

agricultural pests. They have merit over the synthetic antimicrobials due their biodegradable nature and non-mammalian toxicity. Among traditional plant-based antimicrobials of Indian origin, the neem tree (*Azadirachta indica*) represents an outstanding example. In addition, the fungitoxic components of traditionally used plants, viz. *Acacia nilotica*⁸ and *Lawsonia inermis*⁹ have been recommended to be efficacious like many synthetic antimicrobials. Hence, the traditionally used medicinal plants and their components should be tested for their efficacy in protecting herbal raw materials as botanical preservatives. The essential oil of *Cinnamomum camphora* has been recently recorded for protection of raw materials from fungal as well as aflatoxin B₁ contamination⁶. Such products of higher plant origin should be screened against microorganisms of herbal raw materials and their safety profile as botanical preservative should be recorded, so that the taste and odour of the treated raw materials are not adversely affected. The mode of their practical application should also be worked out. Some of these antimicrobials of plant origin, viz. gallic

acid, eugenol, carvacrol, thymol, carvone, gingerol, allicin, carnosol, rosmanol, carnosic acid and thujone are products of different spices which have been traditionally used as food items by humans for a long time. Hence there would be no or least chance of any adverse effects on human systems if such plant products are recommended in post-harvest processing of raw materials. In addition to the antimicrobial nature, these products also possess antioxidant properties¹⁰. Therefore, the storage of herbal raw materials in association with the scented plant chemicals of traditionally used herbs possessing antimicrobial, antiaflatoxicogenic and antioxidant efficacy may enhance the shelf-life of the raw materials by inhibiting fungal and mycotoxin contamination as well as checking their usual deterioration due to lipid peroxidation. There is a need for a large-scale screening programme so as to recommend the antifungals and antioxidants of traditionally used plants in processing and storage technologies of herbal raw materials.

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Special plantation drive – Towards livelihood security in Bundelkhand, Uttar Pradesh

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The Bundelkhand region comprises seven districts, viz. Jhansi, Lalitpur, Jalaun, Hamirpur, Banda, Mahoba and Chitrakoot of Uttar Pradesh (UP) and six districts, viz. Datia, Tikamgarh, Chhatarpur, Panna, Damoh and Sagar and Lahar, and Bhandar Tahsils (of Bhind and Gwalior districts) of Madhya Pradesh (MP). It is located between 23°8′–26°30′N lat. and 78°11′–81°30′E long. with a total area of 71,619 km². Out of 108 poorest districts notified by the Planning Commission, Government of India, nine districts come under this region. The region has been named after Bundelas, who settled first at Mau in Banda with the capital in Mahoni later in Orcha, during the 16th century BC. This region is bounded on all the four sides by rivers, viz. the Yamuna, the Narmada, the Chambal and the Tons, and is the meeting place of many cultures, viz. Biraj, Bhojpuri, Tribal and Malwi. The soils of this region are mainly derived

from gneisses, type red and black. This undulating relief receives average annual rainfall of 1000 mm of which 90% is during monsoon. In general, the rainfall pattern of this region is erratic and uncertain. The average temperatures range from 22.9°C to 26.7°C during winter, and 41.8°C to 43.9°C during summer. Since no industry is available in this region, more than 80% of the population is dependent on rainfed agriculture and livestock for livelihood. Although agriculture is the mainstay of the people, only 20% of the net sown area is irrigated¹. Four years of continuous drought and acute water and power shortage in this region ending self-sufficient agri-livelihoods, has resulted in large-scale migration² up to 36.95%. The change in land-use pattern, dependency of people on forests, and scarcity of natural resources in this region has caused exploitation of dense forest. Under these

circumstances, it is difficult to sustain livelihood without resource enrichment.

Against this background, a special plantation drive in Bundelkhand has evolved and field activities are in full swing to make this region green. Nature also favoured this drive by showering more than 700 mm rainfall during June–July. This special drive is operational in seven districts under Bundelkhand region, covering an area of 29,418 km² (12.21% of UP), which also includes 12 lakh ha of degraded forest area. This will benefit 8.2 million people of the region (4.95% of total UP). Lower rainfall than the average in several years followed by one or two years of excess rainfall in this region¹ clearly emphasize the importance of water storage during good receiving year like in 2008. Since the land is undulating, it needs to be protected from erosion and resulting silting of tanks. The special plantation drive is a good initia-

Table 1. Status of forest in Bundelkhand region of Uttar Pradesh

District	Geographic area (km ²)	Very dense forest (km ²)	Moderate dense forest (km ²)	Open forest (km ²)	Total (km ²)	% of geographic area (km ²)	Scrub (km ²)
Jhansi	5024	0	34	168	202	4.02	119
Lalitpur	5039	0	146	426	572	11.35	42
Jalaun	4565	0	68	179	247	5.41	49
Hamirpur	4282	0	67	111	178	4.16	38
Banda	4532	0	27	76	103	2.27	29
Mahoba	2884	0	20	74	94	3.26	95
Chitrakoot	3092	0	346	208	554	17.92	14
Total	29418	0	708	1242	1950	–	386

Source: State of Forest Report³.

tive for afforestation, rainwater harvesting, livelihood security by guaranteed employment and future supply of fruit, fuel and fodder. It envisages a planting target of ten crore plants during August–September 2008 in 91,414 ha of land, with the budget of Rs 459.07 crores (Rs 218.56 crores from National Rural Employment Guarantee Scheme, Rs 140.00 crores from State plan and Rs 100.51 crores from Department's own resources). In order to meet the land requirement for implementation, 50,000 ha of forest land, 30,000 ha of private/farmers' land, 10,909 ha of community land and 575 ha of department/public offices have been earmarked with the partnership of Forest, Horticulture, Irrigation, Electricity and Public Welfare departments, Gram Panchayats; and local bodies and authorities. The project implementation committee consisting of the Commissioner of Rural Department, Principal Chief Conservator of Forests, and Special Secretary (Forestry) was developed with full power to take decisions.

The major player, the Forest Department will cover the reserve forest area with crown density less than 0.4, community land, road, canal and railway side plantations. The target of 5.5 crore plants will be achieved by planting mahua, neem, aonla, bamboo, imli, jamun, karanj, pipal, bargad, Gular, chilbul, sisham and siras. In order to meet the target, the Forest Department will use the available seedlings in whole of the UP forest departmental nurseries and nearly 1.83 crore plants will be collected from MP Forest Department. The target of 1.3 crore plantings assigned to the Horticulture Department will find place in the farmers' land by planting their preferred species, viz. citrus, guava, aonla and ber. The cost of one sapling has been taken as Rs 50, which includes Rs 6 for digging a pit, Rs 5 for plant cost and Rs 39 for fencing/protection/irrigation/watch and ward.

In case of fruit trees the plant cost may vary due to its large-scale purchase (nearly 56.71 lakh plants) from private nurseries. For people's participation and credibility to this drive, media plan and third-party monitoring and evaluation are also included. Table 1 shows the present status of forests in seven districts of UP. Status of Forest Report, 2005 also indicated good status of tree cover (8203 km²) in UP³. The success of this drive will definitely enrich the forest status and shift the scrub and open forest into dense cover along with the addition of tree cover by adopting agri-horticulture system in this region.

Although this drive is aimed for sustainable livelihood security and enhancing environmental quality of the Bundelkhand region, there are some bottlenecks. (a) Nonavailability of quality planting material due to four years of continuous drought, and rapid and short-project implementation period. (b) Season of planting is not technically advisable due to early monsoon. (c) The targeted density of planting (1094 seedlings/ha) is too high. Importantly, this drive was unscientific because of the urgency in execution⁴. Presently, it is difficult to stop this drive because of political interference and pressure. But, it can lead to partial success by the dedicated officials and field staff.

Scientific research is the backbone for societal growth and prosperity⁵. Therefore, the following proven technologies and/or suggestions may be taken into account during implementation of field work for ensuring maximum success.

(a) Availability of nursery near planting site and supply of seedlings for ensured and good survival, reduced transportation cost and avoiding jeopardizing of plant supply during wet season⁶.

(b) Non-browsable species selection and planting at sapling stage or more than six-month-old seedlings.

(c) Regular and gradual increase in the interval of watering towards hardening of planting materials to face the rainfed conditions.

(d) Advance pit-digging, soil working along with adequate protection measures by stone wall/eco-protection to plant from Anna Pratha and Gwari system of grazing.

(e) *In situ* soil and moisture conservation techniques, box or staged trench digging⁷ along with assured irrigation during dry spells of the subsequent months of planting.

The communities living in Garhkundar–Dabar watershed (located in Bundelkhand region) have immense knowledge about plant wealth due to their dependency on flora for their social and livelihood needs⁸. In support of this kind of traditional knowledge, the public-cum-beneficiaries of Bundelkhand region should extend their cooperation with active participation and protection of common property resources. The mass media should also play its role by creating awareness regarding this special plantation drive.

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