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FORWARD



Agroforestry in our country is not new. In our traditional farming systems, it has been playing a very important role in meeting the multiple needs of the farmers besides sustaining soil productivity. Shifting cultivation, Taungya cultivation, multistoried homestead farming especially in humid regions and growing of Bajra (Pearl millet) alongwith Khejri (*P. cinerarea*) in western arid and semi-arid region are some of the typical examples of agroforestry.

With the thrust on green revolution and introduction of high yielding varieties for increased crop production more and more of the marginal, submarginal and other degraded lands not suitable for farming have been put to arable farming by eliminating woody perennials. As a result of the series of droughts, the dryland farmers have realised the losses accruing from such changes and have again started cultivation of perennial woody plants on their field boundaries especially in dryland areas. But what is urgently needed is the choice of right type of multipurpose woody

perennial including trees (also fruit trees), shrubs, palm, bamboo, etc. and systematic way of growing trees alongwith crops.

By 2000 A.D. we have to produce 250 m.t. of good grain, 2085 of green and dry fodder, 300 m.t. of fuelwood, and about 60 m. M³ of timber besides amelioration of our polluted environment, we hardly have any other alternative except to promote appropriate agroforestry systems in some of our vast marginal, submarginal and other degraded lands particularly those in the dryland agriculture regions.

In India, research, training and development in Agroforestry has been taken up at 31 Co-ordinated centres situated in different Agricultural Universities and ICAR Institutes covering most of the agroclimatic regions of India with a National Research Centre at Jhansi and the Co-ordinated cell at ICAR, New Delhi. The main aim is to obtain optimum return from a unit area without loosing the fertility of the soil by adopting various agroforestry systems.

I am very happy to learn that National Agroforestry Research Centre, Jhansi is bringing out the Agroforestry Newsletter which will provide latest information on various aspects of agroforestry. I compliment the Director and his colleagues for this initiative which will help to create awareness and dissemination of latest technologies on agroforestry to the farming communities. I am sure this newsletter will be useful and handy for the scientists, planners, developmental agencies, students and teachers for updating their knowledge on various aspects of agroforestry.

I wish Agroforestry Newsletter a grand success in achieving the goals set for this publication.

N.S. Randhawa

(N.S. RANDHAWA)

Agroforestry — Past and Present

Agroforestry has earned a definite identity of its own and hardly needs further elucidation. It has been variously defined but one which is simple and is recent could be cited as "Agroforestry is a collective name for land use systems and technologies in which woody perennials (tree shrubs, palm, bamboos etc.) are deliberately combined on the same land management unit as herbaceous crops and/or animals in some form of spatial arrangement or temporal sequence." Although agroforestry is of recent origin in our country but agroforestry was practised in various forms by our ancient people. Shifting cultivation popularly known as jumming was practised by the tribals in eastern and central India since time immemorial. Next comes Taungya cultivation popularly known as Kumri. It was used for reducing the cost of cultivation of trees specially important timber trees like teak, sal etc. Trees were also used and still being used as a shade and for soil amelioration in tea, coffee plantation etc. Farmers also keep certain trees in the boundaries as well as scattered in the field especially Khejri (*Prosopis cineraria*) and Ramkanti (*Acacia nilotica* subspecies *cuprisiformis*) in arid and semi-arid part of western India respectively. Homestead agroforestry is being followed in various parts of the country especially in humid areas.

The area under forest cover in our country is shrinking at an alarming rate (1.5 m. ha) and the area varies from 20.4% to 10.52%. Forest area with closed canopy has been estimated to be around 28 m. ha. The major cause of deforestation and denudation is mainly due to search for more and more areas to produce food including animal products and fuelwood as a result of increase in human population causing more harm than good to the cultivators as it is increasing siltation of the dams and water ways leading to flood and production loss in low fertile areas.

So under the above circumstances there is hardly any alternative but to grow multipurpose trees/shrubs and other woody plants in the various integrated agroforestry systems in some of the marginal, submarginal and the wasted land and also unsuitable arable land in various agroclimatic regions of the country to solve some of the pressing problems like acute scarcity of fuelwood, fodder, timber and animal feed and also to improve and

optimise the productivity of vast tract of our degraded land and for amelioration of the environment.

Lot of emphasis is now being given for practice of various agroforestry systems in some of these degraded lands. But to follow various agroforestry systems we don't have adequate information as such there is urgent need for research on various aspects of different agroforestry systems.

The first Agroforestry Seminar held in India in May 1979 at Imphal to take account of the present situation and recommended action for research and development of agroforestry. A task force was also formed which felt the need for agroforestry research in India and recommended establishment of Co-ordinated Research Project on Agroforestry. The first All India Co-ordinated Research Project was established during 1983 with 20 centres in the VI Plan and 11 more centres were added during the VII Plan and started functioning at 5 different agroclimatic zones viz., Himalayan region, Gangetic plains, Arid and Semi-arid, Tropical, Humid and Sub-humid regions with 3 main core projects. (Dr. S. Chinnamani, ADG-cum-Co-ordinator, Agroforestry joined during May 1988).

- 1) Diagnostic survey and appraisal of existing farming systems and agroforestry practices.
- 2) Collection and evaluation of promising species of cultivars of fuel, fodder and small timber (multipurpose) trees.
- 3) Studies on the management practices of agroforestry systems.

One National Research Centre for Agroforestry was established in the latter part of the 7th Plan at Jhansi and started functioning from May 1988 with the joining of Dr. R. Deb Roy as Director with the following major objectives:

- 1) To conduct necessary supporting research on tree crop genetics, soil ecology, physiology, biomass chemistry, tissue culture to support tree production and improvement.
- 2) Specific priority activities will improve the such status aimed at defining forest food crop

production system under different agro-climatic conditions.

- 3) Selection of superior tree species developing improved programmes.
- 4) Establishing seeding orchards.
- 5) Field testing, plant communities for efficiency of biomass production.

International Collaboration

International collaboration with ICRAF, USAID, Britain and other International agencies for research, training programme on Agroforestry has been taken up. One ICAR-USAID collaborative project, which is being implemented, provision has been made for training in U.S.A. for Indian Scientists in different disciplines/programmes for a period of 6-18 months namely, Tree seed technology and management, Tree nursery technology and management, Agroforestry models using systems analysis methodologies and research methodologies in tree/crop nutrient cycling studies.

Significant findings

Some of the perennial grasses like guinea grass, napier bajra hybrid and setaria were found to be most suitable for agroforestry system and the average reduction in yields were observed to be 13%, 25% and 26% respectively with 35% reduction in radiation availability as compared to open canopy of 7-8 year old A. lebbek. Even with these three crops, there is a great variation at the varietal level with regards to their sensitivity to radiation. The variety Hamil of guinea grass, IGFRI-6 of Napier-bajra hybrid and Narok of Setaria were found to be least affected by radiation curtailment and the yield reductions were 9%, 20% and 13%, respectively as compared to open.

(C.R. Hazra, IGFRI, Jhansi)

Hortipastoral studies in sandy rangelands of arid Rajasthan revealed that Buffel grass (Cenchrus ciliaris) - Jujube (Zizyphus mauritiana) system yielded upto 12 Q/ha/yr of forage in normal rainfall year with about 200-250 plants/ha which did not affect the forage yield.

(S.K. Sharma, CAZRI, Jodhpur)

In a tree-crop interaction studies in 4 year old Leucaena trees planted at 7.5 m x 2 m the yield of Sorghum was 53% of the sole crop (no trees) while that of Leucaena aerial biomass was 85% of the sole tree (no crop). Total biomass production was higher in tree + crop system compared to sole tree or sole crop thereby imparting stability to production and risk reduction especially in poor rainfall year. Intercropping of Sorghum and castor recorded marginal increase in yield under Acacia albida, A. ferruginea and Prosopis cineraria but drastic reduction under Leucaena which shows the importance of canopy management in fast growing trees for successful under cropping.

(R.P. Singh, CRIDA, Hyderabad)

Subabul (Leucaena leucocephala) is considered an important multipurpose, nitrogen fixing tree species in agroforestry systems because it has deep tap root system, erect growing habit and enrich soil by fixation of atmospheric nitrogen and recycling of nutrients through nitrogen rich leaves. It has some limitations as an agroforestry tree like high seed proliferation that leads to inhibition of growth of understorey crops, presence of mimosine in leaves etc.

IGFRI has collections of 494 accessions of all the twelve identified and well descriptive species of genus Leucaena. As a result of intervarietal crosses few plants in F2 and F3 generations identified have high edible leaves to woody parts ratio, low seed yielder, retention of more green leaves in summer and erect type. Besides these, interspecific hybrids of L. leucocephala x L. pulverulenta and L. leucocephala x L. diversifolia were developed which are superior than K8 for fuelwood and forage yield with low mimosine content and extremely low seed producer. However, utilization of these hybrids at commercial level is difficult task due to non-availability of cheap technology for their multiplication through vegetative means. Efforts in this direction are in progress.

(V.K. Gupta, IGFRI, Jhansi)

The tree cropping has a definite edge over non tree situation in improving soil physico-chemical properties. After 7 years of cropping under tree, the gain in average N and P was 83.2 and 9.6 kg/ha. The other soil physical properties like field capacity and bulk density were also favourably influenced.

The organic carbon content was almost doubled in soils with trees than non-tree situation.

(C.R. Hazra, IGFRI, Jhansi)

Field trial on rabi forages (berseem, oats, bokla, metha) and rabi grain crops (wheat, gram) was conducted under Shisham (*D. sissoo*) and siris (*A. lebbek*) plantations for a period of three years (1984-85 to 1986-87) on 2-4 year old plantation at Haryana Agricultural University, Hissar. Among forages, berseem followed by oats, gave maximum yield during all the three years under both the plantations. Fodder yields decreased under 4 year old trees as compared to those of 3 year old plantations.

multipurpose tree with 3 spacing and 4 crop associations in progress at National Agroforestry Research Centre, Jhansi (semi-arid erratic rainfall averaging 850 mm/yr.) under rainfed situation revealed that at the end of first year Babul (*A. nilotica*), Ramkathi (*A. cupriformis*) and Anjan (*H. binata*) recorded more than 90% establishment followed by 80-90% in Jamun (*S. cumini*), Aonla (*E. officinale*), Casuarina (*C. equisetifolia*), Sisham (*D. sissoo*) and Bokain (*M. azedarach*) and less than 80% in Subabul (*L. leucocephala*), Mohua (*M. latifolia*), Safeda (*E. tereticornis*) and Siris (*A. lebbek*) respectively. Maximum growth was observed in Ramkathi followed by Aonla, Babul and Subabul and least in Mohua.



Fig.1: *Albizia-Cenchrus-Dolichos* silvipastoral system in Bundelkhand (U.P.)

The grain yield of wheat was more under both the plantations. Grain yields of both wheat and gram were higher under shisham trees and declines with increasing age of the trees. The depressive effect on yields of all the above intercrops with the advancement of tree age indicated a negative association between yield of intercrops and age of the trees.

(R.S. Dhukia, HAU, Hissar).

Crop production was not significantly affected even with 1000 plants/ha during the first year. Maximum production was observed in Sorghum + Pigeonpea followed by Sesamum and least in groundnut. Growth of rabi crop was also not significantly affected by the tree saplings.

(R. Deb Roy, NARC, Jhansi)

Symposia/Seminars/Conferences

An International Workshop on Agroforestry for Rural Needs was held at Vigyan Bhavan, New Delhi during 22-26 Feb. 1987 organised by Indian Society of Tree Scientists and IUFRO.

A National Rangeland Symposium was held at Indian Grassland and Fodder Research Institute, Jhansi organised by Range Management Society of India and IGFRI, Jhansi during 9-12 Nov. 1987. It was attended by 100 participants from India and abroad. One of the sessions was devoted to Forestry and Agroforestry in which 8 papers

India.

- iii) A higher allocation of forage research should be made and universities and research institutions should draw up collaborative research programmes to increase productivity and avert degradation of lands.
- iv) An extension wing in all state forest departments should be established and an aggressive publicity campaign be launched to safeguard and increase the forest wealth of the country.
- v) Afforestation strategy for wastelands and



Fig. 2: *Leucaena-Cenchrus* silvipastoral system in calcareous soil at Jhansi - Bundelkhand region (U.P.)

including one invited paper was presented and the recommendations are:

- i) Agroforestry which holds great promise for contributing to sustained land use system and is appropriate to needs of low resource farmers needs to be encouraged through extension and govt. support.
- ii) Forest grazing should be strictly controlled and regulated for feeding of essential livestock. Grazing provisions should be incorporated in new forest policy under preparation by govt. of

degraded lands should have sufficient provision for fodder production through planting of legumes, grasses and fodder trees.

- vi) Adequate attention should be paid to sociological aspects. In afforestation programme people's involvement should be encouraged.

Annual workshop of Co-ordinated Project on Agroforestry was held during 26-30 April 1988 at Central Soil Salinity Research Institute, Karnal and participated by number of well known national and international scientists including Dr. N.S.

Randhawa, DG, ICAR, Dr. B. Lundgren, DG, ICRAF, Dr. D.R. Bhumbra, Dr. J.S. P. Yadav and discussed Agroforestry research and development in progress in India.

A National workshop on Research and Extension Needs for Promotion of Fodder and Fuel trees was organised by BAIF, Pune during 4-7 July, 1988 Inaugurated by Dr. M.S. Swaminathan and participated by the scientists from National and International organisations in which fodder and fuel tree species especially nitrogen fixing tree species under various silvipastoral and other agroforestry system, their management and utilisation was specially discussed. Number of important recommendations came out of discussion which has been published.

An International Rangeland Congress was organised by RMSI and ICAR and sponsored by number of national and international organisations which was held at Vigyan Bhavan from 7-12 Nov. 1988 and attended by more than 500 renowned scientists, planners, administrators, NGOs from over 40 countries. A 362 page abstracts printed in two volumes were given in the congress. Out of 11 symposia one symposium was devoted to Silviculture on rangelands in which 37 papers including poster session were contributed and the abstracts have been printed in the Vol. II.

A Workshop on Nitrogen fixing tree species for India was organised by BAIF during 12-13 Nov. 1988 at New Delhi under the chairmanship of Dr. M.S. Swaminathan, President, IUCNNR and number of internationally known scientists including Prof. Brewbaker, NFTA, Hawaii. Prof. R.V. Singh, DG, ICFRE, Dr. M.V. Rao, Spl. DG, ICAR, Dr. Mani Bhai Desai, President, BAIF and others participated.

A National Symposium on Forest Biology in the Service of Mankind was organised at Madurai Kamaraj University during 5-6 Jan. 1989 by Indian Society of Tree Scientists including Dr. M.S. Swaminathan and Chipco Movement Leader Prof. Sunderlal Bahuguna participated.

A National Symposium on Agroforestry Systems in India was organised by Indian Society of Agronomy at CRIDA, Hyderabad from 11-13 January 1989 and attended by number of eminent scientists and inaugurated by the Hon'ble Forest Minister of

Andhra Pradesh, discussed various aspects of agroforestry systems.

A Workshop on Desertification, drought, soil erosion and related problems jointly sponsored by Commonwealth Secretariat and ICAR will be held at CAZRI, Jodhpur (Rajasthan) from 13-25 March 1989.

A National Symposium on Environmental assessment and management through social forestry in tribal regions is being organised at Faculty of Forestry, Birsa Agricultural University, Kanke, Ranchi from 4-6 April, 1989.

AGROFORESTRY ABROAD

An International Workshop on Perennial Sesbania species in Agroforestry systems is being organised during 27-31 March 1989 at Nairobi, Kenya jointly by ICRAF-NFTA. For more details contact Dr. Peter Von Carlowitz, ICRAF, P.O. Box 30677, Nairobi, Kenya.

A 3-week Agroforestry training course is being organised from 8-26 May 1989 by ICRAF. For further details contact Dr. D. James Wahome or Dr. Emmanuel Torquebiau, Human Resource and Institutional Development Programme at ICRAF.

An International Conference on Agroforestry — Principles and practice is being held at the University of Edinburgh during 24-29 July 1989. Details can be had from the Secretariat, Agroforestry Conference, Deptt. of Forestry & Natural Resources, University of Edinburgh, Mayfield Road, Edinburgh EH9 3JU, U.K.

A Symposium on Agroforestry techniques is being organised at Havana, Cuba during 22-24 Nov. 1989. Further details can be had from the Symposium Organizing Committee. Instituto de Investigaciones, Forestales, Calle 174 No. 1723, entre 17-B y 17-C, Siboney, Zona Postal 16, La Habana, Cuba,

Kleinhans Fellowship for Research in Tropical Agroforestry is being offered by the Rainforest Alliance, 295 Madison Avenue, Suite 1804, New York, NY 10017 for 2 years which will begin in September 1989.

The Agroforestry Newsletter aimed at providing important highlights on research, development, education and training in India published quarterly by the National Research Centre for Agroforestry (ICAR). Contributions, letters, comments, Queries etc. on any aspects of Agroforestry may be sent to Dr. R. Deb Roy,

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