facilitate turning. This increases aeration and reduces the drying time. Certain materials require size reduction and processing techniques like washing and fermentation for effective drying.

With regard to regulated industrial drying in all seasons and climatic conditions, the raw materials should be dried in airy, dry, well ventilated premises, usually on rust-free steel mesh frames. Natural drying can be done out in the open in sunny, partially shaded areas and in well ventilated sheds. However, direct sunlight may cause deterioration of active principles due to the high intensity of UV rays.

The duration of drying depends on the plant part being dried and the moisture content of the plant. Aerial parts dry more quickly than underground parts.

Storage

Storage plays an important role in the preservation of crude drugs, with the keeping quality being dependant on temperature during storage, moisture content and exposure to air and light. The ideal temperature for storage should be below 25 degrees Celsius, with a moisture content not exceeding 10 per cent in the material, depending of course on the nature of the particular species being stored.

To conclude, the measures relating to cultivation, post-harvest requirements and storage conditions, described above, if adopted would make a significant contribution to the medicinal plants industry in India by ensuring adequate supplies of high quality medicinal plants and by conserving the medicinal plants resource base in the country.

Socio-Economic and Development Issues

Strategic Planning for Socio-Economic Development Based on Medicinal Plants - A Draft Proposal

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You will never really possess what you inherited unless you work for it and earn it
-A German Proverb

Introduction

The Indian subcontinent possesses a wealth of biodiversity, which, along with associated indigenous knowledge, attitudes and skills, has been inherited and preserved for millenia. However, as the above quoted proverb states, we will have to truly work hard to earn or re-earn our heritage. Our traditional knowledge of stable ecosystems, attitudes of reverence for life and skills in the pragmatic and sustainable use of our rich natural resources will have to be rekindled through a concerted effort on a national scale. Strategic planning will be required for the implementation of action programs, whose emphasis should be on the role of medicinal plants as chain multiplier for socio-economic development and cultural renaissance. For such an endeavour to achieve the goals described above, a draft proposal needs to be evolved as the first step for debates and decisions. This paper provides an outline of such a proposal.

The Objectives of the Mission

The vision of a thriving eco-friendly India, based on the ethos of reverence for life, non-exploitative commerce and industry and sustainable and recycling in the use of resources, should guide the mission and the strategic objectives of a long-term program focusing on medicinal plants. Such a vision will encompass concepts such as human dignity, care and compassion for animals and plants, sustainable agriculture, self-employment, a clean and safe environment, decentralization and community participation as its central considerations. More specifically, the objectives of medicinal plants based socio-economic growth will be to develop and utilize human and plant resources in a coordinated fashion in order to create job opportunities, village level industries, social forestry programs and export revenue. Regular and rational use of medicinal plants would also lead to higher productivity and would improve the health indices of the communities concerned.

Formation of a National Level Network, Coordinated by an Apex Body (NMPASD) to Achieve These Objectives

The reality that health is a state-level program and that medicinal plants directly relate to health status, suggests that a national network would be required for facilitating local development of medicinal plants for socio-economic growth. This would also avoid duplication of efforts and would optimize resources through the use of a state-of-the-art information technology base. The network would be coordinated by an apex autonomous body, which could be known as the National Medicinal Plants

Authority for Socio-Economic Development (NMPASD.), and which would have to be constituted by an Act of Parliament. It would be a trans-ministry organization, reporting directly to the Prime Minister. NMPASD should be provided with adequate funds, personnel, telecommunication facilities and other resources required to guide and coordinate the national network. The central organization would have to be managed as an efficient and effective corporation, incorporating concepts such as accountability and transparency of performance, and is envisioned as being a truly learning organization.

The Mission and Objectives of NMPASD

The mission of the organization will be to develop a knowledge-based approach to enhance socio-economic development through technology, industry, commerce and the use of medicinal plants. The socio-economic impact of the health multiplier effects of medicinal plants will also be qualitatively and quantitatively evaluated. A strategy which analyses and weighs assumptions, based on available information and an environmental scan, will be evolved and modified on the basis of operational experience. The traditional sequence of innovation, development, agriculture/manufacture and marketing will have to be reformulated and restructured into a cross-functional synchrony of a team or task-oriented group of varying constituents. The primary objectives or goals of NMPASD, which are based on its mission and strategy are presented below:

1. To identify, list and evaluate the organizations connected to medicinal plants in the areas of research and development, agriculture, manufacture, marketing and utilization.

2. To create a relevant and purposeful database from a survey of medicinal plant usages and opportunities.

3. To prioritize medicinal plants for wide spread and localized collection, cultivation, standardization, manufacture and marketing.

4. To conduct training programs, nationally and regionally, to develop and/or empower personnel from the national network.

5. To evolve computer technology for capital investment decisions, based on actual analysis of the rate of return, the pay out period, opportunity costs, risks of failure, product life-cycle contributions etc.

6. To evolve mechanisms at the Gram Panchayat level to develop the medicinal plants resource base for use in local health and enterprise.

7. To commission task-oriented teams to implement time bound projects focusing on major opportunities for socio-economic development in the most disadvantaged areas.

Action programs to be implemented

The action programs will essentially be run at the district level and will be coordinated by the state-level interministry autonomous Council on medicinal plants for socio-economic development. The Chairman of the Council will report to the Chief Minister of the concerned State, and precise action programs, focused on socio-economic development will be formulated, based on specialist knowledge, local initiatives and existing opportunities. Gram Panchayats will be involved in project planning and

for identifying local opportunities. It is proposed that each Panchayat should have an "Aushadhi-Udyan" (Rural Herb Gardens) for cultivating medicinal plants for local use. This would not only generate rural employment, but also the sharing of know-how and outlets amongst Panchayats. At the district level, socio-economic parameters of growth will be monitored, and local level business organizations, opinion leaders and management expertise will be actively involved in enterprises in order to foster professionalism and community involvement. A tentative list of medicinal plants to be cultivated in rural herb gardens is presented in Table 1. It will need to be modified and expanded, as per local needs and agronomic conditions. Formularies will have to be prepared of plants commonly found and used for health and cosmetic purposes in local languages.

Table 1: A Proposed List of Medicinal Plants and Their Properties to be Included in the Rural Herbal Gardens

	The Plants	Indications
1.	*Acacia arabica* (Lamk) Willd	Dental Hygiene: conjunctivitis
2.	*Acacia catechu* Willd	Sore Throat
3.	*Adhatoda vasica* Nees	Cough and asthama
4.	*Aegle marmelos* Correa	Colitis: diarrhoea
5.	*Aloe indica* Royle	Skin allergies: liver tonic
6.	*Andrographis paniculata* Nees	Viral hepatitis: drug abuse
7.	*Asparagus racemosus* Willd	Reduced lacatation: eye infections
8.	*Azadirachta indica* Linn	Eczema: dental care: fever
9.	*Boerhaavia diffusa* DC	Fluid retention; eye infections
10.	*Bombax malabaricum* DC	Acne vulgaris
11.	*Boswellia serrata* Robx.	Arthritis
12.	*Butea frondosa* Koen ex Roxb	Eye inflamation; aging
13.	*Cassia angustifolia* Vahl	Constipation; body odour
14.	*Cassia fistula* Linn	Skin fungal infections; constipation
15.	*Centella asiatica* (Linn) Urban	Anxiety; memory lapses
16.	*Cissus quadrangularis* Linn	Fractures
17.	*Citrus medica* Linn	Indigestion
18.	*Clerodendrum serratum* (Linn) Moon	Sinusitis: asthma
19.	*Commiphora mukul* (Hook ex Stocks) Engl.	Artritis; high cholestrol
20.	*Curcuma longma* Linn	Urtcaria; sore throats; cuts and wounds
21.	*Cyperus rotundus* Linn	Conjunctivitus; colitis
22.	*Eclipta alba* Hassk	Hair hygiene; memory lapses
23.	*Embelia ribes* Burm	Intestinal parasites; immuno deficiency
24.	*Eugenia aromatica* Kuntze	Tooth ache: nausea
25.	*Evolvulus alsinoides* Linn	Learning disorders
26.	*Ficus bengalensis* Linn	Weakness; burning
27.	*Ficcus religoua* Linn	Artritis; vaginal infections
28.	*Hemidesmus indica* R.BR.	Dirrhoea; fever
29.	*Hemidesmus rosa-sinensis* Linn	Menorrhagia; weakness
30.	*Holarrhena antidysenterical* Wall	Dirrhoea: dysentery
31.	*Lasonia inermus* Linn	Athlete's foot; skin fungal infections

Table 1: A Proposed List of Medicinal Plants and Their Properties to be Included in the Rural Herbal Gardens

	The Plants	Indications
32.	*Leptadenia reticulata*	Reduced lacation
33.	*Mesua ferrea* Linn	Hamorrhoids: menorrhagia
34.	*Mimosa pudica* Linn	Cuts and wounds; menorrhagia
35.	*Mucuna pruriens* Bak	Parkinson's Disease; impotence
36.	*Ocimum sanctum* Linn	Common cold; weakness; stress
37.	*Operculina turpetheum*	Fever; flatulence; anoxeria
38.	*Phyallanthus emblica* Linn	Anti-pectic diseases; aging
39.	*Phyllanthus amarus* Linn	Viral hepatits
40.	*Piper longum* Linn	Recurrent respratory infections; indigestion
41.	*Punica granatum* Linn	Dirrhoea; tape-worms
42.	*Ricinus communis* Linn	Arthritis; jaundice
43.	*Solanum indicum* Linn	Post-partum weakness; cough
44.	*Terminalia artjana* (Roxb.) Wight & Arn	Angina pectoris
45.	*Terminalia chebula* Retz	Constipation; obesity
46.	*Tinsospora cordifolia* Willd	Hepatitis; Cancer
47.	*Tribulus terrestris* Linn	Urinary stones; infections
48.	*Trigonell foenum-graecum* Linn	Diabetes mellitus
49.	*Vitex negundo* Linn	Local inflammation
50.	*Withania sommifera* Dunal	Stress and anxiety

Standardization and Formulations of Medicinal Plant Products

The standardization and formulation of products based on medicinal plants needs to be actively promoted at all the Pharmacy Colleges, and should be closely coordinated by an industry-academia network. Major industry associations such as IDMA and ADMA, professional societies such as IASTAM, and charitable foundations such as the Zandu Foundation, should create specific working groups for product development. Quality awareness should be central to all such efforts, which should be targeted at the global market.

Manufacture and Marketing of Products

Manufacture and marketing of products should be the domain of the drug and health foods industry and should involve appropriate market research on national and global opportunities. For example, the global market for sweeteners, which is $ 100 billion, is monopolized by leading American companies. A question of relevance is therefore what would the size of the market share be for herbal or plant-based sweeteners. Similarly, the market for herbal cosmetics is huge. Can it be explored in a systematic manner? Other major opportunities include health foods, tonics and beverages.

To conclude, what is required is the setting up of the NMPASD task force at the earliest in order to evolve a blue print of the organization, its mission and objectives, and its priority programs.

Medicinal Plants and Tribal Development

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The Anthropological Perspective

Anthropology can be regarded as the science of man in its totality - his works, thoughts, ideas, faith and relationships with the universe. However, it is primarily understood by those outside of the discipline to be the study of tribal man, which is not true, but only appears to be so from the earlier major studies and publications on the subject. While it continues to remain relatively isolated in its studies of tribal cultures and societies, Anthropology is also concerned with contemporary man and his world, and shares a number of common concerns with other academic disciplines.

Anthropology and Tribal Studies

The question that comes to mind is why are anthropologists so concerned with the study of tribal societies. There appear to be three major reasons for this. Firstly, it is methodologically easier to approach the study of complex human societies by first studying simple, homogenous tribal groups. Secondly, it may be possible to gain insights into the origins and evolution of human institutions and cultures by focusing on tribal societies which are relatively static, as opposed to being dynamic. Finally, tribal peoples enjoy a very close, symbiotic relationship with the environment, including the fauna and flora in their proximity.

Tribal Societies and Their Relationship to the Environment

The last point mentioned above is of relevance to the topic under discussion. Tribals obtain most if not all of their requirements from their surroundings - food, material for constructing shelters and medicines - with the more traditional groups, living in remote interior forest areas, claiming all of their material possessions as being their own creations, as opposed to being purchased in markets. Not being integrated into the market economy, tribals can be traditionally regarded as collectors of food and other essential items from their surroundings (forests and rivers, for example), rather than as producers, their collection being motivated by need as opposed to greed. As such, they are custodians of the environment and do not seek to exploit it.

A brief glimpse of history may help to place things in perspective. Cultivation, which is a more recent phenomenon, replaced traditional hunting and gathering and led to the establishment of settled agricultural civilizations. With the rise of the Nation State and centralized administration, forests came to be regarded as a national resource and a source of revenue for the market economy. Consequently, custody of forests shifted from tribal societies to governments with concomitant negative impacts such as depletion of natural forest resources and loss of biodiversity.

Modern science and technology have led to the development of a market-oriented health care system (allopathy), which considers the human being as an anatomical and physiological entity, under constant attack from bacteria and other virulent micro-organisms. This has led to the rise of the synthetic drug

industry, which focuses on the extermination of these micro-organisms through the use of "drug bullets." The effects of this have been spectacular in the realm of communicable diseases, in the short term. However, medical historians have begun to question the role of allopathy in the control of epidemics since communicable diseases were controlled in the West before the advent of modern day pharmaceutical drugs. This was partially due to the rising standards of living, which included better nutrition, water supplies, environmental sanitation and personal hygiene. In recent times, new communicable diseases such as AIDS have surfaced, and non-communicable diseases related to lifestyles have gained prominence. Furthermore, the side effects of synthetic drugs have risen to unacceptable proportions, as summarized by the statement, "a hospital is the greatest health hazard." Concomitantly, there has been a distinct shift from animal food to plant food, and from synthetic to herbal drugs and cosmetics, observable in many parts of the world.

On a more general level, there is increasing awareness in the West of the limitations of technology, production and affluence, which though conducive to material comforts, do not provide people with peace of mind and happiness. Mortality may have decreased but morbidity has increased. This is manifested in the increasing demands for Indian "Godmen" and Gurus and the search for messiahs.

Tribal Development: The Indian Context

Having briefly examined the global tribal context and health care systems within a historical perspective, we now turn to tribal development within India which also has to be examined in its proper perspective. Tribals in India are not indigenous in the sense that Austalian aborigines and North American Indians are. References to Indian tribals can be found in the great Indian religious epics - the Ramayana and the Mahabharat. It is not implausible that way back in history, some populations from the plains were pushed back and isolated in the forests and hills by invading armies. Over the years, there have been close interactions between tribals and the caste-Hindu peasantry, resulting in transculturation. The local health traditions of tribals is directly linked to the classical textual tradition of Ayurveda.

In recent times, tribals, as Indian citizens, have been brought into mainstream society, under the control of state power and administration, in order to contribute to society and share the fruits of scientific and technological progress. The Constitution of India has endowed them with special rights and privileges, by designating them as "Scheduled Tribes." Special planning and implementation machinery has been developed to address their situation, and the latest Panchayat Raj Act passed by Parliament contains special provisions, transferring more power to tribal panchayats and giving them more rights over their natural resources.

The ground level reality, however, persists, with problems of sustenance resulting in malnutrition-related deaths, which are common amongst tribals. Due to the use of primitive methods of cultivation, agricultural yields are low resulting in poor food security. Further, tribals are used and exploited as casual labour by the Forest Departments as well as by forest contractors and contractors dealing with medicinal plants. The neglect and ignorance of the rich knowledge resource base of tribals, who have developed symbiotic relationships with surrounding flora and fauna, and who have been managing their health needs using local resources over centuries, is abysmal. While tribals may not have consciously cultivated medicinal plants, since, traditionally, there was no need for them to do so, they possess extensive knowledge of the localities, growth patterns and uses of a number of medicinal plant species, based on empirical experience.

While modern governments have been struggling to design development schemes suited to addressing tribal issues, they have not made concerted efforts to develop cultivation techniques for medicinal

plants which are increasingly under threat. Schemes aimed at horticultural development have already proven successful in raising tribal incomes as tribals tend to be proficient cultivators. However their incapacity to manage the marketing of their products necessitates the formation of links between cultivation and management of marketing. The Bhartiya Agro-Industries Foundation in Pune, formerly headed by the late Sri Manibhai Desai is an example of an organization which successfully combined cultivation packages with marketing and processing in the area of horticulture for tribal populations.

Tribal Development Corporations have been established by Indian State Governments for monopoly purchasing of tribal products and for selling goods at fair prices in order to reduce and avoid exploitation of tribals. Forest Development Corporations have also been established for the development of forest cultivation. The Indian Council of Agricultural Research provided funding to agricultural universities to transfer relevant new technologies to tribals. In Tripura, for example, some tribal families have adopted a non-traditional plant, rubber, which has radically improved their economic status. Given the above, it would be desirable for Tribal and Forest Development Corporations, along with the Indian Council for Agricultural Research, as well as Indian industry, to join together in launching cultivation schemes for medicinal plants, which include marketing and export aspects. If the right approach is adopted, tribals should respond favourably to such initiatives.

Every tribal society has local medicine men, known as "Bhagats," who are very knowledgeable about all aspects of medicinal plants used in the formulation of their medicines. However, they do not tend to come forward in view of the history of exploitation of tribals by urban educated folk from the government services and from the trading community. The "Bhagats," could greatly facilitate the documentation of available medicinal plants and their indigenous knowledge would contribute significantly to maintaining biodiversity. The Academy of Development Science has already had some experience in this area. FRHLT is also engaged in similar exercises. Their experiences too would be useful.

To conclude, the Indian Association for the Study of Traditional Asian Medicine (IASTAM) would be happy to collaborate in the training, research, documentation and evaluation of efforts aimed at combining medicinal plants and community development. Another organization, which would be willing to contribute their expertise in schemes concerning tribals, is the Maharashtra Association of Anthropological Sciences.

Medicinal Plants Cultivation, Industry and Rural Communities

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Introduction

The forests of India are a critical source of nutrition, health care, raw materials and cash incomes to hundreds and thousands of rural dwellers. However, recent years have seen a drastic reduction in forest resources in general, and in plant genetic resources in particular. Improper and excessive exploitation of biological resources, which is directly related to existing illiteracy, poverty and the shortage of off-farm employment opportunities, has led to habitat destruction and loss of biodiversity. More often than not, medicinal and aromatic plants are over-harvested as a result of the removal of immature roots, tubers and rhizomes.

During the Third World Congress on National Parks in 1985, the Assistant Director General of FAO, Marco Flores Rodas succintly expressed the view that, "until rural people are ensured adequate food and shelter, and a dignified standard of living, all efforts to establish and manage national parks and protected areas will be futile." Agenda 21 of the Rio Convention has stressed the point that, "the first beneficiaries of conservation and the sustainable use of wild plant and animal species should be rural communities and indigenous people whose traditional knowledge and respect for those resources has preserved them for centuries." (UNCED 1992)

At the community level, local people are the real resource managers since they have a vested interest in maintaining the natural resources on which they depend. The success of conservation measures and promoting the sustainable use of resources, therefore, largely depends on their understanding and acceptance of these concepts.

However, as most rural communities are ignorant of the need for environmental conservation, conservation education should be incorporated into the curriculum, at least at the school level and in adult literacy programs. Environmental education should focus on making people more self-reliant and aware of the value of their local resources, as well as on the issues of sustainability and profitability.

Cultivation as a Means to Conservation

Medicinal plant populations in the wild have to be conserved, in situ, in order to maintain plant diversity at the genetic, species and ecosystem levels, while cultivation is necessary for the ex situ conservation of medicinal plants.

Conservation of selected important medicinal plants is one of the primary objectives of the IDRC - sponsored Medicinal Plants (India) Project, implemented by the Arya Vaidya Sala which has drawn up recommendations regarding in situ conservation of these plants, indicating their natural habitats, and the possibility of their reintroduction in forests for the benefit of the Forest Department. Table 1 shows the results of a study of 10 species conducted by the Project.

Table 1: List of 10 Medicinal Plants Worked out by the Project

Sl No.	Name of Plant	Part used	Annual Consumption in AVS	Econimically viable or not	Pure or intercrop
1.	*Baliospermum montanum*	Roots	5,000 Kg.	Viable	Pure as well as intercrop
2.	*Celastrus fenestratum*	Fruit	1,500 Kg.	Not Viable	-
3.	*Coscinium fenestratum*	Stem & roots	10,000 Kg.	Not Viable	-
4.	*Crateva magna*	Bark & leaves	10,000 kg.	Viable	Pure as well
5.	*Embelia ribes*	Fruit	7,500 kg.	Not viable	-
6.	*Holostemma ada-kodien*	Roots	7,000 kg.	Viable	Pure as well as intercrop
7.	*Hemidesmus indicus*	Roots	32,000 kg.	Viable	Pure as well as intercrop
8.	*Rubia cordifolia*	Runners	9,500 kg.	Viable	Pure
9.	*Saraca asoca*	Flowers, bark	9,000 kg.	Not viable	-
10.	*Trichosanthes lobata*	Whole plant	13,000 kg.	Viable	Pure as well as intercrop

The best provenances of the species listed above were multiplied through the use of suitable techniques, and the planting materials raised by the Project were supplied to the State Forest Department as well as to interested farmers. The importance of cultivation of medicinal plants was stressed during the two National Seminars conducted as part of the Project's activities, and four farmers who attended the seminars subsequently expressed a desire to engage in cultivation of medicinal plants as intercrops in their fields. Scientists from the Project first inspected their fields and identified economically viable species suited to the locality, taking into consideration soil characteristics, water availability, altitude, rainfall etc. Planting materials of early yielding and economically viable species were distributed free of cost to the farmers, as an initial step for encouraging cultivation of medicinal plants, and inspections of their fields and technical inputs were provided at frequent intervals. The farmers were free to sell the harvested raw material in the open market, and in case they faced difficulties in this regard, the Arya Vaidya Sala was prepared to purchase this at the market rate.

Provision of Training for Farmers

The provision of training for the benefit of cultivators is very necessary and has been organized by the Project in the form of three day programs for farmers at two centres. Twenty farmers were selected for training with the involvement of the Grama, Block and District-level Panchayats.

Constraints Faced by Farmers in Undertaking Large Scale Medicinal Plant Cultivation and Proposed Solutions.

The key constraint to cultivating medicinal tree species is the delay period in obtaining financial returns, which can only be obtained a few years after planting.

The solution to this problem lies in educating farmers on the importance of preserving endangered medicinal trees. To this end, the Project has conducted training camps in order to convince farmers that cultivating rare medicinal trees would make an invaluable contribution to the Nation. Examples of such species include Gmelina arborea, Stereospermum personatum, Aegle marmelos, Premna serratifolia (the five constituents of Dasamoola), Saraca asoca and Crateva magna.

Marketing Problems and Proposed Solutions

Farmers often face problems in marketing medicinal raw drugs since no ready assured market exists for these products. Fresh plants or leafy items have to be disposed of immediately after harvesting otherwise the material gets dessicated and the quality quickly deteriorates. Raw drug dealers usually take advantage of this situation and the farmers are ultimately forced to dispose of the items at minimal prices. The processed material, on the other hand can be stored and sold at a good price.

In recognition of this problem, the Arya Vaidya Sala offered every possible assistance to farmers participating in the Project. A solution to this problem also emerged out of the training programs: the formation of a farmers' society for the purchase of the raw material. This is being implemented in certain villages with assistance from NABARD.

A second problem relating to marketing concerns fluctuations of market prices. There are no market price announcements for Ayurvedic raw drugs. Hence the prices vary from shop to shop at a given time. This is a great handicap for farmers. The solution to this problem lies in the inclusion of medicinal raw drugs in the price announcements made by the Statistical Departments, as is done for items like rice, wheat, coconut oil and spices.

Recommendations

It is proposed that the Government of India should establish a Medicinal Plant Board, which would function in a similar manner to the Rubber Board, and which would establish collection depots in every district. The farmers could then sell their medicinal plant products at these depots and Ayurvedic Concerns could purchase raw drugs, as per their requirements, from these depots.

Training should be provided to farmers in the areas of collection, processing and storage, in order to address the issue of quality maintenance, and district-level medicinal plant nurseries should be established for the supply of quality planting materials to farmers.

Developing Social Contracts Between the Medicinal Plants Industry and Rural Communities: Linking the Actors

Linking Collectors/Producers to Processors/Consumers: A Framework for Establishing Social Contracts Between Industry and Communities

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Abstract

South Asia has a rich heritage of traditional systems of medicine, which are mostly based on herbal formulations. Although biologically the region is extremely rich in medicinal plants, due to years of unwise use, regular supply of resources have become difficult, thus raising serious doubt about the safety and efficacy of the formulations currently in circulation. The sustainable production and conservation of medicinal plants is influenced by a number of factors, largely of socio-economic and institutional nature. Rural people derive a substantial portion of their incomes and products for their basic health care needs from medicinal plants gathered from the wild. Unsustainable harvesting of the raw materials from the wild by hired collectors, mostly using primitive methods, and lack of awareness about the real value of the resources are two other important factors. Medplants-based industries and enterprises, which run into the thousands, presently source more than 85 per cent of their raw material requirements from the wild. Thus there is a great need to reduce pressure on natural sources by diversifying the production sites of these important plants. Domestication is one of the alternatives being attempted, but given the large populations of developing countries living below poverty line, and the growing need for economic and environmental security, it is unlikely that land currently devoted to pure or mixed agriculture can be diverted to grow medicinal plants in significant quantities. In addition, domestication has to be carried out by recreating the major attributes of natural habitats because of different chemical and genetic properties of naturally occuring plants as compared to those cultivated in monoculture systems. This paper suggests that a long-term sustainable partnership between industry and rural communities should be formed. This is in the interest of both the producers/collectors and industries since both stand to gain. The former will procure regular, reliable and quality supply sources of raw materials, while the latter will have an assured market, increased incomes and fair prices for their products. Necessary support and facilitation by the GOs and NGOs in terms of policy and legal support and technology transfer will expedite and strengthen the partnership building process. There is an immediate need to initiate dialogue and pilot case studies to launch this process. This paper analyses the social, economic and institutional implications of such relationships, by examining various examples of existing partnerships and focusing on their efficiency, equity, and feasibility.

The Context

The Medicinal and Aromatic Plants Program in Asia (MAPPA), formerly known as the IDRC Medicinal Plants Network (IMPN), aims to support the development of an economically, socially, and environmentally beneficial and sustainable medicinal plants sector in the South Asia region. It is our understanding that such an objective can only be achieved through the development of close and enduring relationships among all the stakeholders involved the majority of which is formed by industry and forest dependent rural communities. Hence incorporated in our work is the idea of an "industry-rural community partnership," whereby herbal drug companies and local communities collaborate for mutual benefit on a sustainable and equitable basis.

Need for New Partnerships?

Perhaps now more than ever before, medplants-based enterprises in the region are facing several challenges to their continued growth. Decreasing quality and quantity of raw materials; increasing competition from allopathic industries; increasing vulnerability to abuses of Intellectual Property Rights (IPR), due to enforcement of various international conventions such as TRIPS; growing demands by consumers and governments for higher standards and improved quality without concomitant capital resources and appropriate technologies being provided for their implementation; and a relative dearth of public funds allocated for research and development, compared to other health care related expenditures, are some of the major issues confronting the industry.

Even as these factors adversely affect the growth of the herbal industry, a more basic problem lies in the lack of particular medicinal plants-based raw material necessary to prepare commercially viable formulations. Shortages in several critical plant parts have begun to be reported, and industries once sourcing plants from within their own districts and states, find themselves in the precarious position of collecting plants from remote parts of the country as well as beyond. At the micro-level too, even areas that remain relatively resource-rich are showing signs of strain, as collectors find that they must travel further and further into the interiors of forests to find plants that they had traditionally collected in their backyards.

Developing Sustainable Supply Sources

Most of the extraction of medicinal plants, both for local as well as industrial use, occurs in the wild, with the major proportion of these being harvested in an unsustainable manner. This suggests that although the evidence demonstrates otherwise, as indicated above, current raw materials sourcing practices adopted by most of the industries involved, continue to be based on the premise of abundant and ever-available raw materials, mostly from natural habitats.

It is clear that industries and the people benefiting from them - those who collect, process, and market their products, as well as those who use them - cannot follow these practices indefinitely. The question is whether these practices will be changed while there is still an opportunity to prepare the Indian herbal industrial sector to compete in the global market, or whether industry will wait until an acute stage of crisis is reached, at which point it will be weakened substantially enough to allow these secondary factors to be put firmly in place. This would effectively reduce its future growth potential and global competitiveness indefinitely.

The supply crunch is already strongly affecting the industry as well as local users, as evidenced by a

high turnover rate in small-scale industries, as well as increased contracting by large firms to regional suppliers and dealers. The result is an increasingly unreliable market for medicinal plants raw materials, which is largely secretive, inefficient, and frequently exploitative. More importantly, perhaps, it is simply unsustainable, and the factors described above have a multiplying effect on one another. Decreasing supplies, increasing prices, and decreasing quality are leading to an uncertain future for all the stakeholders involved.

Hence, the need of the hour is to urgently put into place new practices, to re-invent the herbal industry's supply process so that it is no longer an "Achilles heel," but rather an engine of growth, which will enable the industry to deal with the challenges it faces. It is with this opportunity in mind that the idea of social contracts' with local resource communities is being put forward by MAPPA at this Industry Forum. The remaining section of this paper outlines an approach for developing and strengthening producer-consumer relationships, while addressing the needs of both rural people and industry.

Growing Need for Industry to Play a Social Role

A recently held consultation on medicinal plants development organized by FRLHT, Bangalore, has recommended that Industry in collaboration with the National Wasteland Development Board (NWDB), and with National Bank of Rural Development (NABARD), should establish a direct nexus with farmers in villages. This should be done by providing seed capital and buy-back guarantees at viable prices for village communities, small and marginal farmers who are willing to grow medicinal plants on wastelands and in home gardens (FRLHT, 1997). Due to the on-going government initiative of granting up to 20 million ha. of wasteland to the private sector, primarily for the purpose of growing medicinal plants such as Neem, this is increasingly becoming a reality (Pioneer, Nov. 20, 1997).

A large number of plants are used in the preparation of Ayurvedic drugs, many of which are sourced from forests generally located in areas inhabited by tribals, the rural poor, and forest-dependent communities. Information on tribal and folk practices is vital for drug companies in order to identify prospective plants for future drug manufacture. In recent times, such 'bio-prospecting' companies have attracted a great deal of attention, both positive and negative, in international fora. What is clear is that the pharmaceutical industry, whether international or national, will continue to benefit from traditional knowledge and indigenous plant resources, since many pharmaceutical products have been derived from medicinal plants - some 75 per cent of these products were discovered by examining the use of these plants in traditional medicine (Tempesta and King, 1994). Indeed, it has been shown that by consulting indigenous peoples, the success rates from bio-prospecting can be increased from approximately 1 in 10,000 to 1 in 2 (Anon, 1995 as quoted by Holley and Cherla, 1996).

Need to Address Local Community-Based Issues?

In the process of commercialization, local communities generally get an unfair deal since they are at the mercy of trading networks and agents, who frequently manage to set themselves up in monopolistic positions whereby they have complete control over pricing and payment schedules. In addition, they find themselves making difficult choices between selling plants and using them in local formulations. Subsisting on weekly markets, they do not have the opportunities to learn skills or to add value to their work in order to enhance their position. Hence, they find themselves in an uncertain and difficult position, with few opportunities for economic mobility.

The fact that local communities are increasingly becoming vulnerable and impoverished may also

hurt industry, at least in the long run. In dire need of cash, desperate collectors may substitute adulterated materials, or harvest sub-standard plants. Lacking training and personal interest, their collection methods are frequently unsustainable, and without any guarantees of financial returns, they do not cultivate medicinal plants. Thus, the supply gap only widens with each collection they make.

Another issue to be considered is that traditional uses of medicinal plants may also decline due to increasing commercialization of the medicinal plants sector, and diversion of raw materials for sale in the markets. One study in Arunachal Pradesh examined the use of Mishmi tita (Coptis teeta), a bitter root that grows at an altitude of between 2,000 and 3,000 m. in the Dibang and Lohit Districts of the State. Over the last decade, communities have been selling the roots of the plant at the very remunerative price of Rs. 1,000 per kg locally, from where the raw material is exported via Calcutta to Japan and Switzerland. Tribals traditionally used the plant for the treatment of fever, backache, and dysentery, but with all of the available supplies currently being exported, opium is used as a substitute drug, greatly endangering people's health and social welfare (Aryal, 1993, as quoted by Holley and Cherla, 1996).

Growing Recognition of Tribal Medicine

Although they may constitute the most widely used health care system among India's rural population, especially among the poor, tribal and folk medicinal practices are still not recognized by the Government of India's mainstream health policy relating to primary health care or medicinal plants. Even though Government policies recognize the Indian Systems of Medicine and Homeopathy (ISM & H), with greater recognition being given to Ayurvedic medicine in recent years, these polices have not impacted the primary health sector in rural areas. Some pioneering work has however been done by the NGOs and the private sector, resulting in greater importance and recognition being accorded to tribal and traditional medicinal practices. These knowledge systems have also entered the international debate in the context of protecting intellectual property rights (IPR), utilization of indigenous knowledge and development of micro-level natural product-based enterprises.

Indigenous Knowledge and Property Rights

Plant remedies, although based on natural products, are not found in 'nature' per se, but are the products of human ethnobotanical knowledge. Deploying a plant in health care requires knowing which species to use, when to collect it, what parts are useful and how to prepare and administer it. Moreover, apart from geographical and ecological positioning of diversity within species, there is evidence to indicate that contents of active principles vary widely from source to source. Knowledge regarding the proper season of harvesting, the optimum age of the plant, parts of the plant to be used and the principal effective components is very familiar to local healers and collectors. Indigenous technical knowledge in this respect has to be carefully abstracted, and the design of effective conservation strategies must therefore include safeguarding both the plant genetic resources as well as indigenous knowledge and techniques which can conserve the biodiversity and improve the well being of mankind. Strategies for incorporating this knowledge and these skills into medplants biodiversity assessment and conservation programs need to be developed and actions formulated for subsequent adoption. There is increasing danger of infringement of indigenous intellectual property rights (IPRs), and curtailment of local access to resources, due to the coming into force of World Trade Organization (WTO) provisions such as the Trade Related Intellectual Property (TRIPS) and the International Union for the Protection of New Varieties

of Plants (UPOV). A number of countries in South Asia are signatories to WTO, which requires them to comply with the stipulations in principle, although each country can enact legislation to protect its individual IPRs. There is a need, therefore, for countries in the region to formulate IPR regimes and to prevent the exploitation of their poor and indigenous communities, especially by multinational drug companies and bio-prospectors.

The Scope for Working Together

It is clear that the stakes are high for both industry as well as rural communities to develop a sustainable system of medplants resource management. Given the growing awareness of the biodiversity and environmental values of forests, government agencies and NGOs have a moral responsibility to enforce a sustainable system of medicinal plants extraction. In addition, as a result of the Indian Government's policy of strengthening Panchayats as well as the joint forest management (JFM) institutions in rural areas, local communities are bound to demand higher returns for their resources, including medicinal plants.

Mechanisms for Social Contracts

Basic Principles:

The basic concept of a "social contract" or bio-prospecting as mentioned above, entails that equitable and sustainable relationships are formed which satisfy the short and long-term needs and interests of both parties to whatever extent possible. The term, "social contract" was first coined in the sixteenth century by the philosopher John Locke, in his work "On Liberty." The "contract" referred to was the implicit agreement between citizens and their government, whereby citizens voluntarily turned over some of their freedom and accepted certain rules in order to also experience certain benefits, such as protection of property, social security, and the like. This willingness to become party to such a "social contract" was referred to a century later by the philosopher de Tocqueville as 'enlightened self-interest,' or the recognition that one gained overall by arrangements which sometimes seemed to momentarily constrain one.

To make sense of this agreement in the context of the plant-based drug industry, it will likewise be necessary for the industries involved to begin to adopt certain practices regarding collection and harvesting of medicinal plants. If followed by large enough numbers, this mechanism will actually increase the productivity of the entire sector and hence, the growth opportunities of each firm.

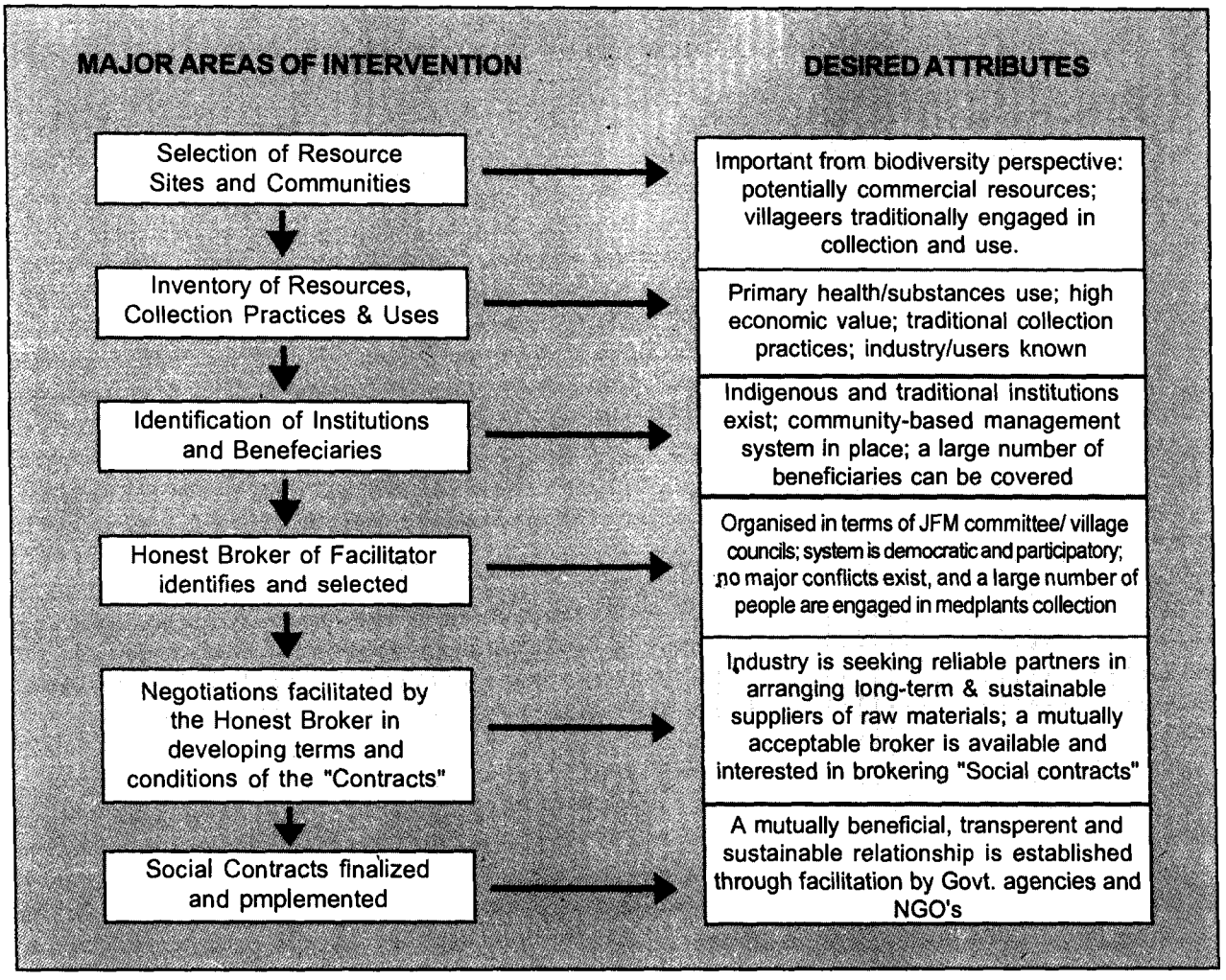
Conservation of valuable biodiversity and realization of social benefits in the form of food security, poverty alleviation and employment are other areas of opportunity. In fact, the development of 'social contracts' with local communities will not only address the basic problem of supply of medicinal plants-based raw materials, but will also assist the industry in lifting the ceilings to growth identified earlier. A closer involvement with local communities and a clear indication that these target groups will also benefit from a more productive sector will attract increased public investment in research and development, as well as technology transfer and marketing opportunities. Intensive management of plant resources will create new employment opportunities for rural people, and will ultimately lead to the development of primary processing units in rural areas.

A Conceptual Framework

"Social contracts" are thus symbiotic interdependent relationships between industry and local communities/ resource poor people. In India, the idea has been propounded by the M.S. Swaminathan Research Foundation (MSSRF) in order to empower the stakeholder communities - especially women,

tribal peoples, and the poor - so as to give them an equitable share of the benefits from common pool resources (e.g. forests, grazing land etc.) on which they depend. The main aim is to first empower the communities with better knowledge, skills, and information so as to gradually train the people involved in collection and cultivation of medicinal plants in sustainable harvesting, primary processing, marketing, and packaging techniques. This will create eco-jobs, thereby enhancing the livelihood security of the poor. The multiplicity of benefits which are possible, can only be realized on a sustainable basis if a long-term contractual arrangement can be worked out between the families of a particular resource community and interested industry or industries. This concept in short is called a `social contract' and a schematic framework is provided in Figure 1.

Figure 1. A Suggested Strategy for Developing
"Social Contracts Between Industry and Resource Communities



As shown in the Figure 1, the process of developing "social contracts" involves a number of sequential steps starting with general discussions between the parties concerned. The initiation can generally be based on past and ongoing relationships, or can be facilitated by an "honest broker" - NGOs, JFM Committees, Gram Sabhas, research and training agencies. The incentive for industries to enter into contractual agreements will be the improved prospect of ensuring regular and reliable supplies of quality raw materials. Similarly, the attraction for rural communities to enter into the contract will be the

increased likelihood of having access to assured markets and fair prices for their products, with possible gains in technology transfer to help achieve sustainable management of their herbal resources and development of their communities. Successful establishment of "social contracts" will however require, first and foremost, a liberal amount of goodwill and commitment of physical and social resources on the part of medplants industries, which need to reach out to poor farmers, tribals and women collectors, and win their trust before rural communities reciprocate and join in the formation of the partnership.

Roles and Responsibilities of the Partners

There are various approaches to social contracts between industry and local communities. Most of these however remain at the theoretical level, and few have been tested in practice and subsequently evaluated. However, for discussion purposes, and without endorsement of any single clause per se, a few of the responsibilities each side may consider in such an arrangement are listed below. The purpose of such a listing is to stimulate discussion, as well as re-articulation, with the hope that one of the outputs of the Industrial Forum would be a finalized list of responsibilities, at a general level, applicable to specific situations.

Before moving into particulars, however, one extremely important factor relating to the success of any social contract that needs to be emphasized is that of trust. Both local communities and the industry must have implicit trust in each other and adhere to the commitments they make. The foundation of any social contract - which after all is referred to as such because it is not really an instrument of law in most cases - is trust, and this is essential in preserving any relationship such as that suggested here. Most of the responsibilities indicated below are extensions and particular understandings of how that trust should be maintained.

The Responsibility of Industry:

- Not to deal with an individual member of the community in sourcing raw materials but to deal with the duly assigned community representatives through the establishment of some transparent mechanisms;
- Not to provide economic support to local communities which do not practice sustainable harvesting methods, or those engaging in NRM practices which might be environmentally destructive or unsustainable;
- To make the communities concerned aware of the real value of medicinal plants in enhancing their health and livelihoods;
- To help carry out inventories, valuations and consumption and marketing studies in the villages where they have a long-term interest in sourcing raw materials;
- To commit itself to the practice of conservation and the adoption of sustainable principles and ethics of good business enterprising;
- To establish standards for collection processing and manufacturing practices;
- To provide training and buy-back gurantee to the products at a fair price.

The Responsibility of Rural People:

- To establish long-term relationships only with those industries which are clearly dependent for their continued survival and economic viability on the conservation of natural resources, especially medicinal plants;
- To undertake to supply raw materials of the required quality and quantity, and according to the schedule agreed upon with the industries;
- To engage in the development of activities which would provide widespread and equitable benefits to local communities;
- To identify and monitor threats to the environment (in association with honest NGOs or similar institutions) and develop a framework, in a participatory manner, which describes how they plan to address the threat over time, using an action-oriented approach;
- The NGOs involved as the "honest brokers" should be familiar with the village situation and should be trusted and accepted by local communities. They should be known to have a good track record in the use of a participatory approach to project implementation, and should have actively been involved in such activities in the past;
- During the setting up of medplants-based primary processing enterprises, the selection of products, processes and end-products should generally be compatible with industrial needs, standards, and quality.

Some Works in Progress

Three IMPN (MAPPA) partners who are involved in translating these principles into practice, provide useful examples of how social contracts can work. Publications of and presentations by representatives of these organizations will provide more details and an opportunity to better understand how these relationships are formed. In addition to illustrating the kinds of problems and benefits that are encountered along the way. It should also be noted that in all three cases, these arrangements are still underway and have yet to be rigorously evaluated. Hence, they are not presented as 'masterpieces,' but rather as works in progress towards developing replicable successes that can become small engines of growth for the renewal for the indigenous herbal industry and its partner local communities.

Arya Vaidya Sala (AVS), Kerala, India

AVS is currently manufacturing about 500 Ayurvedic medicines for the treatment of patients in its Nursing Home and for distribution to the public through 13 branches and 745 agencies. IDRC has been funding a project at AVS to standardize the methods of cultivation for 10 popular medicinal plants species. The IDRC funded Project has been addressing several objectives, one of which is to develop a long-term production to consumption relationship with the cultivators. Under this arrangement, farmers volunteering to grow the recommended medicinal plants will enter into a Memorandum of Understanding (MOU) with AVS, in which the latter will undertake to buy the plant parts produced at an agreed price. Seedlings are supplied to the growers by AVS at charging costs, as well as 30 per cent of the overheads. In addition, regular training in cultivation, harvesting and post-harvest treatments is provided. AVS also helps cultivators in securing fair prices for their products. It is hoped that the MOU will gradually evolve into a long-term agreement between the producers and the industry.

MSSRF, Tamil Nadu, India

MSSRF is currently implementing a project which aims at linking farmers of a particular area with the seed producing companies. The IDRC funded Project focuses on training the farmers in hybrid seed production, especially in the production of vegetables and oilseeds, and helps them to establish linkages with the seed producing companies. A buy-back arrangement has been developed whereby the company provides the parent materials for producing hybrid seeds and buys them back from the farmers at a fixed price. MSSRF facilitates in price fixation and also provides technical guidance to the farmers. The eventual aim is to replicate these techniques among all farmers, on a country-wide scale, through the farmers trained by the Project.

ANSAB, Nepal

ANSAB, Nepal with a grant from the Biodiversity Conservation Network (BCN) has facilitated the establishment and operation of a community-managed oil extraction plant in a remote district of Nepal - Humla. The form of the "social contract" here is somewhat different from the one mentioned above in that here the community itself has set up an industry, which has then established arrangements for buying the raw materials from the collectors. Some of the major collectors or their representatives are made the share-holders of the Oil Company so as to create a stake for them in selling the raw materials. The processed oil is sold either to a public company in Kathmandu (HPPCL) or to interested buyers in Delhi, depending on who offers better prices. ANSAB and ATI, which are helping the Humla Development Council (HDC) in the management of their affairs, are also extending assistance to the company in institutional development, technology transfer, and influencing local/national policies.

Girijan Cooperative Corporation (GCC), Andhra Pradesh

This agency, which has been granted exclusive rights to procure NTFPs, currently deals with more than 30 medicinal herbs. The cooperative provides a good model for developing a partnership with Industry. However, tribals who constitute the bulk of GCC need i) training in sustainable harvesting; ii) access to appropriate planting materials; iii) technologies for production, processing and entrepreneurship; and iv) access to markets (demand creation and market information systems) to facilitate the delivery of quality raw materials in the required quantities, according to the schedule worked out. IMPN's research partner, the Herbal Folklore Research Centre, Tirupati, has been working with tribal communities in order to document the indigenous knowledge base. This will play an important role in strengthening their organizational and technical capacity.

Conclusion

Both industry and rural communities would benefit greatly from the formation of a sustainable partnership. The concept and mechanism suggested in this paper indicate the potential gains which could be accrued from the development of a relationship based on the spirit of "social contract." Industry obviously has a greater role to play through the reinvention of the entire supply process and through proactively supporting communities suffering from poverty, poor management of their rich biodiversity and lack of organizational capacity. What is needed are a few "champions" to take the lead so that the entire herbal industry can eventually participate in this mutually beneficial partnership.

By hosting this Medplants Industry meeting, in collaboration with the Zandu Foundation, our interest is to begin a process of partnership-building between industry and local communities, which is based squarely on the felt needs of both. We seek to work together with industry to develop more innovative

arrangements like those mentioned above, whereby communities and industry can work together for achieving the sustainable use of medicinal plants resources. Since development is comprised of integrated development of people's health, protection of the environment, and provision of livelihood security to the poor, industry will have to shoulder this social responsibility to solve both short and long- term problems. We hope that this Industrial Forum will serve as a platform from which such multi-pronged collaborations can be launched.

References

Aryal, M. 1993 Diverted Wealth: The Trade in Himalayan Herbs, Himal, 6 (1).

FRLHT 1997. Medicinal Plants of India: Guidelines for National Policy and Conservation Programmes, Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore,on behalf of the Ministry of Environment & Forests, GOI, New Delhi; p.32

Holley J. and K. Cherla (1996), The Medicinal Plants Sector in India. MAPPA / IDRC, SARO, New Delhi p.117

Pioneer, 1997 - The Pioneer, 20th November, 1997, New Delhi, India.

Tempesta, M. S. and S. King 1994 Tropical Plants as a Source of New Pharmaceuticals, in P.S. Barnacal (ed.) Pharmaceutical Manufacturing International: The International Review of Pharmaceutical Technology Research and Development. Sterling Publications Ltd., London.

Partnerships Between Industry and Local Community: Key Concept and Issues

Developing Patnerships Between Medicinal Plants Industry and Local Community: A Conceptual Framework

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The Workshop on Medicinal Plants as the Basis for the Relationship Between Industries and Rural Communities, was held in Bangalore, India, on February 17, 1998. It was organized as part of the section on Trade and Enterprise of the International Conference on Medicinal Plants. The main objective of the Workshop was to provide a common forum for representatives from R&D organizations, academia, industry, government agencies, NGOs, International Agencies, donors and community groups to discuss and develop the concept of building a sustainable partnership between medicinal plants industries and rural communities. Participants of this Workshop, which was open to all of the participants of the International Conference on Medicinal Plants, included IDRC-funded project scientists and field workers, who contributed significantly to the discussions in the context of research activities which have been funded by IMPN, as well as on the basis of their own practical experience and specific expertise. A diverse group of participants, representing both developing and developed countries, attended the Workshop and contributed to the quality outcome of the discussions. Overall, the Workshop was successful in building upon the recommendations of the National Colloquium on the role of medicinal plants industries in biodiversity conservation and rural development, held earlier in New Delhi, the proceedings of which are presented in the first section of this report, and came out with suggestions for specific action.

The framework paper on establishing "social contracts" between industries and rural communities for the development of medicinal plant-based enterprises, by Madhav Karki and Jason Holley, which was presented at the earlier conference in New Delhi, formed an introduction to the topic. It suggested that the development of a durable and equitable relationship between the collectors/producers and the consumers/processors of medicinal plants is long overdue and is in the best interest of both parties. Dwindling supplies and the deteriorating quality of medicinal plant-based raw materials warrant the need for a re-invention of the supply mechanism on the part of industry. Such a process may emerge by treating the collectors/producers not as mere gatherers of cheap raw materials, but as an integral part of the entire production to consumption system. The paper recommended that the mechanism proposed for the creation of this new partnership between industry and rural communities be termed a "social contract" or "bio-partnership," the main premise of which is that both parties should forego short-term benefits to ensure long-term survival. This is particularly relevant when survival is threatened by fast disappearing and non-replenishable plant resources and traditional knowledge systems. Herbal industries and enterprises, which run into thousands, presently source more than 85 per cent of their raw material requirements from the wild. There is thus an urgent need to reduce pressure on natural sources by diversifying the production sites of these important plants. Domestication is one of the alternatives being attempted, but given the large population living below the poverty line, and the growing need for economic and environmental security, it is unlikely that the current land area devoted to pure or mixed agriculture can be diverted to grow medicinal plants in significant quantities. By establishing sustainable partnerships with forest management communities, industry will obtain regular, reliable and quality supply channels of raw materials from the wild, as well as from domestic sources. In return communities will have assured markets, increased incomes and fair prices for their products.

The rest of the papers, which are arranged thematically, as opposed to the order in which they were

presented at the Workshop, provide a multi-faceted view of the topic under discussion. Regarding general concepts and issues, the UNIDO representative emphasized the role of down streaming the processing system in rural areas so as to provide employment as well as retain a larger proportion of value-addition in the local economy. The industry, the speaker suggested, should assist in technology transfer and help to develop micro-enterprises as part of their overall operations. Government agencies and NGOs could provide business-oriented training and policy back-ups to manage the nascent micro-enterprises.

The moderator of the Workshop also made some pertinent comments with regard to the areas in which technology is required for the conservation and utilization of medicinal plants through the participation of industry. He stressed that the application of appropriate biotechnologies and agro-techniques must be buttressed by a well-knit policy framework which addresses cultivation and regulation of collection from the wild. Policies should be devised to create a favourable economic climate for commercial cultivation, and the fostering of durable and sustainable partnerships between industries, local communities and R&D institutions. In the process, industry must adopt a forward looking attitude which involves greater participation in research and development as well as greater respect for community rights and equitable benefit sharing.

Case studies from countries within the region - Bangladesh, India and Nepal - are presented in this section of the report. Speakers from Bangladesh, India and Nepal have described the scenario of the medicinal plant sub-sector in their respective countries. Successful cases of community participation in biodiversity conservation are described for Bangladesh, while a innovative model, being implemented in the Humla District of Nepal, with the full participation of the different actors involved in the medicinal plants sector, is also presented.

Three papers were presented with regard to India. The first case study related to the modus operandi of the medicinal plants trade prevailing in the Kullu District of Himachal Pradesh. The contribution of Non Timber Forest Products (NTFPs), especially medicinal plants, in the local economy was quantified and described, clearly indicating the correlation existing between the altitude of habitation and the degree of dependence on medicinal plants-based incomes. The trade was shown to be characterized by traditional relationships, secrecy of maintaining information, domination by individual traders and lack of a collective bargaining strategy. The paper concluded that wanton over exploitation warrants immediate policy and implementation measures from the Government so as to regulate the uncontrolled extraction of medicinal plants in the area.

A presentation from one of IMPN's partner organizations, the Arya Vaidya Sala in Kottakkal, Kerala, highlighted present constraints which exist with regard to the development of medicinal plant-based industries. These related to the low incomes obtained by collectors, the lack of good quality raw materials available in adequate quantities at suitable prices, and the restrictions imposed by the current land ceiling regulations, which prohibit user industries from owning and cultivating medicinal plants for their own use. The presenter described the training programe which has been introduced by the Arya Vaidya Sala on cultivation of medicinal plants for selected farmers, and discussed points raised by farmers with regard to difficulties they face in cultivating medicinal plants.

A final presentation from India related to a case study conducted in Madhya Pradesh, with a description being given of the functioning of a network of 1947 primary forest cooperatives, under the aegis of an Apex Federation. This structure was shown to be a very effective means of conserving and developing the resource base, while at the same time guaranteeing social benefits to the collectors, including the development of community-managed enterprises at the village level.

The major outcome of the Workshop deliberations has been the agreement of the represented medicinal plants industries to participate in research and development projects aimed at decentralizing or down streaming the processing system. Based on the principles of sustainable harvesting, equitable distribution of benefits and unconstrained supply of raw materials to the industry, a set of guidelines was proposed for the development of a suitable institutional framework for promoting and developing community participation in research, development and down streaming of the production process. It is hoped that funding strategies for rural community-based conservation and development projects can be worked out, enlisting industry's participation in supporting sustainable management, selective cultivation and equitable rural development-related action research.

To conclude, the Workshop has been part of a much larger process of partnership building, which has been embarked upon by IDRC in the South Asia region. The focus of these efforts is on medicinal plants as the primary link, connecting the concerned stakeholders together in novel partnership arrangements, It is intended that these partnerships enhance the benefits accrued to each, on an ecologically sustainable, economically feasible and socially sound basis.

Technologies and Policies for the Conservation and Utilization of Medicinal Plants Through Industry Participation

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It is no exaggeration to say that the use of plants for human health is probably as old as human beings themselves. Nonetheless, the recent dramatic increase in sales of herbal products in global markets underscores the growing popularity of herbal therapies. While this has created new opportunities for the herbal industry, it has also posed unprecedented threats to the very resources on which the industry depends. Perceived threats of over exploitation have resulted in several species being included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists. Conservation of threatened medicinal taxa is clearly one of the priorities towards which available technologies are being directed, most notably through ex situ approaches such as seed banks, in vitro banks, cryopreservation and DNA libraries.

There is an urgent need to develop agro-techniques for the cultivation of those species which are in great demand. Biotechnology offers additional possibilities for easing the burden on wild populations. Thus, for example, in vitro propagation of threatened slow-growing species and their re-establishment in nature; clonal multiplication of elites; production of desired phytochemicals in large scale biofermentors and "phytopharming," that is, sophisticated techniques for process optimization, standardization and quality control, need to be adopted by the industry if developing countries are to claim a greater share of the lucrative global market.

The application of technologies, however, needs to be buttressed by appropriate policy frameworks. One of the most serious constraints in most developing countries is the absence of an integrated strategy for the conservation and sustainable use of medicinal plants. The objectives of a well-knit policy framework should therefore include: (a) ensuring long-term in situ measures for conservation; (b) regulation of wild collections; (c) creation of a favourable economic environment for commercial cultivation of medicinal plants, and (d) fostering and facilitating durable and sustainable partnerships between industry, local communities and R&D institutions. The industry in turn will have to participate more actively in research and development activities, in addition to displaying a healthy respect for community rights and equitable benefit sharing. An appropriate mix of technologies and policies, together with a forward looking industrial sector, could ensure appropriate conversion of herbal wealth into economic wealth and health for increasing numbers of people.

Case Studies From the South Asia Region

Medicinal Plant Diversity: The Present Situation and Conservation Needs in Bangladesh

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Background

Bangladesh, with its small area (144,000 sq.km.), and huge population (120 million), is one of the poorest developing countries in the world. Though situated in the sizeable delta of the Ganges - Brahmaputra - Jamuna floodplains, and possessing a humid monsoon climate, the country's previously rich biodiversity has been largely destroyed by deforestation and over exploitation. Yet, in spite of this, a diverse range of macro- and micro-environments - with 30 agro-ecological regions and 88 sub-regions existing in the country - continue to support a wide diversity of plant species.

Central Efforts to Protect the Environment

During the late 1980s, the Government of Bangladesh directed that all projects were to be cleared and assessed for their possible negative impacts on the environment by the newly formed Ministy of Environment. Bangladesh, by that time, had signed, ratified and accessed 22 International Conventions, Treaties and Protocols related to the environment, including the Convention on Biological Diversity.

To date, the National Environment Management Action Plan (NEMAP) has been formulated to set out the policy framework in this area. Another important development has been the planning of the National Conservation Strategy (NCS), which is awaiting final approval before being launched. Recent activities of IPGRI relating to regional collaboration on the conservation of cultivated and wild plant diversity have also been significant, and are currently being documented.

However, very few tangible efforts have been undertaken to assess wild plant genetic resources, especially with regard to medicinal plants in Bangladesh. There is no reliable list available on threatened species, though there are many candidates for this status. A priority need is therefore the implementation of a detailed field survey at the national level to assign Red List Categories to endangered species

Biodiversity and the People

In Bangladesh and in the adjoining regions, a long tradition of indigenous herbal medical systems, based on the rich local plant diversity, exists, forming a very important component of the primary health care system. Though largely neglected over the past half century, the majority of the village poor still rely on the traditional system (known as the Kavirajee system) for their primary health care needs. Every village has several such village herbal practitioners (Kaviraj), who traditionally inherited plant-based indigenous knowledge regarding the treatment of common diseases, and provided primary health care. This knowledge, which in most cases is not documented, is fast eroding as the profession, which is not financially lucrative, is becoming increasingly unattractive. Another point of concern is that with the destruction of forests and natural habitats, and with the abandonment of the use of the traditional system, much of the store-house of medicinal plant diversity has also been threatened.

Many of the medicinal plant species are no longer easily available in the wild and semi-wild states. Wild plants occurring in homesteads, on roadside verges and in fallow lands and fields are widely labelled as "useless weeds" and are collected as biomass fuel.

Effective Methods of Conservation

In view of the above factors, and the agriculture-dominated nature of the economy of Bangladesh, with family-based farming in the villages (about 90 per cent of the population living in some 68,000 villages), the role of farmers and their families in biodiversity conservation can never be over-emphasized. It is for this reason that FAO's Commission on Plant Genetic Resources (CPGR) has long recognized the role of farming communities in biodiversity and conservation of genetic resources. The participatory conservation of biodiversity, especially of the diversity of medicinal plants occurring in the villages, in and around homesteads, is the key method which has been adopted by a group of conservationists in north-western Bangladesh.

Participatory Conservation in North-western Bangladesh

North-western Bangladesh, which occupies about one fourth of the country's total geographical area, is very extensively deforested, containing a mere 0.4 per cent of forest land. It is thus especially vulnerable to biodiversity destruction. The region was, however, previously well known for its diversity of medicinal plants. Many important medicinal species like *Rauwolfia serpentina, Holarrhena antidysenterica, Tinospora cordifolia, Andrographis paniculata, Adhatoda vasica, Gloriosa superba, Vitex negundo, Centella asiatica, Mimosa pudica*, and many others, were known to display wide diversity in their natural habitats in this region. Now, however, many of these species have become rare and difficult to find.

Conservationists at the University of Rajshahi have been involved in the participatory documentation and conservation of local medicinal plants as well as the indigenous knowledge associated with their use in this region. Support resulting from collaboration with IDRC/IMPN has proven very helpful in this regard. Inventories of local traditional doctors, medicinal plant users and the medicinal plant diversity have been initiated. Conservation activities concerning threatened and useful medicinal plants occurring in under-utilized land in and around homesteads, involving women's participation, have been planned under this project. It is hoped that a large number of local NGOs and Farmer Groups will be induced to adopt the participatory conservation, utilization, marketing and value-addition of the medicinal plant diversity as a sustainable method of poverty alleviation and nature conservation.

Proposed Project in North-western Bangladesh

The first phase of the project involved the inventorying of herbal practitioners and their plant resources in sample villages in north-western Bangladesh. Attempts were also made to identify medicinal plant species occurring in the area, which were listed and documented.

The proposed second phase of the project will focus on an assessment of the distribution, occurrence, status and commercial value of the plant species occurring in a wider area. Efforts to protect and conserve the worst affected and most economically important species and their natural habitats will be another major goal during the second phase. Controlled access to biodiversity thus conserved and cultivated for extraction and marketing will result in the sustainable use of the resource base, and will play an important role in raising living standards and alleviating poverty amongst the rural poor.

Some Perspectives of Rural Trade in Medicinal Plants, Based on a Field Study Carried out in Himachal Pradesh, India

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Introduction

A complete understanding of the key features of the medicinal plants trade, with its strengths, as well as weaknesses, is important if we wish to put into place a more efficient and sustainable system. The following paper, which is based on an in-depth study of 12 villages located in Kullu and Mandi Districts of Himachal Pradesh, presents some key issues and findings relating to the trade and marketing of medicinal plants. These may be of relevance when considering other hill regions, both within India as well as in Nepal.

Exploring the Veracity of Charges Most Commonly Levelled Against the Trade

1. Secrecy

The medicinal plants trade network is highly sophisticated and complex in nature, with a deep penetration into the remotest of villages and with a system of fine-tuning collection activities in response to demand. The trade is knowledge-intensive and is based on trust. It has historically maintained a high degree of secrecy, which continues to this day. This secrecy is only partially a response to the illegal nature of some of the transactions carried out. Its main role is that of an entry barrier so that existing traders can maintain their market positions.

2. Monopolistic Nature of the Trade

An analysis of the export permit records shows that the number of traders in each division varies from eight in Parbati Division to 38 in Seraj Division. Of these, four to five are large-scale operators, working over three to four divisions, while the remainder are confined to one or two divisions.

In strictly technical parlance, the trade cannot be described as a monopoly, or even a monopsony, as a multiplicity of traders operate at each level, and are permitted to operate as per the rules and regulations. There are no legal barriers to bar fresh entrants to the trade, no restrictions to bind the collector to selling their produce to any particular trader, and no evidence of the existence of collusive price setting by the traders. At best, the basic structure of the trade can be described as imperfect competition.

3. High Mark-ups

A final major charge levelled against the trade in medicinal plants concerns high mark-ups with regard to prices at successive tiers of the market. In assessing this claim, an examination of the differences between prices paid to the collectors, as compared to those prevailing in the final market, provides a good indication of the distortions within the market structure. In the course of the study, the prices of the twenty most common commodities reported in the surveyed villages were compared to prices

gathered from five or six trades in the Amritsar and Lucknow markets. This analysis is presented in Table 1 below.

Table 1. A Comparison of Prices Prevailing at the Village Level Versus Prices Prevailing in the Final Markets for Twenty Selected Commodities.

Commodity	Range of prices reported in sample villages (in Rs./kg.)	Range of prices reported by traders in Amritsar and Lucknow markets (Rs./kg.)	Final prices as a percentage of village prices
1. Anardana	50	115 - 180	230 - 360
2. Baj	2.5 - 8	25 - 30	375 - 1000
3. Banafasha	60 - 150	150 -300	200 - 250
4. Bankakri	20	45 - 52	220 - 260
5. Brahmi/Minaki	6 - 12	20 - 30	250 - 300
6. Dhoop	45	80 - 95	175 - 210
7. Dioscorea	3 - 18	27 - 30	150 - 1000
8. Dorighas	10	15 - 17	150 - 1000
9. Guchhi	1500 - 2500	2500 - 3000	165 - 200
10. Kadoo	80 - 85	135 - 145	150 - 180
11. Kakarsinghi	100	270 - 300	270 - 300
12. Mushakbala	12	40 - 80	330 - 666
13. Nihani	22	65- 90	300 - 400
14. Patish (karvi)	700	850 - 950	120 - 135
15. Rewandchini	10	22 - 27	220 - 270
16. Ritha	5 - 7	12	170 - 240
17. Salam mishri	200	1300 - 1500	650 - 750
18. Salam panja	225 - 300	550 - 1100	200 - 480
19. Tejpatta	2 -3	8.5 - 12	400 - 425
20. Talispatra/Rakhal	16.5	25 - 28	150 - 170

As is evident from the table above, final prices are 1.2 to 3.5 times higher than the village prices in the majority of cases. In a few cases, Amritsar prices are as high as six to ten times those reported in the villages. These latter cases are, however, in all probability attributable to differences in quality and do not reflect actual mark-ups in price.

Reasons for High Mark-ups

High price mark-ups are partially a reflection of the high costs and risks involved in the trade of medicinal plants. A case study of five lower level traders revealed that returns on investments were in the range of 22 to 26 percent over costs.

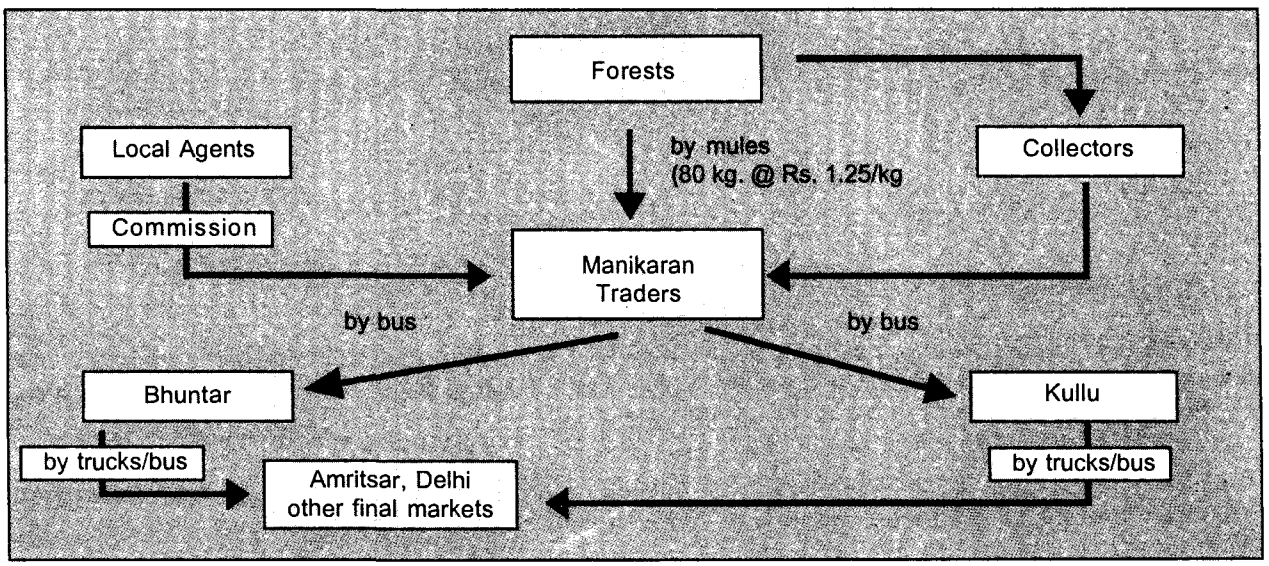
A significant determinant of collector level prices is the distance of the concerned village from the roadhead. Table 2 compares the prices of *dioscorea* across four surveyed locations, in addition to a major trading town, Bhutar, and the whole sale market at Amritsar.

Table 2. Differences in the Price of *Dioscorea*, in Relation to Distances of the Village from the Roadhead.

Villages	Distance from roadhead (km.)	Price (Rs./kg.)
Tosh	19	3.00
Barsiani	12	5.00
Hibab	5	12.00
Jana	On the road	18.00
Bhuntar	Trading town	25.00
Amritsar	Wholesake market	30.00

The table above reveals that the greater the distance from the roadhead, the lower the village level price is for *Dioscorea*. To some extent, this can be explained by the difference in costs, for example, an additional cost of Rs. 125 per quintal is incurred for transporting produce from Tosh to Manikaran on mules. Similarly, a distance of 45 to 50 km. separates Manikaran from the main trading towns of Kullu and Mandi, and a cost of Rs. 200 can be reasonably imputed to transporting the produce. Figure 1 below, which shows the flow of non-timber forest produce from Tosh village in Kullu District, helps to clarify the issue of transportation costs.

Figure 1. The Flow of Non-Timber Forest Produce from Tosh Village, Kullu.



Thus, about 15 percent of the differences in prices between villages such as Tosh and Barsaini and trading towns like Bhuntar and Kullu can be attributed to transportation costs. Another 15 to 25 per cent can be reasonably imputed as compensation to the trader for the time and money invested in organizing the marketing activity. With regard to other reasons for high mark-ups, the following factors also play a part:

1. Ignorance and lack of access to market/price information on the part of collectors;

2. Lack of bargaining power and indebtedness and reliance of collectors on traders, who play an important role in village society as money lenders;

3. Lack of resources or minimum quantities required for direct sale by collectors.

The above described situation typifies localized monopolies which may operate in the more inaccessible parts of the region, and is more common in Kullu, with its high altitude villages, as opposed to Mandi, where a better road network increases the options available to the sellers.

Key Strengths of the System

The major strengths and areas of opportunity of the current system of trade of medicinal plants are summarized below:

1. The trade network penetrates even remote and inaccessible areas;

2. A complex network of local contacts, which minimizes operating and infrastructure costs, is in place;

3. The system is flexible and able to fine tune supply (collection activities) to demand;

4. The system of trade in medicinal plants plays an important role in the communities involved, for example, through the fulfilment of lean season credit requirements.

Possible Areas of Intervention

Some of the most commonly suggested areas of direct intervention include:

- Nationalization
- Co-operative arrangements
- Industry-Community tie-ups

With regard to the first option, nationalization, experiences to date have not been encouraging, while mixed experiences have been obtained for co-operative arrangements. Tie-ups between industries and communities are yet to be tried on a significant scale.

All of the above strategies are high cost - low flexibility systems, which are unsuited to the dispersed uncertain system of production/collection found in areas such as the surveyed villages. Thus, interventions in the trading system without simultaneous intervention in the production system, in terms of guaranteeing a more continuous and steady supply of output from a particular area, are unlikely to succeed. A more effective strategy would be to improve basic infrastructure, such as roads, telephones and to provide rural credit. Such an approach would probably have a greater impact on the prices obtained by collectors, as is suggested from the case study described in this paper, than direct market interventions.

Medicinal Plants as the Basis for Linking Rural People to Safe and Effective Health Care Systems

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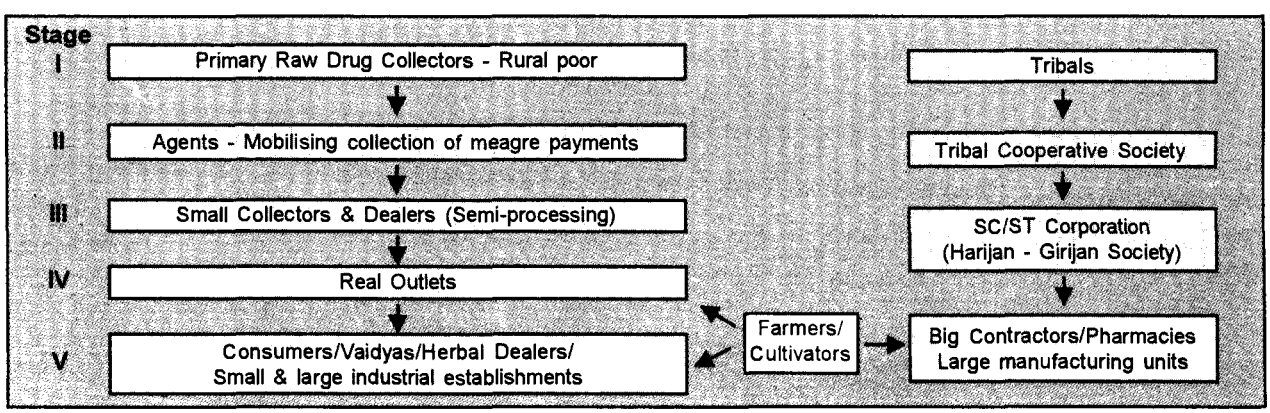
Introduction

Cultivation of medicinal plants in India dates back to the Vedic period. About 700 species of medicinal plants are known to be used in the Ayurvedic system of medicine. Most of these species occur naturally in forested areas. However, due to indiscriminate and unplanned over exploitation of these plants, many have become rare or even extinct. The only way to regain the biodiversity balance is therefore to resort to re-introduction of these species in forests and to engage in their cultivation on a large scale, with the active involvement of farmers and voluntary organizations.

The Supply of Raw Materials for the Medicinal Plants Industry

The tribal belt of India is richly endowed with medicinal plant species, with local tribes being dependent on their collection and trade for their primary health care needs, as well as a source of income. The supply of raw materials for the medicinal plants industry is mainly through minor forest produce contractors/dealers, who in fact determine the prices of the materials. The existing channel for the supply of raw materials for the industry is shown in Figure 1 below.

Figure 1: Raw Material Flow from Collectors to Consumers/User Industries



The raw drug collectors/tribals, living in and around forests, are generally paid only subsistence allowances for their collection activities. Pricing of the ultimate product for the user industry generally depends on the season of collection, the availability of the raw material and the demand for it. Thus, availability of good quality raw material, free from adulterants, in adequate quantities, and at suitable prices, has been one of the chronic problems facing the medicinal plants industry. No effort appears to have been made, however, by the Government or by the industry to assess the extent of the area available under these crops (both in the wild as well as in their cultivated forms), the present supply situation and the demand by existing pharmacies.

In addition to more than 10,000 licensed pharmacies dealing with the Indian Systems of Medicine, there are thousands of local vaidyas, local healers, monks, bone setters and tribal doctors who possess indigenous medical knowledge and practise traditional systems of medicine. Many of them are believed to be dependent on retail outlets for their supplies of raw materials. Even commonly occurring crops such as gooseberry, neem, cloves, nutmeg and ginger are not available in adequate quantities to meet the requirements of the user industries. The problem is further compounded by the fact that the existing land ceiling regulations prohibit user industries from owning and cultivating medicinal plants for their own use.

The introduction of medicinal plants into the cropping patterns of farming communities, especially in dry land and watershed areas, could provide a strong thrust to soil and water conservation, in addition to providing returns which would directly and indirectly contribute substantially to the ex situ conservation of these crops.

The IDRC-Assisted Medicinal Plants (India) Project Being Implemented by the Arya Vaidya Sala at Kottakkal

The Medicinal Plants (India) Project (Supplement 1) is focusing on the development of strategies for ensuring sustainable supplies of selected medicinal plants, thereby making a significant contribution to the provision of holistic health care, increasing the incomes of small and marginal farmers and preserving biodiversity. The project specifically aims to motivate farmers, tribals and rural women to cultivate medicinal plants through the provision of practical training programmes and through the establishment of two production centres for the supply of propagules of medicinal plants studied under the Project. Ultimately, the objective of the Project is to evolve a viable production to consumption system, through the involvement of production centres, cultivators and drug manufacturers.

Activities conducted under the Project include preparation of distribution maps, the establishment of a germplasm bank and the undertaking of pharmacognostic studies of the 10 species of medicinal plants used extensively in Ayurvedic preparations. These species are shown in Table 1. The Project is also focusing on the development of strategies for undertaking future studies with respect to harvesting, processing and storage problems of important medicinal plant species.

Table 1: Studies on Collection, Propagation, Cultivation and Pharmacognosy of Ten Selected Species Used in Ayurveda

Sl. No.	Botanical Name	Sankrit Name	No. of preparations
1.	*Limonia acidissima* Linn.	*Kapittah*	3
2.	*Holarrhena pubescnes* (Buch-Ham.) Wallich ex Don	*Kutajah*	42
3.	*Oroxylum indicum* (Linn) *Benth* ex Kurz	*Syonakah*	17
4.	*Aegle marmelos* (Linn.) Corr.	*Bilvah*	44
5.	*Kaempferia rotunda* Linn.	*Bhumicampaka*	21
6.	*Nervilea aragoana* Gandich	*Padmacarini*	3
7.	*Plumbago indica* Linn.	*Citrakah*	102
8.	*Asparagus racemosus* Willd.	*Satavari*	64
9.	*Bacopa monnieri (L)* Pannel	*Brahmi*	21
10.	*Rotula aquatica* Lour.	*Pasanabhedah*	10

Under the IDRC-assisted Project, the Arya Vaidya Sala has started a training programme in the cultivation of medicinal plants for selected farmers. The main highlights of the programme are shown in Figure 2 below.

Figure 2: Training Programmes for Rural Farmers on Cultivation of Medicinal Plants

1. Selection of 20 farmers with help from NABARD, Panchayats municipalities and voluntary organizations

2. Details of Training Programme Aids

a) Live medicinal plants commonly used
b) Slides and OHP projectors
c) Charts and models

3. Lectures classes handles by experts in the field

i Importance of medicinal plants
ii Nursery techniques & transplanting
iii Cultural operations
iv Harvesting, processing and storage
v Use of fifty medicinal plants as first aid.

Practicals

Demonstrations of the above, followed by participants repeating the same themselves. Demonstrations classes will be conducted especially in the method of use of the first aid medicinal plants

4. Discussions with the participants, followed by their suggestions

Finally, points raised by farmers with regard to problems faced in cultivating medicinal plants are summarized below:

1. The systematic cultivation of several medicinal plants as pure crops is uneconomical.
2. Many tree species, for example, Ashoka, Bael, Fig, Kashmari, Bijasal etc. have a long gestation period from the time of planting to the time of harvesting the produce.
3. Unstable market conditions have acted as a deterrent to farmers taking up cultivation of medicinal plants species.
4. Non-availability of quality planting materials in required quantities is a problem faced by farmers.
5. Marketing problems for fresh raw material, which requires immediate transportation, as well as lack of an assured market in many cases.
6. Problems relating to obtaining loans from banks.

Some of the above constraints, for example those mentioned in points 1 and 2, can be tackled through training and awareness building programmes. However, with regard to economic and marketing

constraints, it was agreed, during the course of discussions held with farmers, that if NABARD is prepared to provide financial support, the farmers in turn would be prepared to form a society which could purchase and sell cultivated medicinal raw material at competitive rates. This would result in cultivators having assured markets, increased incomes and fair prices for their products, while industry in turn would benefit from reliable and quality supply channels of raw materials from domestic sources.

Rural Perspectives in Collection Practices, Primary Processing and Marketing: A Case Study of a Tribal Community-Managed Enterprise in Madhya Pradesh

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Introduction

India is known for her rich variety of medicinal plants, with ancient literature, for example, the Atharveda and the epics of the Ramayana and Mahabharata being replete with examples of the usage of medicinal plants in health care. Indigenous systems of medicine are practised throughout the country - in the North as Ayurveda and in the South as Siddha, with the Unani system being linked to the advent of Islamic civilization. Tribal and rural populations within the country have also, over the course of time, developed folk systems of medicine through a process of trial and error. All of these systems depend on medicinal plants as the basis of their drug development, and even Homeopathy and Allopathy utilize plant species and their extracts in several formulations.

There are more than 47,600 species of plants in the country, out of which nearly 10,400 species have known medicinal uses according to nation-wide surveys carried out by the Botanical Survey of India. Most of these (8,000) are flowering plants. India can thus be seen as a wonderland of medicinal plants. Furthermore, habitat diversity is extremely wide - there are 16 different agro-climatic zones, 10 vegetation zones, 25 biotic provinces and 426 biomes within the country.

Specifically, the Central Indian Plateau and the plains of the mighty Narmada River, an area that encompasses the states of Madhya Pradesh, Maharashtra, parts of Rajasthan and Gujarat, contain a vast wealth of medicinal plants growing in forested areas. They are collected by local rural and tribal populations, as well as by petty contractors, and in some cases, by the Forest Departments, Federations and Government Cooperations. Madhya Pradesh, in particular, is known for its rich medicinal plant resources. This is not surprising given the fact that 34.88 per cent of the state is forested and nearly 23 per cent of the country's total forests are located there. Primitive tribes, constituting almost 22 per cent of India's total tribal population, inhabit the forests and their surroundings. The Central Council for Research in Ayurveda & Siddha has identified close to 750 species of medicinal plants occurring naturally in Madhya Pradesh. Table 1 shows the number of medicinal plant species occurring district-wise within the state, as revealed by a survey conducted by the Vanoushadi Anusandhan Ekai Government Ayurvedic College in Gwalior.

Table 1. Number of Medicinal Plant Species Identified in Nine Districts of Madhya Pradesh by the Government Ayurvedic College, Gwalior

Sl. No.	Name of District	No. Medplant Species Identified
1.	Dhar	258
2.	Guna	163
3.	Hoshagabad	310
4.	Shadol	183
5.	Bastar	104
6.	Sagar	478
7.	Gwalior	119
8.	Chhttarpur	232
9.	Satna	273

Other districts in the State, such as Bilaspur, Sarguja, Raigarh, Mandla, Balaghat, Rajnandgaon, Chhindwara, Betul and Seoni are also rich in medicinal plants.

The Present Production Base

The majority of collectors of medicinal plants are tribal and rural populations living in and around fringe forest areas. Their collection activities meet 90 per cent of the requirements for medicinal plants, at the local as well as the industrial levels. The present collection methodology is, however, extremely destructive, with no emphasis being given to the conservation and sustainable use of the resource. This is not only because collectors have little awareness regarding sustainable use, but also because of poverty and greed, which prompt individual collectors to gather all of the available plants lest other collectors gather them first. This leads not only to a destructive utilization pattern, but also to collection of immature plants with little or no medicinal value. The result has been a gradual depletion of a number of very valuable species from the wild, some of which are on the verge of extinction.

The cultivation of medicinal plants has not generally been given much consideration or importance in India. Even though a number of government and non-government organizations are engaged in the research and propagation of medicinal plants, the success rates for many of the species have been minimal with regard to cultivation. The principal government agency involved in this activity has been the Council of Scientific and Industrial Research Development (CSIR), along with its seven research institutions, namely, the Central Drug Research Institute (CDRI); the Central Institute of Medicinal and Aromatic Plants (CIMAP); the National Botanical Research Institute (NBRI); and the four Regional Research Laboratories (RRL) at Jammu, Surat, Bhubaneswar and Thiruvananthapuram. The Central Council for Research in Ayurveda & Siddha, and its regional research centres are also conducting much needed research in this field. With regard to non-government organizations, various non-governmental organizations have also laid emphasis on the research and development of medicinal plants. Some of these are the Arya Vaidya Sala (AVS), Kottakkal, Kerala and the Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore. However, in spite of the efforts of

organizations such as those mentioned above, transfer of technology from lab to land has not taken place to the desired extent, and there is still extreme pressure being exerted on the country's natural resources as a result of unsustainable and destructive exploitation.

In the State of Madhya Pradesh, certain species of medicinal plants have been taken up for cultivation on a large scale. These include Ashwagandha *(Withania sp.),* Isabgol *(Plantago ovata),* Lemongrass *(Cymbopogon flexiosus),* Mentha-Japanese *(M. arvensis),* Peppermint *(M. pipereta)* and Spearmint *(M. spicata).* However, cultivation of medicinal plants is confined to a limited area in the north-western districts of Madhya Pradesh, namely Ratlam and Mandsaur.

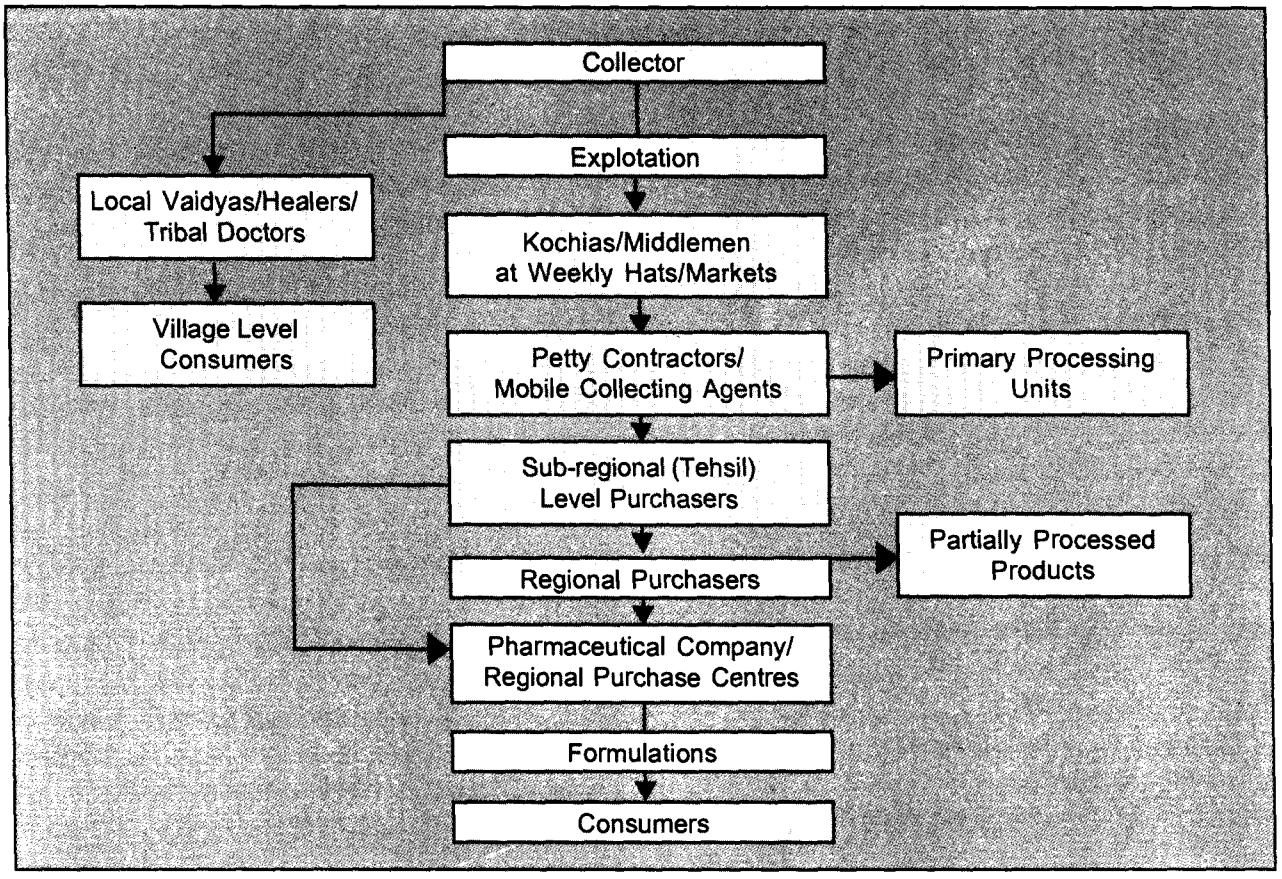
The Present Market

The Ayurvedic system of medicine, which has been practised in India for the past 3,000 years, has resulted in the utilization of medicinal plants in formulations for a corresponding period of time. In recent times, the growing interest being shown in Ayurveda and other natural systems is directly related to a realization of the adverse effects of Allopathy. In India, today, there are close to 360,000 registered practitioners of Ayurveda, mainly located in rural areas, as well as in some urban areas, in addition to 1,150 Ayurvedic hospitals and 12,840 dispensaries. With regard to training facilities, there are 98 Undergraduate Ayurvedic colleges turning out 3,947 graduates annually and 25 Post- Graduate institutions turning out 314 postgraduates annually. It has been estimated that nearly 700 medicinal plant species are used in Ayurveda; 600 in Siddha; 700 in Unani and 30 in allopathic medicine. There are more than 4,000 registered pharmacies, which prepare about 15,000 Ayurvedic and Unani medicines to a value of nearly 3,000 crore Rupees. A UNDP report released in 1994 put the annual value of medicinal plants originating in developing countries alone at about USD 32 billion.

India is a traditional source of supply for about three-quarters of the crude drugs listed in the pharmacopoeias of the world. In addition, there are innumerable local dealers and herbal doctors scattered throughout the country, especially in tribal areas. These local doctors have direct access to the medicinal plant resource base, and normally obtain their requirements directly from the forests. The market for medicinal plants is thus huge, not only at the local level, but also at the national and international levels. The shift in interest from Allopathy to traditional systems of medicine, which can be observed world-wide, will further boost the trade in medicinal plants.

The market structure,however, is presently disorganised and lacks co-ordination The end-user industries are obtaining their raw materials from forest areas without giving any thought to the conservation and sustainable use of the resource base, and without spending any part of their profits on the propagation of biodiversity. In the survey carried out by the author, and from his extensive experience of tribal-dominated remote areas, the following production to consumption system has been identified, as shown in Figure 1.

Figure 1. The Present Production to Consumption Chain.



State Interventions in the Trade of NTFPs through Tribal Community-Managed Enterprises.

In order to develop a collection and marketing chain, which is favourable to the producers, it is extremely important to control the exploitative practices adopted by the Kochias, or petty contractors, who secure the major share of the profits in the trade of NTFPs. The Government of Madhya Pradesh has successfully intervened in the production to marketing chain with regard to selected nationalized Minor Forest Produce, for example, Tendu Patta *(Diospyros leaves)*, Sal seeds *(Shorea robusta)* and Mycrobalan-Harra *(Terminalia chebula)*. This was achieved through the establishment of a three-tier co-operative structure with the following objectives.

1. People's participation at the primary level in collection, processing, go-downing and marketing of NTFPs through the establishment of co-operatives;

2. Elimination of the exploitative middle men through direct purchase from collectors;

3. Due remuneration to the collectors at pre-determined prices;

4. Development of enterprises at the village level to make collectors the owners of NTFPs, and to teach them to trade successfully;

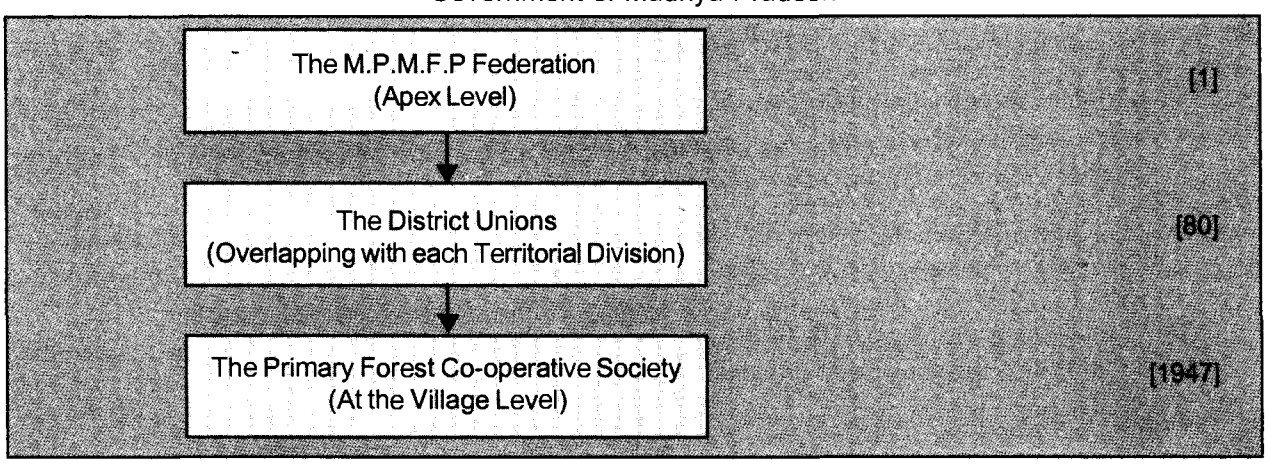
5. Facilitation of value addition at the grassroots level;

6. Conservation and development of NTFPs through *in situ* and *ex situ* strategies for sustainable use;

7. Assurance of social benefits to the collectors.

With the co-operatization of the Tendu-Patta Trade in 1989, a three-tier co-operative structure was established as shown in Figure 2.

Figure 2. The Three-Tier Co-operative Structure Established by the Government of Madhya Pradesh



The Primary Forest Co-operative Society is a registered society under the Co-operative Act, and consists of all of the actual collectors of Non-Timber Forest Produce in an area. These co-operatives appoint an agent known as the Phad-Munshi, who is a replacement for the Kochia at the village Hat, or market. The government has also imposed state monopoly over minor forest produce so that no other persons or bodies can trade in these products. The society purchases the produce at a rate fixed annually by the government. It then ensures that primary processing of the produce occurs before handing it over to the district union, which is responsible for transporting and go-downing it. The Apex Federation handles the marketing of the produce through a system of periodic national tenders and auctions. It is the State Government's responsibility to ensure that the net profit after deduction of expenses and royalty goes to collectors through a system of commissions or deferred wages. The structure described above has functioned efficiently for the last 8 years, with an annual turnover rate of nearly 3,500 million Rupees, and a gross profit of nearly 1,000 million Rupees.

Critical Factors Determining the Success of the Above State Intervention

Critical success factors for this novel system of empowering people include the following:

1. Establishment of a huge three-tier co-operative network including
   - 1947 Primary Forest Co-operatives.
   - 80 District Co-Unions.
   - An Apex Federation.

2. A total membership of more than 2.4 million collector families, most of whom are tribals;
3. The existence of a massive network consisting of more than 30,000 purchase centres, locally known as Phads;
4. Guaranteed weekly payments at pre-determined collection rates to the tune of more than 2,000 million Rupees;
5. Ensuring collection, primary processing, go-downing and marketing of:
   - 4.5 million standard bags of Tendu Patta.
   - 79,000 tonnes of sal seeds.
   - 10,000 tonnes of myrobalans.
   - 700 tonnes of gum.
   - 7,200 tonnes of other MFPs.
6. Gross sales turnover of more than 3,500 million Rupees;
7. Establishment of primary processing units at the village co-operative level;
8. Guaranteeing social security to all of the collectors by covering member families through the biggest group insurance scheme in the country;
9. The initiation of conservation and development of NTFPs through people's participation and funds provided by the Government of India, the State Government and the co-operatives; and
10. The initiation of training and extension programmes for co-operative members in accounting, co-operative laws, primary processing and the development of market information.

On the basis of the success of the tribal community-managed co-operative enterprises in the state during the past six years, the Government of Madhya Pradesh decided to establish a special Medicinal Plants Task Force in 1995 with the following objectives:

1. To identify the gaps which exist between the private sector, commercial activities and public sector research and development activities, and which have adversely affected the well-being of producers and collectors living in remote areas;
2. To identify ways and means of making public development strategies more commercially oriented to specific demand patterns for particular plants and plant parts, and to specify methods of brokering deals and establishing direct collaboration between the end user private enterprises and the collectors;
3. To suggest and develop a production to consumption chain which will facilitate the removal of the exploitative market mechanism which presently exists in the trade of medicinal plants, and to ensure due remuneration to the collectors and cultivators of medicinal plants;
4. The very survival and success of the Medplants Industry lies in easy and sustainable availability of sufficient quantities of medicinal plants. This task force will therefore aim to bridge the gap between the awareness of local communities and user agencies regarding the environmental threats and the potential endangerment of medicinal plants. It will suggest inputs needed from indigenous enterprises/industries for the sustainable production of the raw material;
5. The local traditional medical industry, that is, the vaidyas, tribal doctors and hakims, currently play a major role in the exploitation of medicinal plants from forests. The task force will therefore aim to identify the efforts of this group of users to combat the problem of dwindling supplies, and to gauge the role they can play in the protection and conservation of the resource; and

6. To identify research partners from user agencies who can help improve processing, storage, quality control procedures and development of plant material for ex situ conservation. This will also assist in the identification of agencies, which can supply quality seeds and plants on a commercial basis for the cultivation of medicinal plants.

Problem Areas

As a result of the work carried out by the Medicinal Plants Task Force over the past two years, the following problem areas have been identified:

1. Insufficient primary and secondary data of existing potential, areas of occurrence, present extent of exploitation and demand/supply rates of procurement and sale;
2. Non-existence of forward and backward linkages between producers and users;
3. Poor price control;
4. Destructive harvesting due to insufficient knowledge at the grassroots level;
5. Poor standardization of raw materials and crude drugs;
6. Lack of knowledge regarding laws governing the medplants trade;
7. Major share of the flow of benefits going to middlemen and end users;
8. Absence of value addition at the primary level;
9. Plundering of the resource by end users without any investments in its development;
10. Minimal research and development efforts being made regarding in situ/ex situ conservation/ cultivation of medicinal plants;
11. Minimal lab to land transfer of technology in this sector; and
12. Little co-ordination between various government agencies/departments handling the trade and development of medicinal plants.

Strategies for the Development, Conservation and Marketing of Medicinal Plants in Madhya Pradesh

Encouraged by the success of its intervention in the trade of nationalized NTFPs through the tribal community-managed co-operative societies, as well as the success of Joint Forest Management in the state, and with the identification of key problem areas, the State Government has adopted the following strategy for the conservation, development and marketing of medicinal plants:

1. Collection and compilation of data on the potential, the extent of exploitation, and areas of occurrence of prioritized species;
2. The implementation of market surveys for pin pointing demand and supply matrices/rates;
3. Initiation of dialogue with private companies/departments for standardization of raw materials and crude drugs;
4. Implementation of extensive training and extension programmes for the collectors;
5. Initiation of due legislation and implementation of laws to curb unfair practices and destructive exploitation;
6. Ensuring value addition at the primary level;

7. Ensuring investments by end users in the development and conservation of the resource base for sustainable harvesting;
8. Substantiation and co-ordination of research and development efforts and lab to land technology transfers;
9. Co-ordination of the efforts of various government agencies for ensuring a continuous flow of funds;

Conclusions

Considering the above objectives and the present strategy adopted, as outlined above, it is expected that the following production to consumption chain will emerge as the ideal operation unit for the sustainable harvesting and development of the medicinal plant resource base.

Figure 3. The Ultimate Goal

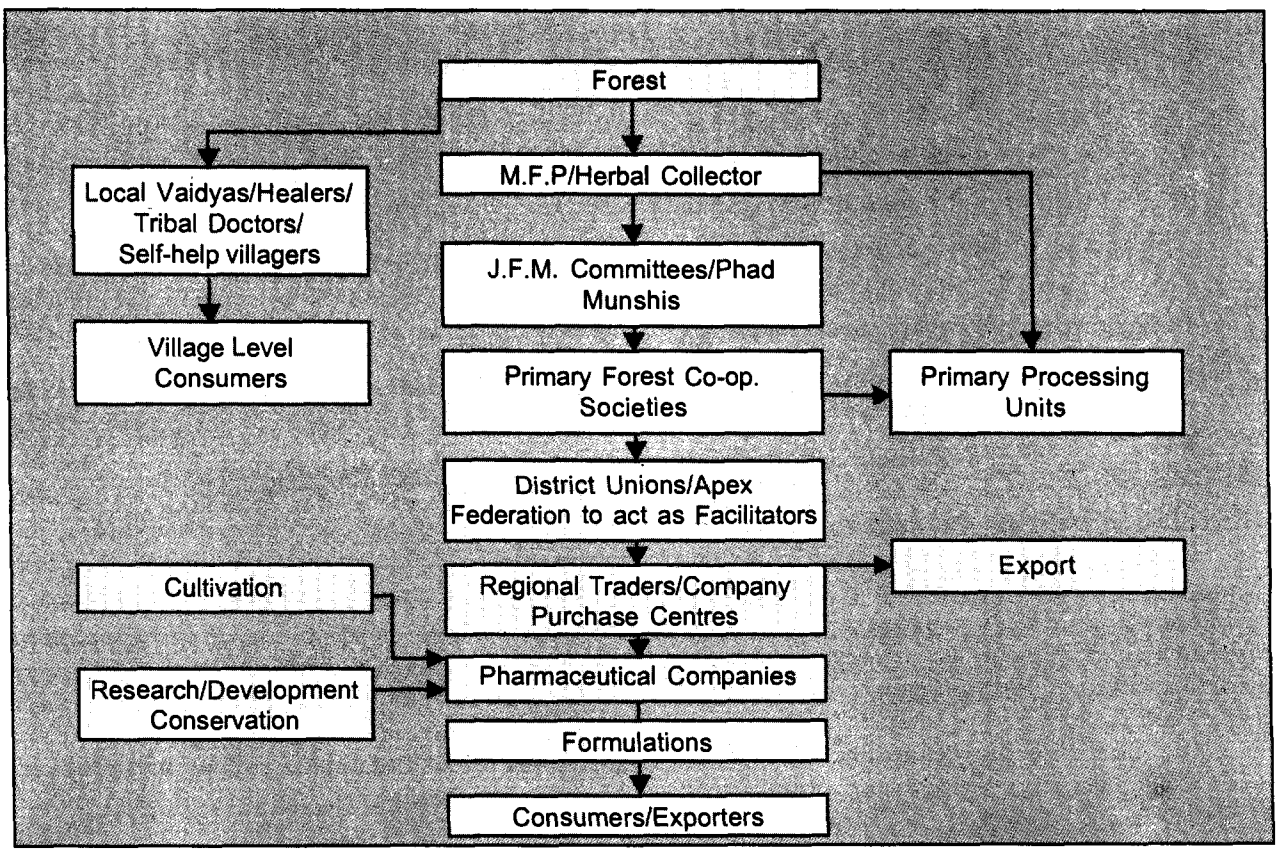


Figure 3. shows the structure necessary to ensure the efficient development of the medicinal plants-based industry, as well as the non-destructive, sustainable development and supply of raw material through participation of village level Forest Committees and Primary Co-operative Societies. In such a scenario, collectors themselves make conscious decisions, which will result in curbing the presently destructive exploitation of the resource base. The entailed education, research and development activities undertaken as a result of adopting this strategy, not only by the public sector but also by private companies, will help collectors as well as forest protection groups and primary co-operatives to conserve and develop their forest resources for sustainable use.

It is well known that a lot needs to be done with regard to educating collectors on storage and primary processing. As a result of establishing a dialogue with tribal collectors in remote areas of Madhya Pradesh, some eye opening facts came to light, as discussed below:

- The collectors in most cases are guided by Kochias to start and end collection;
- Collectors have had to gradually venture deeper into the forests as more and more of the ground flora disappears from fringe forest areas;
- Collectors gather all of the plant material available at a particular site without giving thought to the propagation of species. In this regard, plants whose roots are used for medicinal purposes are the worst affected, particularly Safed Musli *(Withania spp.), Satawar (Asparagus spp.)* and Nagarmotha *(Cyprus rotundus);*
- Simple primary processing procedures such as drying in the shade to conserve alkaloid contents are not being adopted;
- In certain areas, the local Vaidyas/ tribal doctors do share their knowledge with the community, but collectors only adopt sustainable practices when collecting material for them, and not for the Kochias.

The above facts point to the need for launching an extensive education programme for collectors. The M.P.M.F.P. Federation has already started this programme on a small scale, and envisages the distribution of educational pamphlets amongst the collectors, and the holding of training camps at the village level. In order to be successful, this programme would have to be supported by private companies, which have a stake in not only obtaining quality plant material, but also in obtaining it in ample quantities for running their enterprises.

As far as primary processing and value addition at the local level is concerned, the programme will be beneficial to both local communities as well as the industries involved. Khadi Village Industry Corporation (KVIC), Tribal Marketing Federation (TRIFED) and other government agencies have already taken the initiative, but due to lack of marketing linkages, these units are already in a state of disuse. What is therefore required is the creation of a linkage with the pharmaceutical companies, which would ensure quality control in primary processing, thus saving costs with regard to bulk transportation of raw materials. These companies are also in a position to pay higher prices to the primary societies in areas where primary processing plants have been established.

The most important issue, which has been sorely neglected by the pharmaceutical industry as well as by the public sector concerns *ex situ* cultivation of medicinal plants. Supplies of plant material are gradually dwindling, and with the emphasis on conservation of biodiversity, more stringent conservation laws will further diminish supplies of medicinal plants from the wild. It is high time that both the public and the private sector opened their eyes to the ground situation and made due investments in the cultivation of medicinal plants in order to ensure sustainable supplies which match the ever increasing demands for plant material.

Vast areas of both forested and non-forested land are available in the country for the cultivation of medicinal plants. The Government of India has already initiated action with regard to planting medicinal species in degraded forest areas with the assistance of J.F.M. Committees. However, good planting material is difficult to obtain. Government sector research organizations such as CIMAP, CDRI, RRLIS

and ICFRE are conducting research on the development of improved varieties of medicinal plants. However, such activities require a boost through the involvement of private sector pharmaceutical companies. Such companies would not only ensure supplies of quality planting material developed through research, but would be in a position to provide buy-back guarantees, or establish M.O.Us with cultivators and co-operative societies which come forward to grow medicinal plants. It is suggested that an approach similar to the one adopted by paper mills and match factories in the past, involving entering into agreements with growers of pulpwood and softwood, needs to be adopted to give cultivation of medicinal plants the necessary boost. This will not only ensure an unrestricted supply of raw material, but would also ensure the socio-economic upliftment of tribal populations and rural communities, thereby bringing about a medicinal plants revolution in India.

Community-Managed Enterprises: Participation of Rural Communities in Medicinal and Aromatic Plants Conservation and Use

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Abstract

Humla is one of the most remote and least developed districts of Nepal, where the majority of the population is involved, directly or indirectly, in the collection, transport and trade of non timber forest products. Increasing market demands for these products, poverty and lack of employment opportunities have exerted additional pressures on the wild medicinal plant resource base, posing considerable threats to the district's biodiversity and economic stability. Although there is considerable evidence of over-exploitation of certain medicinal and aromatic plants in some accessible localities within the district, the major part of the district remains under-exploited. This situation provides ample opportunities for the management of the medicinal and aromatic plants of the district for economic development as well as for environmental benefits. Humla Oil Pvt. Ltd. (HOPL), a community-managed enterprise, was established to create a mechanism for involving local people, the major stakeholders with regard to biodiversity, in the conservation and sustainable use of their resources. Experience has shown that the provision of technical, financial, managerial, training and market support result in the development of adequate incentives and motivation among local people to properly manage and sustainably harvest the raw materials to ensure biodiversity conservation. This contributes to the smooth running of the enterprise, with the resulting economic benefits to local communities. If the common property wild plant resources of an area are to serve the needs of local people through sustainable utilization, a multi-pronged approach involving sound management and the provision of benefits to the local communities involved, must be adopted. It should also cover a range of issues, from improving economic standards in the area to changing the attitudes of local people. This paper discusses the mechanism for involving rural communities in the conservation of MAPs (Medicinal and Aromatic Plants). Specifically, it examines the process by which the HOPL was created, Its mode of operation, and lessons learned may be useful for providing similar support in developing conservation-oriented enterprises.

1.0 Introduction

Humla, which is the second largest district in Nepal, with a geographical area of 5,655 sq. km. and a population of around 35,000 people, is located in a remote region in the northwestern corner of the country. The nearest road to the district is a two day journey by foot from Simikot, the Distict Centre, to the road head in the Terai. While the district's southern borders contain limited sub-tropical valleys,

most of the vegetation is temperate or alpine. A cold, generally dry climate exists in the high alpine valleys, north of the southern arm of the Himalayas, which runs across the lower portion of Humla. The region is located in a partially rain-shadowed area, clearly separated from the southern monsoon-dominated parts of the country by a series of high mountains. July and November are the wettest and driest months, respectively. Altitudes in the district range from 1,500 m. to over 7,000 m. above sea level, resulting in a wide range of micro-climates characterized by elevation and aspect. As is the case throughout the Himalayas, Humla's natural vegetation communities are primarily defined by altitude gradients. The transitions are so narrow that, in some parts of the district, the sub-tropical vegetation found in the valleys and the arid vegetation of the Tibetan plateau are separated by an aerial distance of less than 25 km.

While mountainous areas in Nepal are rich in medicinal and aromatic plants (MAPs), increasing national and international demands for them, coupled with rural poverty, lack of income-generating opportunities, demographic pressure, illiteracy and unsustainable systems of harvesting and trade, have resulted in the degradation of the resource base. Traditional systems of harvesting are neither capable of sustaining natural ecosytems, nor providing adequate incomes to collectors for improving their livelihoods. (Subedi 1997; 1998). Further, the structure and functioning of the social system supports the vicious cycle of poverty and the accompanying degradation of the environment. It was to address this situation that the Humla Oil Pvt. Ltd. (HOPL), a community-managed enterprise, was established in Humla District in 1994, with assistance from the Asia Network for Small Scale Bioresources (ANSAB), and Appropriate Technology International (ATI). The objective of establishing HOPL was to create a mechanism for involving local people, the major stakeholders of biodiversity, in the conservation and sustainable use of their natural resources.

2.0 The Context

The raw material supply base of HOPL consists of approximately 51,000 hectares of forests, scrub and grass land. At least 50 per cent of households from eight Village Development Committees (Bargaon, Chhipra, Kharpunath, Lali, Raya, Ripa, Rodikot and Thehe) in Humla, have been participating in the enterprise, in one way or another.

A total of 102 species of MAPs have been identified and recorded in the project area, of which 16 are commercially used in trade and 31 have potential commercial value. Of these, all of the commercial species, 24 of the potentially commercial species and a further 55 species are used for subsistence purposes in the Humla Project Area (Subedi, 1998).

The project area is inhabited by mixed caste and ethnic groups of both the Hindu as well as the Buddhist religions, including Brahmin, Thakur, Chhetri, Lama, Byansi, Kami and Sarki groups. Most of the population (70 per cent) is illiterate, and almost all households engage in agriculture, or a combination of agriculture and animal husbandry, as their main occupation. Thus, the predominant economy in the area is agrarian-based, and is subsistence in nature. Social, religious and cultural practices are, in one way or another, linked with natural resources.

Since ancient times, and until very recently, the people of Humla bartered certain medicinal herbs for iron tools, grain and clothes with traders from Jajarkot, the neighbouring district. Likewise, people from Jumla, another neighbouring district, used to come to Humla to harvest Kutki *(Picrorhiza scrophulariiflora),* Atis *(Delphinium himalayi),* Panchaunle *(Dactylorhiza hatagirea),* Guchche-chyau *(Morchella conica, M. esculenta)* and Silajit *(organic exude* from rock). However, the markets for most wild harvested plants from Humla have only developed more recently. Herbs like Bhutkesh *(Selinum*

tenuifolium), Lekh-Satuwa *(Trillidium govanianum),* Bhojpatra *(Betula utilis),* Sugandhwal *(Valeriana jatamansi)* and Guchche-chyau *(Morchella conica),* have been harvested for just a few years, and the current demand for Jatamansi dates back to less than two decades.

The inhabitants of Humla district have traditionally traded in goods with India and China. Previously, when all the routes (posts) between India and China were closed, their business was at its peak. Now, however, with good relations existing between India and China, the traditional trade has shown considerable decline. Consequently, the trading activities of local communities have largely been concentrated on the collection and trade of medicinal herbs and other non-timber forest products.

Apart from commercial harvesting of economic plant species, most of the Humla population uses wild plants for a variety of purposes, including food, folk medicine, fodder, fuel and for manufacturing a number of domestic articles. They are also used for dyes, tannin, fibre, gum, resin, and for making agricultural tools and hunting weapons. Some species also find uses in worship and rituals. Most of the communities in the district are aware of the importance of maintaining intact and viable ecosystems. In most cases, they also realize the importance of biodiversity conservation, and have adopted certain types of traditional management practices to this end. Low population pressure, combined with indigenous management practices and isolation have together contributed to the preservation of the district's natural resources for generations. However, although the traditional management systems have remained functional for long periods of time, they cannot serve as a model for the future.

Threats to these resources are directly linked to human activities such as uncontrolled harvesting (over harvesting, premature harvesting, the use of unscientific methods etc.), over grazing, burning, shifting cultivation and related activities contributing to deforestation and habitat destruction. These activities are the consequence of several socio-economic conditions such as unclear definition of property rights, cash needs of local people, illiteracy, lack of knowledge regarding conservation, and increasing market demands for these products. In the existing trade channels, local collectors harvest the raw materials from national forest land and carry them back to their houses for drying. They are then sold to traders, either at the village or the district centre. Traders regularly visit the collection areas of Humla before the harvesting seasons, placing orders for set volumes, at an agreed price, with the collectors. They usually provide an advance on the final payment. On completion of collection activities, the traders return to finalize their purchases. Occasionally, they pay only a fraction of the agreed price, and the collectors are forced to sell at rates lower than expected due to the fact that the number of traders is limited. Some collectors try to market their products directly in the Terai wholesale markets. However, this is both costly as well as risky. The market structure described above has been in operation for a number of decades, and raw materials from the area eventually make their way to India, where they are sold to traders and processors for use in cosmetics, consumer products and medicines.

Heavy use of these resources has resulted in the conversion of formerly diverse vegetation into homogenous strongholds of a few resilient species. The homogenous vegetation belts surrounding the villages, and other areas of heavy use, illustrate the degradation and loss of biological diversity occurring close to human settlements. The vegetation around villages in the project area has been significantly transformed by human use for cultivation, including slash and burn agriculture, grazing, fodder and fuelwood collection. Such degraded areas are often taken over by resilient species such as *Urtica dioica, Girardinia diversifolia, Salvia moorcroftiana, Chenopodium album, Prinsepia utilis, Artemisia sieversiana, Rumex nepalensis, Berberis asiatica* and *B. aristata.*

In recent years, most of the collectors have noted the disappearance of commercially valued non-timber forest products, including medicinal and aromatic plants, from the more accessible locations, as well as a decrease in their populations in the more remote harvesting areas.

3.0 Technical Support and Enterprise Development

The initial planning and sub-sector analysis of non-timber forest products (NTFPs) was done with the participation of local stakeholders and outside experts. The planning exercise resulted in the conclusion that a community-managed enterprise to process a variety of MAPs would be feasible in Humla, and required the preparation of a business plan. Following this, HOPL, which is owned and operated by local communities, with technical assistance provided by ANSAB and ATI, and financial support from the Biodiversity Conservation Network and ATI, was established in 1994. At the commencement of the project, heavy technical support was required. This has, however, gradually lessened as the local institutions have become more capable and the enterprise has generated adequate profits to cover the investment and to become financially viable. The process of creating and running this enterprise is presented below.

3.1 The Creation of a Community-Based Organization

The Humla Conservation and Development Association (HCDA), a local community-based organization was created to represent the interests of all of the stakeholders involved in the collection and utilization of NTFPs and other natural resources, including collectors, traders, local communities, women's groups and local leaders. The provision of continuous support has enabled HCDA to become a sustainable institution with a well-established mode of operation. HCDA currently works to support all local NTFP collector societies and Community Forest User Groups (CFUG), and with the assistance of ANSAB and ATI, has been contracting outside expertise, whenever necessary, to accomplish specific technical tasks beyond the capacity of local communities. To date, HCDA has helped local communities to establish Humla Oil Pvt. Ltd., design and implement community forestry schemes and monitor the impact of commercial activities on local biodiversity. In continuation of its aims at the time of its establishment, HCDA has already started to assume responsibility for project-initiated activities, which will continue even after the termination of project funding. It has already established its reputation and has gained the trust of local communities in Humla as well as of outsiders. As a result, it has started receiving funds from other organizations to implement community-based conservation and development activities.

3.2 The Establishment of a Community-Managed Enterprise

Humla Oil Pvt. Ltd. was established with financial and technical assistance from ANSAB and ATI, as mentioned earlier. All of its activities are now planned and implemented by local people, who through training and practical experience have become not only capable of performing technical and managerial tasks, but have also developed confidence in their ability to provide technical support to other communities. It is noteworthy that the level of outside technical expertise required during the addition of HOPL's second distillation unit in 1996 was lower in comparison to the level required for the addition of the first one. Currently, HOPL runs two separate production units, which process four high altitude MAP products collected from the forests and pastures of Humla for producing high-value essential oils. With the assistance of ANSAB and ATI, HOCL markets its products directly to users in India and Europe, and through a distributor, to users in the United States.

3.3 Science and Technology for Value-Addition

Although the technology behind the processing of many MAPs is relatively straightforward, and a wide range of Ayurvedic preparations are produced, the herbal processing industry on the whole is in its

infancy in Nepal. The main constraints it faces are obtaining reliable information, processing technologies and access to markets (Subedi, 1997). There are neither enterprises for value-addition to MAP raw materials, nor a sizeable number of cottage industries in Humla. With little or no exposure to processing activities, it was very difficult for local communities to conceptualize the processing technologies required. A simple water-cum-steam distillation technology was therefore identified and a machine was designed to operate in remote areas using a simple technology. It was initially designed to run with fuelwood as its energy source, but can be adapted to run on electrical power when electricity becomes available from the micro-hydropower plant which is being established with assistance from ANSAB and ATI. The power generated by the plant will also be utilized by local communities, mainly for lighting purposes.

3.4 Market Support Services

Local communities invariably face difficulties in obtaining reliable marketing information. Further more, the understanding of market dynamics and the ongoing process is as important as current market information. In recognition of these issues, market support services commenced with a market systems analysis to generate the information needed for sustainable management, the setting of fair prices and for efficient marketing. Development of marketing infrastructure, including the provision of telephone, storage and processing facilities has facilitated local traders and HOCL to market their products profitably. Another very important form of support required by the community was start-up and working capital for the enterprise. In this regard, ATI and ANSAB arranged for the much needed capital by establishing a revolving equity fund administered by HCDA. The main objectives of the revolving equity fund are to assist the people of Humla (individually or in groups) to establish businesses based on the collection and processing of NTFPs and other natural resources (Subedi, 1997). Increased access to market information and the establishment of the processing enterprise have resulted in increased market competition, which has benefited collectors by providing higher prices for the raw materials at the source.

3.4 Resource Management Inputs

Inputs were provided for raising awareness and improving technical skills for resource management, including *in situ* management, cultivation, harvesting and post-harvesting operations. Management skills and practices have consequently been improved by a combination of indigenous knowledge and external expertise.

Following the holding of basic literacy classes, a specially designed conservation training module was used to raise conservation awareness and to introduce specific management techniques to the newly formed CFUGs. In the process of facilitating the hand over of community forests, ANSAB Foresters provided a range of options for the utilization and management of forest and pasture resources. The CFUGs made use of these options in the preparation of their management plans. Special emphasis was placed on the sustainable harvesting of the roots of jatamansi *(Nardostachys grandiflora),* and of several other aromatic plants, including Sugandhwal *(Valeriana jatamansi),* Juniper *(Juniperus indica)* and Sunpati *(Rhododendron anthopogon).* The prescriptions were based upon a sustainable rate determined through botanical inventories estimating the biomass and productive potential of the target species.

4.0 The Results

A community owned and managed enterprise, based on locally available natural resources, which is directly linked with the economic development of the local communities, as well as of the country, has

been established in Humla. As a result of its establishment, local communities have realized that they were previously merely suppliers of raw materials for value addition in distant localities. With the creation of the processing enterprise within their locality, they have also come to realize that their previous traditional activities had deprived them of additional employment and economic development opportunities. Increased participation of the collectors and other community members in the sustainable management of the resource base is one of the most noteworthy achievements of the newly established enterprise. The communities have become convinced that value addition procedures at the local level can make them largely independent of the different stakeholders outside the area, including various levels of market forces, resulting in greater opportunities for employment and economic development. Realizing the destructive nature of traditional collection practices, local collectors have become increasingly convinced that a collection practice, better than their own in terms of ensuring resource sustainability, exists, which is closely related to the long-term supply of the raw materials as well as increased economic benefits. This realization, accentuated by adequate orientation and training, has initiated the practice of controlled harvesting, together with managed utilization of the common property resource. It has also resulted in increased community control over the common property resource. A cadre of trained local manpower, in terms of sustainable harvesting practices, value addition procedures, and management and marketing skills, has been developed in the district. They have become efficient as well as influential members of the community, capable of acting as motivators and trainers in identical attempts, which may be made in other parts of the country in the future.

5.0 Lessons Learned

An approach, which is aimed at improving or restoring the ill effects of resource use and environmental degradation, should be a multi-pronged one, involving a variety of thrusts, from improving economic standards to changing the attitudes of local people. Some of the important lessons learned from the case study described in this paper, which can be shared by others involved in similar efforts to develop conservation-oriented enterprises, are listed below.

a) Establishing a community-managed enterprise which depends upon local biodiversity could serve as a strategy to provide more equitable returns to community groups, thereby providing incentives for conserving the resource base;

b) Community-owned enterprises gain more support from the local people than those owned by local individuals or by outside investors;

c) Community training and capacity building are necessary prerequisites to income generation and local biodiversity conservation programmes, as important decisions regarding the use, management and conservation of biological resources are made at the local level.

By providing communities with technical, financial, managerial, marketing and training support, they develop a new economic incentive to conserve the resource base of their raw materials, thus conserving the biodiversity of their area as a whole, for the benefit of all. As community groups make the transition from being merely suppliers of raw materials to processors of those materials, they become aware of and promote the conservation of those resources to ensure a sustainable supply for their commercial operations.

References

Subedi B.P. 1997 Utilization of Non-Timber Forest Products: Issues and Strategies for Environmental conservation and Economic Development. Workshop theme paper presented at the Workshop on "The Utilization of NTFPs for Environmental Conservation and Economic Development in Nepal," organized by ANSAB on March 29, 1997 in Kathmandu, Nepal.

Subedi B.P. 1998 Participatory Utilization and Conservation of Medicinal and Aromatic Plants: A Case Study form Western Nepal Himalayas. A paper prepared for the International Conference on Medicinal Plants held in Bangalore, February 16-19, 1998.

Conclusions and Recommendations of the Colloquium: The Delhi Resolution

Government - MOEF, DISM&H, DBT and CSIR; International Donor Community - IDRC, Ford Foundation; Banks/NGOs- NABARD, IASTAM and one other relevant NGO; MAPPA to facilitate the formation and functioning of the Committee;

2. The Group recommends that industry creates a Medicinal Plants Biodiversity Conservation Fund, the modalities of which will be worked out by the Expert Committee;

3. ADMA in conjunction with DISM&H to initiate database preparation work of key medicinal plant species;

4. Training needs, mechanisms, contents, schedules and technology transfer activities will be prepared by responsible groups in consultation with the concerned communities. ADMA and MAPPA will identify suitable groups;

5. Regarding product development, marketing and globalization, a Sub-Committee consisting of appropriate industrial representatives, NGOs and Canadian partners will be formed;

6. The group strongly recommends the setting up of an autonomous National Medicinal Plants Authority for providing a holistic approach to MP biodiversity conservation and socio-economic development. The Expert Committee will prepare a proposal for submission to the appropriate Government of India agency by March 31, 1998;

7. The Expert Committee will hold its first meeting before the end of January 1998.

Preamble

India is one of the most richly endowed countries, both in terms of the diversity of its medicinal plant (MP) resources, as well as its wealth of traditional medicinal practices. The country's current state of biodiversity conservation and management is, however, alarming since over 30 per cent of important medicinal plant species are classified as being critically endangered or vulnerable. Similarly, the primary health care system is in a precarious position, mainly due to the rising costs of modern health care systems and the neglected state of traditional systems. Equally threatened is the livelihood security of millions of poor people who depend on the collection, processing, transporting and marketing of these plant commodities.

The aim of the IDRC Medicinal and Aromatic Plants Program in Asia (MAPPA) is to bring local and indigenous community perspectives into mainstream conservation and development debates. In India, medicinal plants constitute the basis of primary health care for over 85 per cent of the population. Over 600 million people are fully or partially dependent on these resources for their livelihoods, while more than 10 000 small and large scale enterprises are dependent on them for providing health care products to the domestic and global markets, both of which are expanding at a dramatic rate. The Medplants sector is estimated by the World Bank to reach USD 5 trillion by the year 2050.

MAPPA's enterprise development strategy is to work with industry to reorient current practices of sourcing raw materials into becoming more fair, equitable, transparent and sustainable. Additionally, IDRC plans to make industry more aware of global commercial challenges and opportunities. It would also encourage and promote the active involvement of various stakeholders of the Medplants sector in conservation and cultivation activities. Some of these groups, particularly government agencies and the private sector could become potential funders of MAPPA programs and initiatives.

Noting the need for the effective development of the Medplants sector, key players involved in the sector, including IDRC, Zandu Foundation, Ford Foundation, government agencies, NGOs and other industrial representatives, decided to organize a two day National Colloquium on "The Role of Medicinal Plants Industry in Rural Development and Biodiversity Conservation."

It is well recognized that industry, being the largest user of medicinal plants, can play a significant role in achieving long term biodiversity conservation goals. Based on the contexts and realities outlined above, participants of the two day Colloquium have therefore deliberated and agreed upon the following roles, responsibilities and plan of action:

Medicinal Plant Biodiversity Conservation

1. Develop conservation programs involving the full participation of local communities, especially women's groups and tribals, with simultaneous attention being paid to their livelihood security.

2. Accord due recognition to cultural property rights, IPR issues relating to the use of community resources and indigenous knowledge.

Trade and Enterprise Development in Herbal Medicine

1. Prepare a database on key medicinal plant species based on the different lists prepared by various agencies, including MAPPA;

2. Prioritize medicinal plant species for developing conservation strategies, cultivation technologies and other R & D needs, taking into consideration the specific requirements of different states and regions;

3. Support rural communities through training, technology development/refinement and institution building to improve production and management of key medicinal plant commodities;

4. Spearhead activities related to appropriate technology transfer to rural and tribal communities with respect to the prioritized species, in consultation with NGOs and relevant government agencies;

5. Initiate dealings with recognized grassroots - level committees, cooperatives and indigenous institutions to develop a long term supply system of medicinal plants based industrial raw materials.

Marketing and Globalization

1. Promote awareness of the true economic value of medicinal plant products and by-products to support the national health system, especially primary health care programmes in the country;

2. NGOs and Industry to identify the key players in R & D organizations and the national/ international business sector in order to establish links with global partners;

3. Initiate preparation of common guidelines for maintaining quality, safety and efficacy, as well as to establish harmonization between alternative systems of medicine (the Indian Systems of Medicine and Homeopathy) and the allopathic system;

4. Develop collaborations with international business and R & D organizations to establish socially, morally and ethically responsible commercial dealings with the communities involved;

5. Focus on the major ailments prevalent in global societies and produce quality (safe, effective etc.) as well as affordable herbal drug products which meet national and international health care needs;

6. In order to promote socio-economic development of rural and tribal communities, industry should promote micro-enterprises such as value added processing units, agro-technologies and sustainable harvesting systems in resource collection/production sites.

Operationalization of Social Contracts Among Key Stakeholders

1. An Expert Committee will be formed to advise on species prioritization and the identification of appropriate processing, marketing and consumption strategies. The Committee will comprise representatives of the following organizations: Industry-ADMA and IDMA;

Appendix 1: Workshop Programmes

APPENDIX 1: WORKSHOP PROGRAMMES

I. National Colloquium, New Delhi

16th December, 1997

09.00	Registration

MORNING SESSION: PLENARY (Presided over by Mr. C.P. Oberoi, Inspector General of Forests, GOI)

09.30	Welcome by Mr. Roger Finan, Regional Director, IDRC/SARO and Dr. Cherla Sastry, Director General, INBAR & Senior Forestry Specialist IDRC/SARO
09.35	Introduction to the Seminar by Madhav Karki, Programme Coordinator, MAPPA, IDRC and Jason Holley, Research Officer, INBAR (formerly with IDRC/IMPN)
09.55	Opening of the Colloquium by Dr. Shanta Sastry, Secretary (Indian Systems of Medicine), Ministry of Health & Family Welfare, GOI
10.00	Key Issues and Problems Faced by Med Plants Industry Presenter: Dr. K.M. Parikh, President, ZFHC
10.20	Technology and Infrastructure Needs for Cultivation, Processing and Preservation of Medicinal Plants Presenter: Dr. M.K. Raina, IDMA
10.40	Medicinal Plants and Tribal Development Presenter: Prof. R.K. Mutatkar, IASTAM
11.00	Tea/Coffee Break
11.15	Examples of Cultivation and Collection of Plants to Meet the Requirements of the Industry: A Few Examples and Case Studies Presenter: Mr. Raman Mehta, Alchem International Ltd.
11.30	Opportunities and Constraints for the Production and Development of Medicinal Plants in India Presenter: Mr. A. Puranik, ADMA
11.45	Quality Specifications for Ayurvedic Herbal Raw Material: A Review Presenter: Dr. D.B.A. Narayana, Dabur Research Foundation
12.10	The Status of R&D in Cultivation and Management of Medicinal Plants Presenter: Dr. S.S. Handa, RRL, Jammu
12.35	The Role of Medicinal Plants to Meet Primary Health Needs Presenter: Dr. N.S. Bhatt, IASTAM
12.50	Questions/Comments/Clarifications
13.00	Lunch

AFTERNOON SESSION (MIXED)

14.00	Interface between Industry and R&D Communities: The North American Perspective Presenter: Prof. A.V. Rao, University of Toronto, Canada
14.25	Emerging Global Markets in Medicinal Plant Products - Challenges and Opportunities for Indian Herbal Drug Industries Presenter: Dr. Vedanand, University of Manitoba, Canada
14.501	Production to Consumption Chain in Cultivation and Management of Medicinal Plant Products: Opportunities for Value Addition Presenter: Dr. A.A. Boaz, M.P. Minor Forest Produce Federation
15.10	Linking Collectors/Producers to Processors/Consumers: A Framework for Establishing Social Contracts Between Industry and Rural Communities Presenter: Madhav Karki/Jason Holley, IDRC/IMPN
15.40	Discussions on the Papers Presented
16.40	Tea/Coffee Break
16.55	OPEN SESSION: Presentation of Case Studies (5 minutes each)
17.55	Panel Announcement and Adjournment of Session

17th December, 1997

MORNING SESSION: PANEL MEETING

09.30 - 11.30	Discussions
11.30	Tea/Coffee Break
11.45 - 13.00	Discussions Continued
13.00	Lunch

AFTERNOON SESSION: PLENARY SESSION

14.30 - 16.00 Panel Presentations on Individual Issues:

- Mechanisms for developing social contracts
- Mechanisms for developing a sustainable supply of industrial raw material
  requirements using rural communities
- Rights of indigenous communities and needs of biodiversity conservation
- Mechanisms for promoting rural people's participation in production, processing and marketing activities

Concurrent Activity: Drafting of the Delhi Resolution

16.00	Tea/Coffee Break
16.15	Presentation of the Delhi Resolution
16.20	Amendments/Comments/Suggestions
17.00	Closing Remarks by the Organizers, Dr. K.M. Parikh and Dr. C.B.Sastry

II. Bangalore Workshop

II. Bangalore Workshop

Panel Presentations: Time 16.00 - 18.00

16.00-16.151	Introduction to the Workshop: Linking Collectors/Producers to Processors and Consumers: A Framework for Developing Social Contracts Between Medplants Industries and Rural Communities in South Asia Madhav Karki and Jason Holley, IDRC/IMPN
16.15-16.30	Industrial Utilization of Medicinal Plants in Developing Countries: Prospects and Constraints Dr. Tuley De Silva, UNIDO
16.30-16.45	Some Perspectives on Rural Trade in Medicinal Plants Based on a Field Study Carried out in Himachal Pradesh, India Ms. Manjul Bajaj, Natural Resource Economist - Medplants Consultant
16.45-17.00	Rural Perspectives in Collection Practices, Primary Processing, and Marketing of Medicinal Plants: A Case Study of Tribal Community Managed Enterprise in Madhya Pradesh, India Dr. A.A. Boaz, M.P. Minor Forest Produce Federation
17.00-17.152	Mechanisms of Co-operation between Rural People and Herbal Industry. Dr. K.M. Parikh, President, Zandu Foundation
17.15-17.30	Community-Managed Enterprises: Participation of Rural People in Medicinal and Aromatic Plants Conservation and Use Mr. Bhishma Subedi, ANSAB, Kathmandu & Dr. Nirmal Bhattarai, National Herbarium, Kathmandu, Nepal
17.30-17.45	Medicinal Plant Diversity: The Present Situation and Conservation Needs in Bangladesh Prof. I.M. Zuberi, Centre for Environmental Research, University of Rajshahi, Bangladesh
17.45-18.00	Medicinal Plants As The Basis For Linking Rural People to Safe and Effective Health Care Systems Prof. V.P.K. Nambiar, AVS, Kerala
18.00-19.00	Panel Discussion on Rural People - Industry Participation Panelists: Dr. Chusa Gines, Team Leader, BIO Group, IDRC, Ottawa Dr. Ana Doris Capistrano, Program Officer, The Ford Foundation, New Delhi Mr. Rajiv Khedkar, Academy of Development Sciences, Karjat, Maharashtra Dr. M.I. Zuberi, Director, CER, Bangladesh Facilitator: Madhav Karki, IDRC/IMPN, New Delhi

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Appendix 2: List of Participants

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Through support for research, Canada's **International Development Research Centre (IDRC)** assists scientists in developing countries to identify long-term, workable solutions to pressing development problems. Support is given directly to scientists working in universities, private enterprise, government, and nonprofit organizations.

Priority is given to research aimed at achieving equitable and sustainable development worldwide. Projects are designed to maximize the use of local materials and to strengthen human and institutional capacity.

Led by the dedication and innovative approach of Third World scientists — often in collaboration with Canadian partners — IDRC-supported research is using science and technology to respond to a wide range of complex issues in the developing world.

IDRC is directed by an international Board of Governors and is funded by the Government of Canada. At the United Nations Conference on Environment and Development (UNCED), IDRC's mandate was broadened to emphasize sustainable development issues. IDRC's international network and expertise will be used to help the world move toward implementation of UNCED's Agenda 21 program of action.

Le Centre de recherches pour le développement international (CRDI) soutient des travaux et des activités de recherche dans les pays en développement de manière à assurer un developpement durable et équitable à l'échelle mondiale.

Les recherches sont menées par des scientifiques affiliés à des instituions, à des entreprises, à des gouvernements ou à des organismes de développement. Des partenaires canadiens y contribuent régulièrement.

Les projets soutenus financièrement ou techniquement par le CRDI privilégient le recours aux ressources locales et s'appuient sur le génie, l'intelligence et le sens de l'innovation des chercheurs des pays en développement.

Le CRDI contribue au renforcement des connaissances et des capacités de recherche des pays en développement pour lutter contre la pauvreté et pour améliorer les conditions de vie et l'environnement des populations affectées.

Le CRDI est dirigé par un Conseil des gouverneurs international. Ses fonds proviennent du gouvernement du Canada. La Conférence des Nations unies sur l'environnement et le développement (CNUED) a choisi le CRDI pour participer à la mise en oeuvre du développement durable à l'échelle planétaire. Le CRDI verra à concrétiser le programme Action 21 élaboré lors du Sommet de la Terre.

Con el fin de asegurar un desarrollo sostenible y equitativo a escala mundial, **el Centro Internacional de Investigaciones para el Desarrollo (CIID)** financía trabajos y actividades de investigación en los países en desarrollo. Las investigaciones están a cargo de científicos que trabajan en instituciones, empresas, gobiernos u organismos dedicados al desarrollo. Estos científicos reciben regularmente la colaboración de sus colegas canadienses.

Los proyectos apoyados financiera o técnicamente por el CIID favorecen el uso de recursos locales y se apoyan en el talento, la inteligencia y el sentido de innovación de los investigadores de los países en desarrollo.

El CIID contribuye al fortalecimiento de los conocimientos y a la capacidad investigativa de los países en desarrollo para luchar contra la pobreza y mejorar las condiciones de vida y el medio ambiente de las poblaciones afectadas.

Un Consejo de Gobernadores Internacional tiene a su cargo la dirección del CIID, cuyos fondos provienen del Gobierno de Canadá. La Conferencia de Naciones Unidas sobre el Medio Ambiente y el Desarrollo (CNUED) ha seleccionado al CIID para participar en la realización del desarrollo sostenible a escala mundial. El CIID se encargará de hacer realidad el programa Agenda 21, elaborado durante la Cumbre de la Tierra.

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The growing demand of consumers worldwide for herbal and natural products to meet both their healthcare needs and dietary supplements has opened up new opportunities for the medicinal plants-based industries. However, this market-propelled demand has created tremendous pressure on the natural resources which contribute more than 90% of the current demand for the raw materials of medicinal plants. The local communities mostly belonging to tribals and rural poor are not benefitted from the increased commercial activities as only a fraction of the total markets return reaches them.

The publication collates information describing concepts, approaches and practical experiences of the researchers, practitioners and commercialization experts in the field of medicinal plants use in the South Asian region. The research findings and case studies reported provide models and mechanisms not only on how to use the threatened medicinal plant resources wisely but also how to enhance local benefits on a sustainable manner. The views expressed and recommendations suggested by the representatives of the Ayurvedic drug industry of India provide the perspectives from the industry. Development of long-term partnerships between industry and local communities is the thrust of this publication which has been reflected in the resolution adopted by the Workshops.

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