

Revitalizing Indian systems of herbal medicine by the National Medicinal Plants Board through institutional networking and capacity building

Chandra Prakash Kala* and Bikram Singh Sajwan

In view of the leading role of the National Medicinal Plants Board (NMPB) in India for developing the medicinal plants sector, the present study was carried out for exploring the functions and major initiatives taken up by NMPB for developing the medicinal plants sector. NMPB has successfully set up 35 State Medicinal Plants Boards for dealing with various aspects of medicinal plants at the state level. From April 2001 to March 2006, NMPB has sanctioned 4254 projects under two major schemes, viz. promotional and contractual farming. Besides funding projects, NMPB is engaged in a number of activities, including development of monographs on good agricultural and collection practices, an e-portal on market information, supporting projects for raising quality planting material and setting up of herbal gardens in schools. The major strategic role of NMPB is to generate livelihood options and employment as well as conservation of medicinal plants. The information presented in this article will help disseminate information for those seeking assistance and willing to know about the initiatives taken at the national level by the Government of India for developing the medicinal plants sector.

Keywords: Capacity building, herbal medicine, institutional networking, medicinal plants.

INDIA is one of the 12-mega biodiversity centres having about 10% of the world's biodiversity wealth, which is distributed across 16 agro-climatic zones. Out of 17,000 species of higher plants reported to occur within India, 7500 are known to have medicinal uses¹. This proportion of medicinal plants is the highest known in any other country against the existing flora of that country^{1,2}. Ayurveda, the oldest medical system in the Indian subcontinent, has alone reported approximately 2000 medicinal plant species, followed by the Siddha and Unani medical systems. The *Charak Samhita*, an age-old written document on herbal therapy, reports on the production of 340 herbal drugs for curing various diseases³. Currently, approximately 25% of drugs is derived from plants, and many others are synthetic analogues built on prototype compounds isolated from plant species in modern pharmacopoeia⁴.

Continuous exploitation of several medicinal plant species from the wild and substantial loss of their habitats during the past 15 years have resulted in the population

decline of many high value medicinal plant species over the years^{5,6}. The primary threats to medicinal plants are those that affect any kind of biodiversity used by humans^{4,7}. The weakening of customary laws, which have regulated the use of natural resources, is among the causes threatening medicinal plant species⁸. These customary laws have often proved to be easily diluted by modern socio-economic forces⁹. There are many other potential causes of rarity in medicinal plant species, such as habitat specificity, narrow range of distribution, land-use disturbances, introduction of non-natives, habitat alteration, climatic changes, heavy livestock grazing, explosion of human population, fragmentation and degradation of population, population bottleneck and genetic drift^{8,10-12}.

There are several stakeholders in the medicinal plants sector, right from herb collectors and growers to manufacturers and consumers. More than 700,000 practitioners of Ayurveda, Siddha, Unani, Yoga, Naturopathy and Homeopathy are registered in the Indian Systems of Medicine and also a sizeable number of practitioners are not registered. There are 9493 manufacturing units, 22,635 dispensaries and 1355 hospitals of the Indian Systems of Medicine¹³. Approximately 800 species of medicinal plants are in active trade and still there is a gap of 40,000

The authors are in the National Medicinal Plants Board, Ministry of Health and Family Welfare, Chandralok Building, 36, Janpath, New Delhi 110 001, India.

*For correspondence. (e-mail: cpkala@yahoo.co.uk)

metric tonnes in the demand and supply of medicinal plants. The major source of medicinal plants is the forested area and about 90% medicinal plants is collected from the wild, which generates about 40 million man-days^{5,14}. In spite of such a huge resource, involvement of manpower and livelihood option, the medicinal plants sector is largely unregulated and not studied properly even at the national level.

With a view to strengthen the medicinal plants sector all over the country as well as to conserve the wild stock, the NMPB was set-up by the Government of India¹⁵ on 24 November 2000. The prime objective of setting up the Board was to establish an agency which would be responsible for coordination of all matters with respect to the medicinal plants sector, including drawing up policies and strategies for *in situ* conservation, cultivation, harvesting, marketing, processing, drug development, etc. In view of the leading role of NMPB for developing the medicinal plants sector, the present article deals with functionary and major initiatives taken up by the NMPB since its establishment. The information presented in this article will help disseminate information to those seeking assistance and willing to contribute in developing the medicinal plants sector.

Methods

All proposals received by the NMPB from April 2001 to March 2006 were scrutinized for studying the patterns in project proposals sanctioned and their financial and physical status. Proposals approved for funding were segregated for further analysis such as total amount sanctioned, major objectives of the proposal, type of proposal, requirement of the proposal and amount sanctioned to meet the objectives. Based on the overall project objective, each project sanctioned under a promotional scheme of the NMPB was categorized into seven major categories, namely (1) cultivation and establishment of herbal gardens, (2) *in situ* conservation, (3) raising of quality planting material, (4) research and development, (5) dissemination of information, education and communication, (6) marketing and (7) value addition.

The projects sanctioned under various research and development activities were further divided into ten major sub-categories, namely (1) multiplication/agro-techniques, (2) biotechnology/tissue culture/micro-propagation, (3) assessment, survey and inventory, (4) intercropping, (5) genetic, molecular and chemical compound studies, (6) organic farming, (7) traditional systems, (8) post-harvest, drying and storage, (9) developing technology park and laboratory, and (10) pathological studies on medicinal plants.

Further, the allocation of funding was analysed state-wise on the basis of projects approved to the institutions/organizations located in the concerned state. Besides, the status of studies on 32 prioritized medicinal plant species was determined by calculating the number of projects

sanctioned to the respective prioritized species. Medicinal plants other than the prioritized ones were also taken into account for determination of funds allocated to such species by the NMPB. All the projects sanctioned under contractual farming scheme of the NMPB were examined and analysed for the area of land supported for farming. The major policy guidelines of the NMPB and thrust areas for funding different types of projects were identified during the present study. The major initiatives taken up by the NMPB from its establishment have also been identified and analysed by scrutinizing and studying its various official documents.

Results and discussion

Prioritization of medicinal plants

Earlier, the medicinal plants sector was not organized in India; therefore attempts were made to organize all stakeholders under various schemes of the NMPB. Efforts have been made at various levels (Society to Government) to develop linkages with various national and international organizations and individuals for smooth and systematic running of the sector. In order to initiate the various schemes of the NMPB, 32 medicinal plant species were prioritized at the national level for research and development. Commercial viability and greater importance for health care were the major basis of identifying and selecting these prioritized species.

Major schemes of NMPB

For giving a boost to the activities and development of the medicinal plants sector in the country, the NMPB formulated two major schemes, viz. promotional and commercial, for financial assistance and implementation of various studies submitted through project proposals.

Promotional scheme: This scheme mainly aims to disseminate awareness about the importance of medicinal plants and the medicinal plants sector as a whole. Besides, it covers the following major areas for research and development for which maximum Rs 30 lakhs may be sanctioned by the NMPB on the basis of objectives and requirement of the project.

- Survey and inventory of medicinal plants.
- *In situ* conservation of medicinal plants.
- *Ex situ* cultivation or establishment of demonstration centre (herbal gardens).
- Production of quality planting materials.
- Extension activities – information, education and communication.
- Marketing of medicinal plants.
- Research and development in the medicinal plants sector.
- Value addition in medicinal plant products.

Recently, under a promotional scheme the NMPB has launched a new activity with a view to educate and sensitize students about conservation, cultivation and indigenous uses of medicinal plant species. It is planned to provide financial assistance for setting up herbal gardens in schools on a pilot basis. Since schools may not have much area for cultivation, it is proposed to provide funding for raising herbal gardens of about one-tenth of a hectare in each school. For developing one herbal garden of about 1000 sq. m, financial assistance will be limited to Rs 10,000 for setting it up and Rs 4000 for maintenance during the second year. The cost of establishing herbal gardens will include land development, irrigation, transportation of planting material, organic manure, barbed wire fencing, etc.

Commercial scheme: The major objective of the commercial scheme is to strengthen cultivation of medicinal plants on a large scale, which includes value addition, harvesting, processing, storage, extraction, packaging and facilitating the development of market infrastructure for medicinal plants. To mobilize and meet these objectives, the NMPB has identified different groups of people such as registered farmers (with the State Medicinal Plants Boards (SMPB)), association/federation of growers, traders, manufacturers, societies, pharmaceutical companies, public sector undertakings, NGOs and recognized private research institutions, Joint Forest Management (JFM) committees, self-help groups and any group of people devoted to the development of the medicinal plants sector. Such groups can take up the following major tasks under commercial scheme:

- Commercial cultivation of medicinal plants.
- Production and supply of quality planting material in bulk.
- Value addition for developing proper harvesting techniques, semi-processing of produces, viz. collection, grading, drying, storage, packing, extraction, etc.
- Developing innovative marketing mechanisms.

Under the commercial/contractual farming scheme, financial assistance is provided to the extent of 30% of the total project cost as estimated by the NMPB, subject to a maximum of Rs 9 lakhs only. This scheme is also called as contractual farming scheme.

Status of projects sanctioned by the NMPB

A total of 4254 projects worth Rs 17,593.78 lakhs have been sanctioned under both promotional and contractual farming schemes since the establishment of the NMPB in 2000 till 2006. Eighty-three per cent of the projects was sanctioned under contractual farming scheme and the rest (17%) were sanctioned under the promotional scheme. The allocation of funding was 50% each to both the schemes. The NMPB schemes of funding projects have so

far covered 32 States and Union Territories across the country. In comparison to contractual farming, a larger number of States and Union Territories have been brought under promotional schemes (Table 1).

Several projects under both promotional and contractual farming schemes have been sanctioned to the states of Central India, namely Rajasthan (808) and Madhya Pradesh (798), followed by the South Indian State (Karnataka; 410), and the State in the west of India (Maharashtra; 237). In the promotional scheme itself, the largest number of projects (98) was sanctioned to a North Indian State, namely Uttarakhand, followed by the South Indian States of Tamil Nadu (67) and Karnataka (51). Eight States and Union Territories, namely Andaman and Nicobar Islands, Bihar, Chandigarh, Goa, Lakshdweep, Meghalaya, Mizoram and Puducherry have not yet been covered under the contractual farming scheme. Apart from Lakshdweep, all the States and Union Territories have been brought under the promotional scheme of the NMPB (Table 1).

Under the promotional scheme, a total of 727 projects worth Rs 8737.71 lakhs have been sanctioned for financial assistance under different aspects of the medicinal plants sector. Of these, the largest number of projects was sanctioned for cultivation of medicinal plants and development of herbal gardens (220), followed by dissemination of information related to the medicinal plants sector (192) and research and development (111). The number of projects and funds sanctioned under major categories of the promotional scheme of the NMPB are given in Table 2.

Within the research and development category of the promotional scheme, the projects were sanctioned to ten different aspects ranging from development of agro-techniques, tissue culture, intercropping, molecular studies, and pathological studies of the medicinal plants, as given in Table 3. The largest number of projects within research and development has been allocated for the development of agro-techniques. The NMPB has funded projects to various types of organizations, including government and non-governmental organizations. The Forest Department has received the largest number of projects, followed by NGOs and universities (Table 4). Government research and development institutions have received higher funds than the NGOs.

So far, the projects sanctioned by the NMPB have covered about 120 important medicinal plant species under various tasks of the promotional scheme. Most of the projects were sanctioned for mixed-cropping of medicinal plants. Within prioritized species of medicinal plants, the largest number of projects has been sanctioned for cultivation and conservation of *Emblica officinalis*, followed by *Rauvolfia serpentina*, *Withania somnifera*, *Aegle marmelos*, *Asparagus racemosus*, *Gloriosa superba* and *Ocimum sanctum*. Some of the prioritized species such as *Aconitum ferox*, *Crocus sativa* and *Berberis aristata* have received low funding under the promotional schemes of the NMPB (Table 5). Therefore, it is required to encourage

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Table 1. Number of projects sanctioned for financial assistance under promotional and contractual farming schemes of the National Medicinal Plants Board (NMPB) during 2001–06

State/Union Territory	Contractual scheme		Promotional scheme		Total	
	No. of projects	Amount (in lakhs)	No. of projects	Amount (in lakhs)	No. of projects	Amount (in lakhs)
Andaman and Nicobar Islands	0	0	4	80.00	4	80.00
Andhra Pradesh	187	222.92	30	482.15	217	712.15
Arunachal Pradesh	42	194.11	18	157.50	60	344.09
Assam	2	1.81	8	91.00	10	92.81
Bihar	0	0	3	12.00	3	12.00
Chandigarh	0	0	2	25.00	2	25.00
Chattisgarh	89	301.11	26	531.50	115	843.61
Delhi	1	1.95	22	211.20	23	213.15
Goa	0	0	3	60.00	3	60.00
Gujarat	68	105.56	19	241.50	87	347.06
Haryana	196	639.13	14	217.90	210	857.03
Himachal Pradesh	66	258.42	31	377.00	97	635.42
Jammu and Kashmir	41	100.97	23	219.00	64	319.97
Jharkhand	2	4.00	9	106.00	11	110.00
Lakshdweep	0	0	0	0	0	0
Karnataka	359	411.91	51	572.25	410	984.16
Kerala	60	81.45	33	340.20	93	431.65
Madhya Pradesh	763	1819.49	35	431.50	798	2250.99
Maharashtra	207	409.95	30	250.70	237	658.65
Manipur	164	779.20	10	124.50	174	903.70
Meghalaya	0	0	5	43.00	5	43.00
Mizoram	0	0	19	245.00	19	245.00
Nagaland	25	57.48	7	73.00	32	130.48
Orissa	138	271.66	34	488.30	172	759.96
Puducherry	0	0	1	3.00	1	3.00
Punjab	81	466.31	7	89.50	88	555.81
Rajasthan	785	2148.71	23	310.00	808	2458.71
Sikkim	32	72.20	18	355.00	50	427.20
Tamil Nadu	55	142.41	67	587.95	122	730.36
Tripura	1	8.44	5	99.00	6	107.44
Uttar Pradesh	28	94.26	49	517.30	77	611.56
Uttarakhand	117	219.04	98	1175.46	215	1394.50
West Bengal	18	47.58	23	199.30	41	246.88
Total	3527	8858.07	727	8737.71	4254	17,595.78

Table 2. Number of projects and funds sanctioned under major categories of the promotional scheme of the NMPB

Category	No. of projects sanctioned	Amount sanctioned (in lakhs)
Cultivation/herbal gardens	220	3052.10
<i>In situ</i> conservation	79	1446.40
Quality planting material	89	1377.50
Research and development	111	1295.35
Information, education and communication	192	1192.86
Marketing	26	264.30
Value addition	10	109.20
Total	727	8737.71

various institutions to spread their research activities to such less-studied prioritized species. Apart from prioritized species, about 90 other important species of medicinal plants have also been covered under the promotional scheme for cultivation, conservation and commercialization. *Aloe vera*, *Stevia rebaudiana*, *Terminalia chebula* and

Terminalia bellirica were such important medicinal plant species which received maximum number of projects under the promotional scheme in spite of their exclusion from the priority species (Table 6).

A large number of projects have been sanctioned for the cultivation of medicinal plants under both contractual and

Table 3. Status of funding provided by the NMPB under different research and developmental activities

Category	No. of projects sanctioned	Amount sanctioned (in lakhs)
Multiplication/agro-techniques	32	377.50
Biotechnology/tissue culture/micro-propagation	29	349.85
Assessment/survey/inventory	21	227.00
Intercropping	7	81.00
Genetic/molecular/chemical compound studies	6	78.00
Organic farming	4	51.00
Traditional systems	4	38.50
Post-harvest/drying/storage	3	40.00
Developing technology park/laboratory	2	35.00
Nematode/other diseases	3	17.50
Total	111	1295.35

Table 4. Status of funding provided by the NMPB to different types of organizations

Institute/organization	No. of projects sanctioned	Amount sanctioned (in lakhs)
State Forest Departments	205	3540.26
NGOs	186	1523.90
Universities	151	1384.20
Government research and development institutions	147	1788.85
SMPB	38	500.50
Total	727	8737.71

promotional schemes of the NMPB. Through 3527 projects under the contractual farming scheme, the NMPB has supported 89,626 acres of land across the country for cultivation of more than 50 species of medicinal plants. Among these, 79,444 acres of land is supported exclusively for cultivation of prioritized species of the NMPB (Table 7). More than 25 species of medicinal plants, other than the prioritized species, are also supported under the contractual farming scheme, which covers 10,182 acres of land (Table 8). During 2004–05, the largest area (53,876 acres) was brought under medicinal plants cultivation in comparison to the other financial years. Species-wise, *Plantago ovata* was cultivated in the largest area (23,348 acres), followed by *Embllica officinalis* (13,300 acres) and *Cassia angustifolia* (12,635 acres). These three species have covered about 62% of land area supported for cultivation of total prioritized species under the contractual farming scheme. However, some of the prioritized species such as *Berberis aristata*, *Gymnema sylvestris*, *Crocus sativus*, *Aconitum ferox* and *Saraca asoca* still required attention of farmers for their large-scale farming, as the representation of these species in farming of medicinal plants is insignificant compared to other prioritized species.

Aloe vera and *Stevia rebaudiana* are two important medicinal plant species other than those prioritized, which were supported for cultivation in relatively large areas under the contractual farming scheme. *Nardostachys jatamansi*, *Podophyllum hexandrum*, *Taxus baccata*, *Aconitum heterophyllum*, *Gloriosa superba*, *Picrorhiza kurrooa*, *Saussurea costus*, *Arnebia benthamii* and *Swertia chirayita* are among the rare and endangered medicinal

plant species supported for cultivation under the contractual farming as well as promotional scheme of the NMPB. Although there are many more aspects of the medicinal plants sector, at the initial stage, the prime aim of the NMPB was to coordinate among different organizations, encourage various stakeholders, develop a congenial environment for production of raw materials through large-scale cultivation, mitigate pressure on the wild stock, and streamline the flow of raw materials for both domestic and commercial needs. The NMPB has been successful in achieving the aim of farming important medicinal plant species with their quality planting materials.

Monitoring of projects

The NMPB has established networks with different institutions and universities for dissemination of information, capacity building and application of research findings on various medicinal plant species. Some of the major institutions and universities supported by the NMPB for strengthening the medicinal plants sector in India are listed in Table 9. The institutional networking has resulted in helping while preparing policies, assessing medicinal plants sector and understanding the performance and impact of various policies. For example, in order to monitor the performance of different projects, the NMPB is coordinating with two major centres of excellence, namely Indian Institute of Forest Management, Bhopal and Indian Council of Forestry Research and Education, Dehradun. The role of both institutions is to take a comprehensive look at the programme, assess what has been achieved, analyse the

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Table 5. Number of projects sanctioned and major areas covered under research and development of the prioritized species of the NMPB (2003–06)

Latin name	Local name	Projects	Per cent	Major areas covered under research
<i>Aconitum ferox</i> Wall.	Vatsnav	2	0.31	Post-harvest processing
<i>Aconitum heterophyllum</i> Wall. ex Royle	Ateesh	19	2.92	Marketing, post-harvest processing, tissue culture
<i>Aegle marmelos</i> (L.) Corr.	Bel	37	5.68	Nutraceuticals, germplasm conservation, post-harvest processing, value-addition
<i>Andrographis paniculata</i> Wall. ex Nees	Kalmegh	26	3.99	Molecular markers, tissue culture
<i>Asparagus racemosus</i> Willd.	Satawari	32	4.92	Genetic improvement, tissue culture, post-harvest processing, survey, molecular markers
<i>Bacopa monnieri</i> (L.) Pennell	Brahmi	23	3.53	Organic production, post-harvest processing, molecular markers
<i>Berberis aristata</i> DC.	Daruhaldi	2	0.31	Survey
<i>Cassia angustifolia</i> Vahl.	Senna	17	2.61	Pathological study, molecular markers
<i>Chlorophytum borivillianum</i> L.	Safed Musli	19	2.92	Tissue culture
<i>Coleus barbatus</i> Benth.	Pattarchur	27	4.15	Tissue culture, value-addition, molecular markers
<i>Commiphora wightii</i> (Arn.) Bhandari	Guggal	21	3.23	Tissue culture, molecular markers
<i>Crocus sativus</i> L.	Kesar	1	0.15	Cultivation
<i>Embelia ribes</i> Burm f.	Viavidang	9	1.38	Tissue culture, molecular markers
<i>Emblica officinalis</i> Gaertn	Amla	77	11.83	Value-addition, germplasm conservation, post-harvest processing, molecular markers
<i>Garcinia indica</i> Chois	Kokum	5	0.77	Molecular markers, value-addition
<i>Gloriosa superba</i> L.	Kalihari	29	4.45	Survey, value-addition, pathological study
<i>Glycyrrhiza glabra</i> L.	Mulethi	11	1.69	Molecular markers
<i>Gymnema sylvestre</i> R. Br.	Gudmar	18	2.76	Germplasm conservation, tissue culture, survey, molecular markers
<i>Nardostachys jatamansi</i> DC.	Jatamansi	9	1.38	Tissue culture
<i>Ocimum sanctum</i> L.	Tulsi	29	4.45	Organic production, tissue culture, survey, molecular markers
<i>Phyllanthus amarus</i> Schum & Thonn.	Bhumi Amlaki	6	0.92	Pathological study, molecular markers
<i>Picrorhiza kurrooa</i> Benth. ex Royle	Kutki	18	2.76	Non-destructive harvesting techniques, value-addition, tissue culture, marketing
<i>Piper longum</i> L.	Pippali	23	3.53	Post-harvest processing, tissue culture, survey, molecular markers
<i>Plantago ovata</i> Forsk.	Isabgol	2	0.31	Cultivation
<i>Rauvolfia serpentina</i> Benth. ex Kurz	Sarpagandha	59	9.06	Survey, tissue culture, varietal improvement
<i>Santalum album</i> L.	Chandan	16	2.46	Tissue culture
<i>Saraca asoca</i> (Roxb.) de Wilde	Ashok	29	4.45	Germplasm conservation
<i>Saussurea costus</i> C.B. Clarke	Kut	17	2.61	Tissue culture
<i>Solanum nigrum</i> L.	Makoy	3	0.46	Pathological study, molecular markers
<i>Swertia chirayita</i> (Roxb. ex Fleming) Karsten	Chirata	16	2.46	Tissue culture
<i>Tinospora cordifolia</i> Miers.	Guduchi	3	0.46	Varietal improvement
<i>Withania somnifera</i> (L.) Dunal	Ashwagandha	46	7.07	Tissue culture, survey, pathological study, molecular markers

success and failure of the projects, ascertain the current status of the projects and provide suitable recommendations. These two Institutions submit their monitoring report on ongoing and completed projects directly to the NMPB.

Evaluation carried out by these organizations has highlighted the positive impact of the programme with regard to cultivation initiated by farmers in a number of states, especially Rajasthan and Madhya Pradesh. Besides, a scheme for monitoring the projects has been launched in 2006. Under this scheme, different Principal Investigators (PIs) of the projects are being asked by the NMPB to make presentations on the salient achievements of the projects. So far more than four dozen PIs have made their presentations on the various project activities carried out under the supervision and financial assistance of the NMPB.

Ongoing policies and activities of the NMPB

Besides funding different research and development projects, currently the NMPB is engaged in a number of other activities related to medicinal plants. Some of these are:

- Development of monographs on good agricultural and collection practices.
- Development of an e-portal on market information.
- Development of database on supply and demand.
- Supporting projects on various aspects of the medicinal plants sector.
- Setting up of herbal gardens in schools.
- Monitoring and evaluation of the projects.

The NMPB has also supported establishing agri-export zones in two different corners of the country – Kerala in southern India and Uttarakhand in northern India. The

Table 6. Major medicinal plant species other than those prioritized covered under the promotional scheme of the NMPB for funding during 2003–06

Latin name	Local name	Projects	Major areas covered under research
<i>Acorus calamus</i> L.	Buch	7	Documentation of indigenous knowledge
<i>Aloe vera</i> Tourn. ex Linn.	Aloe	24	Post-harvest processing
<i>Aquilaria agallocha</i> Roxb.	Agar	4	Cultivation
<i>Arnebia benthamii</i> (Wall. ex G. Don) John.	Bal chhadi	3	Survey, documentation
<i>Artemisia annua</i> L.	Kunja	3	Value-addition
<i>Azadirachta indica</i> A. Juss	Neem	11	Survey, cultivation
<i>Cymbopogon martini</i> Roxb.		3	Cultivation
<i>Dactyloctenium aegyptium</i> (L.) Don	Salampanja	5	Survey, documentation of indigenous uses
<i>Hippophae rhamnoides</i> L.	Amesh	4	Tissue culture, documentation of uses
<i>Podophyllum hexandrum</i> Royle	Bankakri	3	Tissue culture, post-harvest processing
<i>Pogostemon cablin</i> (Blanco) Benth.	Pachauli	6	Value-addition
<i>Stevia rebaudiana</i> Bertoni	Stevia	22	Standardization of agro-techniques, survey
<i>Taxus baccata</i> L.	Thuner	9	Survey, development of agro-techniques
<i>Terminalia arjuna</i> (Roxb.) W. & A.	Arjun	11	Survey
<i>Terminalia bellirica</i> Roxb.	Baida	17	Survey, cultivation
<i>Terminalia chebula</i> Retz.	Haida	20	Survey
<i>Tinospora cordifolia</i> (Willd.) Miers ex Hk. f. & Th.	Giloe	17	Tissue culture, survey
<i>Zanthoxylum armatum</i> DC.	Tejbal	4	Documentation of indigenous uses

Table 7. Area of land (in acres) supported for cultivation of prioritized species under the contractual farming scheme of the NMPB during 2001–06

Latin name	Year-wise land area (in acres) supported for cultivation				Total
	2002–03	2003–04	2004–05	2005–06	
<i>A. ferox</i> Wall.	0	50	0	0	50
<i>A. heterophyllum</i> Wall. ex Royle	13	55	1014	215	1297
<i>A. marmelos</i> (L.) Corr.	14	47	118	367	546
<i>A. paniculata</i> Wall. ex Nees	119	184	254	373	930
<i>A. racemosus</i> Willd.	0	157	171	417	745
<i>B. monnieri</i> (L.) Pennell	120	111	88	59	378
<i>B. aristata</i> DC.	0	0	0	10	10
<i>C. angustifolia</i> Vahl.	2600	1398	8425	212	12,635
<i>C. borivillianum</i> L.	304	1751	1520	1532	5107
<i>C. barbatus</i> Benth.	12	512	1561	1350	3435
<i>C. wightii</i> (Arn.) Bhandari	26	0	197	1183	1406
<i>C. sativus</i> L.	0	27	0	0	27
<i>E. ribes</i> Burm f.	0	11	63	58	132
<i>E. officinalis</i> Gaertn	290	2248	7042	3720	13,300
<i>G. superba</i> L.	0	47	590	1933	2570
<i>G. glabra</i> L.	0	668	1445	749	2862
<i>G. sylvestre</i> R. Br.	19	0	0	0	19
<i>N. jatamansi</i> DC.	0	10	97	0	107
<i>O. sanctum</i> L.	0	30	39	77	146
<i>P. kurrooa</i> Benth. ex Royle	7	51	57	97	212
<i>P. longum</i> L.	16	169	724	225	1134
<i>P. ovata</i> Forsk.	0	2428	20,533	387	23,348
<i>R. serpentina</i> Benth. ex Kurz	115	368	1569	695	2747
<i>S. album</i> L.	0	0	309	46	355
<i>S. asoca</i> (Roxb.) de Wilde	0	0	0	76	76
<i>S. costus</i> C.B. Clarke	6	118	269	85	478
<i>S. nigrum</i> L.	0	13	448	0	461
<i>S. chirayita</i> (Roxb. ex Fleming) Karsten	68	99	942	62	1171
<i>W. somnifera</i> (L.) Dunal	188	372	2078	1122	3760
Total	3917	10,874	49,553	15,050	79,444

main objective of this scheme is to collect and disseminate all available data about medicinal plants, publish trends and export information weekly through the website of Department of Agriculture and establish farmer-friendly

and easily accessible information centres on medicinal plant species.

The NMPB is coordinating with different institutions and universities for dissemination of information, capacity

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Table 8. Area of land (in acres) supported for cultivation of species other than those prioritized under the contractual farming scheme of the NMPB during 2001–06

Latin name	Local name	Year-wise land area (in acres) supported for cultivation				Total
		2002–03	2003–04	2004–05	2005–06	
<i>A. calamus</i> L.	Buch	0	51	568	63	682
<i>A. vera</i> Tourn. ex Linn.	Aloe	0	74	1154	2032	3258
<i>A. agallocha</i> Roxb.	Agar	7	118	237	10	462
<i>A. benthamii</i> (Wall. ex G. Don) John.	Ratanjot	0	0	64	0	64
<i>C. martini</i> Roxb.		56	4	59	0	119
<i>P. hexandrum</i> Royle	Bankakri	0	7	0	0	7
<i>S. rebaudiana</i> Bertoni	Stevia	0	8	872	1938	2818
<i>T. baccata</i> L.	Thuner	0	0	0	70	70
<i>T. chebula</i> Retz.	Haida	0	5	0	0	5
<i>Rubia cordifolia</i> Linn.	Manjith	0	11	370	10	391
<i>Valeriana wallichii</i> D.C.	Tagar	0	8	0	0	8
<i>Cymbopogon citratus</i>		10	185	78	83	356
<i>Gmelina arborea</i> Linn.	Gambhari	0	4	0	0	4
<i>Bixa orylna</i>	Sinduri	0	20	0	0	20
<i>Caesalpinia sappan</i> Linn.		30	0	0	0	30
<i>Caesalpinia bonducella</i>	Karanj	0	70	35	0	105
<i>Dioscorea</i> sp.		0	0	10	28	38
<i>Vanilla</i> spp.		0	0	0	18	18
<i>Mentha piparata</i>	Japanese mint	22	0	0	0	22
<i>Mentha spicata</i> Linn.	Mentha	0	0	13	0	13
<i>Mucuna prurita</i> Hk.	Konch	0	0	0	114	114
<i>Melincara japota</i>	Sapota	0	29	0	0	29
<i>Piper betle</i> Linn.	Pan	0	7	0	0	7
<i>Jatropha curcas</i> Linn.	Jatropha	0	0	64	0	64
Other species of medicinal plants		83	165	799	431	1478
Total		208	766	4323	4797	10,182

building and application of research findings on various medicinal plant species. Since many important medicinal plant species have specific ecological requirements, long gestation period, low population size, high dependency on natural pollinators, unpredictable seed germination patterns and poor seed viability, the NMPB is giving equal importance to the *in situ* conservation of medicinal plants, and various government organizations and NGOs have been supported in identifying suitable areas for meeting this objective. Within the promotional scheme, an area of approximately 19,965 ha has been brought under *in situ* conservation measures and an area of 3872 ha under development of herbal gardens. Approximately 35,000 ha of land has been supported under the contractual farming scheme for large-scale farming of commercially important medicinal plant species. Herbal gardens have been created even in the remotest parts of the country through NMPB's schemes, enabling farmers to become aware of the cultivation practices and utility of medicinal plant species for healthcare.

Proposed policies and activities of the NMPB

- To promote and intensify *in situ* conservation by setting up medicinal plants conservation areas and forest gene banks.

- To establish field gene banks in different agro-climatic regions and forest types targeting top species of medicinal plants identified on the basis of their conservation status and market demand.
- To set up herbal gardens in different states as an *ex situ* conservation measure.
- To provide financial support for cultivation.
- To initiate steps for setting up medicinal plants processing zones in different agro-climatic zones.
- To develop post-harvest management practices (e.g. storage-cum-drying, grading, sorting, etc.).
- To develop marketing infrastructure (e.g. price support, setting up of mandies, brand promotion, etc.).
- To promote extension activities (e.g. quality planting material, training and farmers' mobilization).
- To augment infrastructure in existing agri-export zones.
- To evolve and notify good agriculture practices, good collection practices and good storage practices for medicinal plants.
- To develop monographs on important species of medicinal plants.
- To encourage and support research and development for developing protocols for sustainable harvest of important medicinal plants.
- To identify agencies in the government and non-government sector backed up by independent certi-

Table 9. Major institutions and universities supported by the NMPB for working on medicinal plants in India

University/institute	Funding for major areas in medicinal plants research
University	
Acharya N.G. Ranga Agricultural University, Hyderabad	Quality planting material
Annamalai University, Annamalai Nagar	Training, contract farming
Arunachal University, Itanagar	Micropropagation, conservation, threatened medicinal plants
Dr H.S. Gour University, Sagar	Inventory, conservation, documentation
Dr Y.S. Parmar University of Horticulture and Forestry, Solan	Quality nursery stock production
G.B. Pant University of Agriculture and Technology, Pantnagar	Cultivation, organic farming
Gauhati University, Guwahati	Mass propagation, tissue-culture technology
Hamdard University, New Delhi	<i>Ex situ</i> conservation
Jadavpur University, Kolkata	Information, education, communication
Jawaharlal Nehru Krishi Vishwa Vidhyalaya, Jabalpur	Information, education, communication, management
Kerala Agricultural University, Trissur	Survey, standardization of quality planting material
Krishi Vishwavidyalaya, Palampur	Micropropagation, conservation and promotion, quality planting material
Osmania University, Hyderabad	Conservation, cultivation, quantification of active constituents
Tamil Nadu Agricultural University and its associated colleges	Conservation, quality planting material, information, education, communication, value-addition
Tezpur University, Tezpur	Survey, inventory
University of Agricultural Sciences, Bangalore	Evaluation, development of agro-techniques
University of Allahabad, Allahabad	Herbal formulations, screening, survey
University of Delhi, New Delhi	Information, education, communication
University of Calcutta, Kolkata	Information, education, communication
University of Pune, Pune	Cultivation, raising medicinal plants nursery
University of Rajasthan, Jaipur	Information, education, communication
Utkal University, Bhubaneswar	Survey, conservation, documentation
Institute	
Central Institute of Medicinal and Aromatic Plants and its units	Information, education, communication, biotechnology, cultivation, molecular studies
National Botanical Research Institute, Lucknow	Herbal gardens, cultivation, conservation
National Bureau of Plant Genetic Resources, New Delhi	Characterization, multiplication, evaluation, germplasm conservation, post-harvest processing
Foundation for Revitalisation of Local Health Traditions, Bangalore	Herbal gardens, conservation, survey, inventory, documentation, marketing study
Herbal Research and Development Institute, Gopeshwar	Threatened species, genotypes, training, cultivation, technology transfer
High Altitude Plant Physiology Research Centre, Srinagar	Agro-techniques, cultivation, conservation, survey
Indian Institute of Forests Management, Bhopal	Marketing, monitoring, survey, <i>in situ</i> conservation
Indian Council of Forestry Research and Education with its major State Forest Research Institutes	Monitoring, tissue culture, biotechnology, survey, <i>in situ</i> conservation, cultivation
Indian Institute of Science, Bangalore	Herbal gardens
Indian Institutes of Technology, New Delhi and Kharagpur	Agro-techniques
Regional Research Institutes, Itanagar, Jammu and Bhubneshwar	Tissue culture, survey, conservation, cultivation
State Institute of Rural Development, Guwahati	Herbal gardens
The Energy and Resource Institute, New Delhi	Cultivation, tissue culture, biotechnology
Tropical Forest Research Institute, Jabalpur	Breeding, variety improvement

fication in order to use as focal points for raising nurseries and supplying quality planting material to farmers and cultivators.

- To develop independent certification mechanism for the benefit of the growers, manufacturers and users of medicinal plants.
- To develop effective marketing strategies and establishing policy frameworks for the marketing of medicinal plants.

Proposed priorities for research and development

The NMPB is setting priorities for research work on medicinal plants for the 11th Five-Year Plan, which has major

objectives towards addressing information gaps in relation to inventorization of medicinal plants and their distribution pattern, study of genetic and chemical diversity in medicinal plants, development of agro-techniques, intercropping, micropropagation, studies on heavy metals/pesticides contamination, etc. A meeting was held with the heads of various institutions for identifying priority areas for research and development. The following points emerged during the brainstorming session and discussion:

- There should be strong coordination with major research and development institutions/organizations/agencies.
- The present funding amount (Rs 30 lakhs) provided by the NMPB for each project is low and should be

increased. Also the outlays for research and development activities should be enhanced.

- Duplication in research work should be avoided and socially relevant programmes need to be honoured and incorporated in research activities. Better coordination needs to be achieved with DBT, CSIR and DST.
- Regulatory mechanism for harvesting of medicinal plants from the wild should be strengthened. System to establish traceability of raw drugs should be put in place to improve the supply chain management for improved quality standards and better return to collectors.
- Standards should be developed for traditionally used medicinal plants.
- Correct taxonomic nomenclature of medicinal plants should be made and disseminated to all stakeholders.
- Developing agro-techniques and methods for organic farming of medicinal plants should be given priority.
- A strong and reliable database should be developed which includes all major aspects of the medicinal plants sector.
- Regulatory mechanism for transit crude drugs and their marketing should be streamlined to ensure transparency and uniformity across inter-state boundaries.
- Adulteration in raw drugs should be checked through linkages with quality testing laboratories and setting up referral centres for verification of authentic samples.
- Rare and endangered medicinal plants should be given priority for research and development activities.

International cooperation

Considering the importance of Indian medicinal plants and Indian systems of medicine in the international market, there is an immense potential for international cooperation with countries that are endowed with rich plant resources and those having strong traditional systems of medicines. Like India, there are many countries which have rich traditional knowledge, strong traditions and culturally acceptable herbal medicine systems. Protecting medicinal plants and the indigenous knowledge associated with these valuable species are major areas of concern across the developing nations, which include patenting products and indigenous knowledge. The knowledge on medicinal plants available in the public domain needs to be documented without any further delay. Besides, the NMPB may collaborate with countries involved in developing agro-techniques, scientific validation of traditional knowledge, biotechnology, techniques for mass propaga-

tion of medicinal plants, exchange and trade of herbal products, quality control, production of quality planting material and capacity building. There could be many more possible areas of collaborations, which need to be explored by conducting meetings and seminars between the officials and medicinal plants stakeholders of both developed and developing nations.

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