3. Farming/Cropping System

Farmers' friendly Decision Support Tool for selection of IFS Components: Farmers' friendly Integrated Farming System Components Selection Model has been developed by employing Visual Basic platform. The model is useful in taking decision about selection of integrated farming system components based on expected profit under the prevailing constraints and also to suggest beneficial integrated farming system components not only from profit but also from land and water productivity point of view. Maximum 9 IFS components can be selected.

A novel technique of pest detection using remote sensing: The satellite data was used for identification of pest incidence in cotton in Mylaram village of Warangal district of Andhra Pradesh. There was a severe incidence of mealy bug in the target village on 2 December, 2009. Ground truth information was collected from 52 locations on the same day using differential GPS. After acquiring the image and using the ground truth data, cotton crop areas were separated out and were subjected to maximum likelihood classification using ENVI. The overall accuracy of classification was to the extent of 67%. Remote sensing and geo-spatial techniques, therefore, hold promise in pest monitoring and management on large tracts.

Promising *shisham* germplasm: The PT 2 *shisham* strain has been identified for straight bole with high wood volume for better return in agroforestry as well as in pure plantation. This progeny obtained 3.6 and 4.4 score out of 5 on cultivated and degraded lands, respectively compared with 2.1 scope of local race.

Backyard composite livestock farming as income generating option for unemployed youth—a case study: After being convinced about raising meat animals while undergoing a consultancy course on Commercial Rabbit Farming conducted at ICAR Research Complex, Goa and a part time worker and small farmer (land holding 0.25 ha) shifted to livestock farming by raising rabbits. In a short span of six months he established himself in rabbit farming and started selling rabbits as pets and for meat. This was a turning point for him to resort to composite farming. Presently he is engaged in composite farming of rabbits, goats, pigs, ducks, backyard poultry birds, turkeys etc., in addition to raising of plant nursery including bush paper and other floriculture plants for sale. He is also cultivating black pepper plants yielding about 100 to 110 kg/year. There are five family members and two of them spare about 7 to 8 hr a day to maintain all the above livestock and nursery. His net income has risen to about ₹ 39,210/ month. Such a remunerative venture is certainly expected to attract more number of youths for their livelihood.

Fodder security through Integrated Watershed Management interventions in Bundelkhand—a case study: Livestock are an integral part of the resource poor farmers' economy and contribute significantly to their livelihoods under complex, diverse and high risk situations particularly semi-arid areas like Bundelkhand. However, acute shortage of fodder for livestock is not only threatening livelihood but also creating problems of ecological degradation through overgrazing and deforestation. Adoption of integrated watershed management interventions, namely soil and water conservation measures, crop demonstrations with improved package of practices and agrotechniques, alternate land use and agroforestry, plantation and human resource development in participatory mode in Garhkundar–Dabar watershed in Jhansi, Uttar Pradesh, played a significant role in increasing the fodder production on sustainable basis. The fodder production from crop residues/by-products, cultivated

Backyard composite livestock farming

fodder, weeds and thinning material, scrub lands, forest lands, along water course and field bunds increased by 400, 79, 25, 99, 83, 115 and 103%, respectively in 2009–10 as compared to 2005–06 level. Further, total fodder production from all sources increased by 208% and as a result, the watershed area became fodder surplus (+1.992 Mg/year/animal) from a net fodder deficit (–0.569 Mg/year/animal) despite 34.4% increase in animal population during the period. The average milk productivity from buffalo and cow increased to 6 and 3.5 litres/animal/day in 2009–10 from 4.5 and 2.5 litres/animal/day in 2005–06, respectively. Further, the substantial increase in fodder production from cultivated land itself reduced the pressure on forest land which, in turn, has checked further degradation of forests and also improved the livelihood of the people in a sustainable manner through increased animal production. Thus, successful implementation of agroforestry interventions along with soil and water conservation measures on watershed basis not only mitigated the ill effects of drought but also ensured fodder security for livestock.

Agroforestry helps in biodiversity conservation: An Agri Biodiversity Park (ABDP) has been established on 150 acres area with natural ecosystem, undulating terrain rocks, boulders and hillocks on the ANGRAU campus, Hyderabad. The Agri Biodiversity Park is aimed to preserve and conserve the native flora and fauna of Deccan plateau region through *ex-situ* conservation of the species and to establish 15–20 biotic communities including wild relative field crops as a repository that flourished in the region in the past. Tree blocks depicting vast genetic diversity with species, such as Teak, Mahuwa, Palm, *Ficus* and Medicinal plants were planted in mixed tree block in an area of 25 acres. The park has 30 *Ficus* species in *Ficus* block. In addition to plantation blocks, water ponds and water bodies were also created as a source of water for all resident and migratory bio creatures for promotion of faunal genetic resources. At present in agri-biodiversity park there are 24 spp of insects, 5 spp of fish and 8 spp of reptiles. Of 120 species of butterflies present in the Andhra Pradesh, 56 were recorded in the Agri Biodiversity Park. The bird species increased from 35 to 162 within two years. The agroforestry not only helps in livelihood support but plays vital role in conservation of biological diversity as well. This is the best tribute to the "International Year of Biodiversity".

Development of eco-friendly bamboo treeguards (Value-addition of bamboo): Bamboo-based agroforestry systems are being promoted for livelihood support, natural resource conservation and environmental protection through carbon sequestration. The treeguards were made from locally available bamboo. This has replaced the non-degradable, traditional iron/steel treeguards used for long to protect the trees in plantation programme. For fabrication of one unit of one thousand bamboo treeguards, it requires 4,000 to 6,000 green bamboos and 1,000 to 1,500 man-days. Rural unemployed youth were trained to fabricate treeguards. They were paid @ ₹ 120. Thus for fabricating one unit (1,000) treeguards of bamboo, a cultivator can earn ₹ 100,000 to ₹ 150,000 by way of producing raw material and ₹ 120,000 to ₹ 180,000 worth of employment. Nagpur Municipal Corporation has planned to use more than five thousand bamboo treeguards in the current financial year for protecting plants in the city. Many other government organizations (National highway divisions, Power stations etc.) and NGOs are planning to use these treeguards in their plantation programmes.

Brackishwater fish species farming in freshwaters: An euryhaline fish species, *Etroplus suratensis* has successfully been bred in captivity. The species has been proved to be a good partner in composite culture with carps, sharing over 4–7% of total production (1,131.3–2,645.0 kg/ha/yr). Since it is herbivorous, there is no competition with other carps.

Impact assessment of shrimp farming on mangroves: To ensure that the aquaculture development in Gujarat is not adversely affecting mangroves, an impact assessment was carried out using satellite data and geographical information system. The district wise comparison of existing brackishwater area and shrimp farm area indicated that shrimp farm development has utilized less than 1% of the brackishwater area. Shrimp farms were not located in mangroves or adjacent to mangroves. An area of 3,210 ha was used for shrimp farming in 2009, and all development was from erstwhile wastelands. This confirmed what has already been proven in Tamil Nadu and Andhra Pradesh that aquaculture development has not been at the cost of mangroves.

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