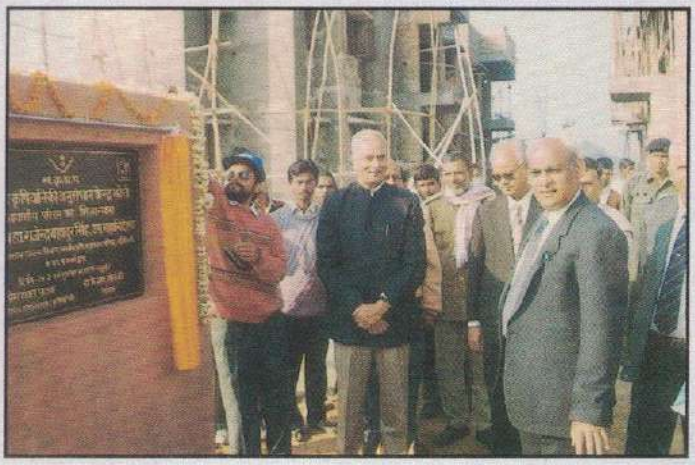
Agroforestry
NEWSLETTER
National Research Centre for Agroforestry, Jhansi

Vol. 10, No. 1 JANUARY-MARCH, 1998

'PADMA BHUSHAN' AWARD FELICITATION

The Director and staff of National Research Centre for Agroforestry, feel proud in conveying their hearty congratulations to Dr. R.S. Paroda, Secretary to Govt. of India, Department of Agricultural Research & Education and Director General, Indian Council of Agricultural Research (ICAR) on being conferred the prestigious award 'PADMA BHUSHAN'

Visit of Deputy Director General (NRM), ICAR, New Delhi



Hon'ble Dr. G.B. Singh, Deputy Director General (Natural Resource Management), ICAR, New Delhi along with Dr. P.S. Pathak, Assistant Director General (AF) visited the Centre on 26.2.98. Dr. K.R. Solanki, Director, welcomed Dr. G.B. Singh, Deputy Director General and Dr. P.S. Pathak, Assistant Director General (AF). The DDG (NRM) laid foundation stones of building

complex of the Centre. This function was followed by plantation of fruit trees. Dr. G.B. Singh, DDG (NRM), Dr. P.S. Pathak, ADG (AF) and Dr. K.R. Solanki, Director, NRCAF planted tree on the road side. Further he inspected all on going research projects.

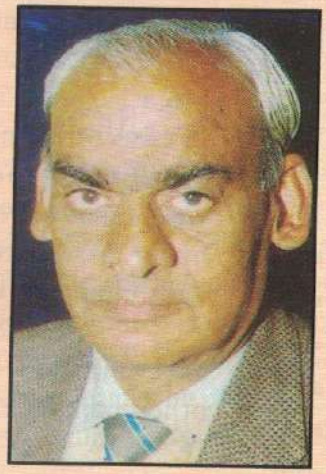
Dr. G.B. Singh, DDG (NRM) addressed the Scientists in a meeting where he emphasized on the following points.

- The data generated during the past years should be analyzed and preserved.
- Out of 18 MPTs tested at Centre, some prominent MPTs for different soil types, irrigated and rainfed condition should be identified.
- Tree species preferred by farmers should also be included in research programme.
- Bamboo is an important woody component and its demand in market has increased to manifolds . This species should be investigated for its potential in agroforestry system.
- Involvement of every scientist in programmes of All India Coordinated Research Project on Agroforestry is rather essential and would yield good results .

- There is an immediate need of an economist to work out economic outcome as large meticulous collected data. The DDG appreciated the research work conducted so for and overall progress of the Centre. He was delighted to see more young scientists of different discipline and advised that they should work hard for the all round development of the Centre.

STAFF RESEARCH COMMITTEE

The SRC meeting of the Centre was held on 5.1.98 and from 13.1.98 to 17.1.98 in the forenoon of each day under the chairmanship Dr. K.R. Solanki, Director, NRCAF, Jhansi.



From the Director's Desk

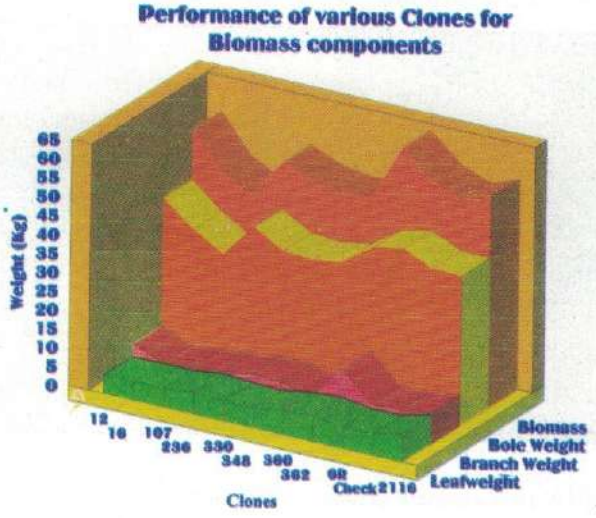
It is my immense pleasure in presenting Vol. 10 of Agroforestry Newsletter during the 50th year of India's independence. The Centre has completed 10 years. The significant contributions of the Centre have been the development of Hardwickia binata (Anjan) based agrisilvicultural system, Emblica officinalis (Aonla) based agrihorticultural system, improved silvipastoral system and propagation of Azadirachta indica (Neem) & Anogeissus pendula (Kardhai) through layering.

KR So Canh

(DR. K.R. SOLANKI)

Correlation studies of biomass and growth attributes in tissue culture raised clones of *Eucalyptus tereticornis*

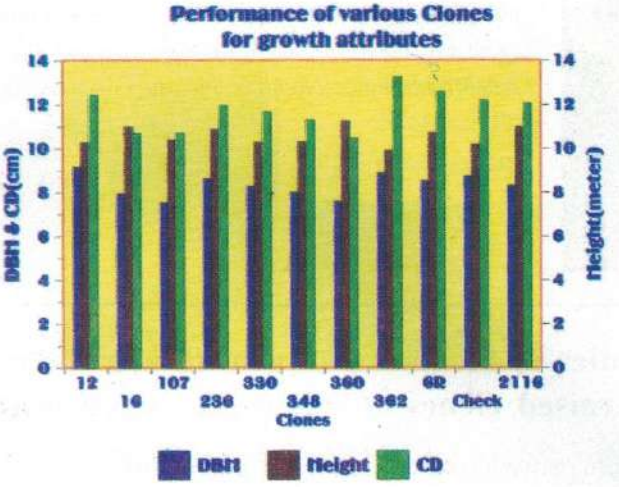
An adaptability cum growth trial of tissue culture raised clones of *Eucalyptus tereticornis* has been conducted at National Research Centre for Agroforestry, Jhansi. Jhansi is situated between latitude 24°11'-26°27' N and longitude 78°17' - 81°34' E with mean annual precipitation 936 mm of which 80-90% is received during July-September. The climatic pattern of Jhansi is true representative of semi-arid region with weekly mean maximum temperature ranged from 22°C-47°C and minimum from 2.5°C to 29.9°C. The soil of the experimental site is black containing organic carbon 0.29%, pH 7.07 and available NPK 82.3 kg/ha, 3.16 kg/ha, 83.66 kg/ha, respectively and EC 5.64 dsm^{-1}.



Tissue culture raised clones of 10 plus trees (ET-12, ET-16, ET-107, ET-236, ET-330, ET-348, ET-360, ET-362, ET-6R & ET-2116) collected from TERI, New Delhi with local check were transplanted in first week of September, 1994 in randomized block design with three replications. Each plot consisted of 25 plants in five rows spaced 3x2 meter. Whole of the experimental area was surrounded by guard rows. Fertilization was given

in the pits at the rate of 60 kg N/ha and 40 kg P_2O_5/ha and 25 kg BHC (10%)/ha as a basal dose at the time of plantation. Bucket irrigation (2 buckets at a time) was given fortnightly up to June, 1995.

From each replication, 5 trees of each clone were harvested for manifold purposes including biomass productivity at the age of 3.5 years. Data on basic growth attributes (height, CD & DBH) and on biomass components (leaf weight, branch weight & bole weight) were recorded on actual felling of trees. Comparative performance of clones for growth attributes and biomass components are given in Fig. 1 & 2. Survival of all the clones were more than 80 per cent. Clones ET-6R, ET-12, ET-362 and ET-2116 were found quite promising based on growth attributes as well as the total biomass is concerned.



The correlation coefficients of all the attributes amongst growth parameters and biomass components were found significant (1-tailed significance at p=.001). Amongst the growth characteristics, circular growth has maximum linear association ($r_{CD \& DBH}$=.9076) as compared to polar growth ($r_{Ht,CD}$=.4146, $r_{Ht, DBH}$=.5554). In case of biomass attributes, bole weight shows strong linear association with biomass ($r_{bole\ weight,\ biomass}$=.9588) as compared to other components ($r_{leaf\ weight,\ biomass}$=.8240, $r_{branch\ weight,\ biomasss}$=.7952).

Considering growth attributes and biomass components simultaneously, fairly strong linear dependence of total biomass on DBH & CD was observed ($r_{biomass,\ DBH}$=.9295, $r_{biomass,\ CD}$=.8768), while the linear association of biomass with height ($r_{biomass,\ height}$=.6333) was not supported by the scatter plot of biomass on height. It reveals that circular growth attributes plays dominant role for determination of biomass as compared to polar growth.

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Management of Tree Roots in Agroforestry Landuse for Rehabilitation of Degraded Lands in Outer Himalayas

Land is a vital resource and is the basis of our existence. Therefore, management of this resource including its stabilisation, conservation and utilisation is of crucial importance. About 50% of the land in the major continents of the world is non-arable. Out of 329 million ha of the total geographical area of India, about 175 million ha is subjected to varying degrees and forms of degradation which is nearly 50% of the rural India. In north western outer Himalaya of Utter Pradesh (Doon valley) nearly one-third of the area is under marginal and degraded lands which is poor in nutritional status and water retention characteristics. In view of the shrinking land resources and mounting human and animal pressure such lands may be utilized for growing trees and crops beside silvipastoral land use. Keeping that is view a study was conducted for ten years (1986-96) in a systematic agroforestry design at Central Soil Conservation Research Farm, Selakui, Dehradun (India) to evaluate effect of pruning of tree roots and planting direction on rainfed crops, tree growth and ameleoration of bouldery class V riverbed land composed of 30% boulders, 30% gravel and 40% sand, silt and clay. The site revealed extremely poor water retention (WHC 6.2%) and fertility (Organic C 0.16%, total N 0.018%, available P 3.3 ppm and available K 61 ppm). Eight months old *Eucalyptus* hybrid saplings were planted at 1.25 m during 1986 in the north-south and east-west directions in a plus (+) design with 15 plants on each arm divided into three segments to prune tree roots on both sides, on one side and no pruning. Root pruning was imposed by a trench (1m deep, 0.5 m wide and 0.4 m away from tree line) embedded with a high density polyethylene sheet upto 1m and packed with excavated soil to restrict lateral root development and water stagnation near trees. Rainfed corn-wheat (1987-88 to 1990-91), Brassica- Sesame (1991-92 to 1992-93) and sorghum - oat for fodder (1993-94 to 1994-95) were grown in association with trees. Tree effect was recorded segmentwise upto 10 m from tree rows. No adverse effect of trees on crops was observed upto three years, there after a reduction in yield near the *Eucalyptus* tree line was recorded in cereals, oil seeds as well as in fodder crops (Table-1)

Table-1 : Effect of tree root pruning and planting direction on yield of crops (kg/ha)

Crops	Pruning		No pruning		North-south		East-west	
	0-4m	4-10m	0-4m	4-10m	0-4m	4-10m	0-4m	4-10m
Corn	1782	2115	1358	1807	1510	1955	1600	1907
Sesame	275	511	182	417	159	134	248	494
Sorghum (fodder)	14231	17766	11740	15355	11487	15755	14208	17254
Wheat	999	1134	724	1032	743	992	883	1173
Brassica	162	243	107	203	121	209	145	237
Oat (fodder)	2720	2975	1985	2540	2134	2585	2548	3051

Reduction in grain and fodder yields was more pronounced in plots with out root pruning. Trenched plots (0-4m segment), with eliminated root competition of *Eucalyptus* trees with crops, showed increase in yield near tree/crop interface over non-trenched plots by 31.2, 37.4, 51.0, 51.4, 21.2 and 37.0 per cent in maize, wheat, sesame, toria, jowar and oat fodder, respectively. Reduction in yield of cereals and fodder was more pronounced in winters due to prevailing moisture stress than in rainy season. The east-west direction representing NE-SW aspect recorded higher grain and fodder yields due to more exposure to solar radiation. Higher tree growth rates (height, diameter at breast height and crown diameter) were also recorded in this direction but root pruning tend to depress the tree growth slightly. Soil analysis after 10 years revealed decrease in soil pH by 0.4 units, bulk density by 0.1 Mg m-3 and improvement in organic carbon by 0.16% and water holding capacity (1-5%) showing ameleorative effect of agroforestry landuse on such degraded lands.

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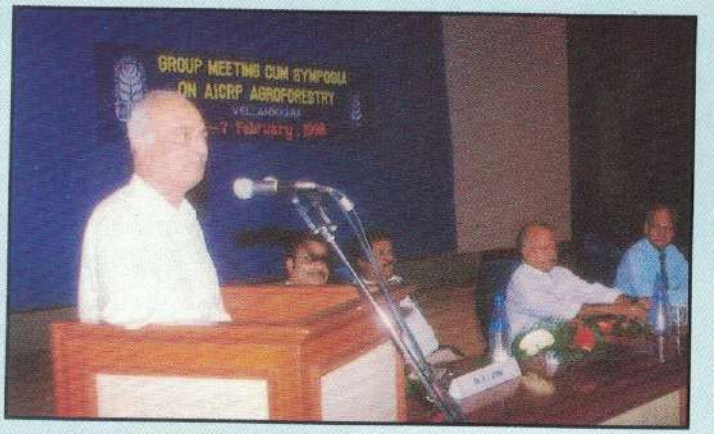

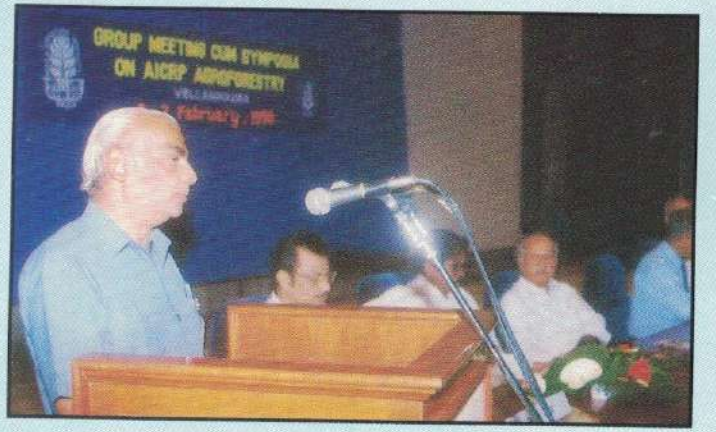

GROUP MEETING CUM SYMPOSIA OF AICRP AF

Dr. K.R. Solanki, Director, and Co-ordinator of AICRPAF organised annual group meeting cum symposia at K.A.U. Trichur, 5-7th Feb., 1998. Sh. N. Govindankutty, IFS, Principal Chief Conservation of Forest, Kerla Forest Department, was the chief guest. Dr. G.B. Singh DDG (NRM) ICAR, Dr. P.S. Pathak, ADG (AF) ICAR, Dr. K.S. Nair, Director, Kerala Forest Research Institute, Peechi, Sh A.K. Dhaini, IFS, Registrar, KAU and Dr. A.I. Jose, Associate Dean of KAU, were present in the symposia.

Changing Definition of Agroforestry

India is a vast country with a total geographical area of 329 m ha which is about 2 per cent of the world but she has to provide food and fodder to huge human and livestock population of 960 and 490 m respectively which are likely to exceed 1.00 and .60 billion respectively by 2000 A.D. Man's desire to live in peaceful coexistence created settled agriculture. In order to meet the increasing demand of our fast growing population we would require to boost the production of food grain and fuel wood for human consumption and green and dry fodder for livestock to tune of 250, 350 and 2085 mt, respectively besides 75 million meter$_3$ of timber. Therefore, in the quest of optimizing productivity, the multitier system 'Agroforestry' has assumed global recognition. Although, harmonised agriculture and pasture with trees, animal and birds was in practice during vedic era (Ancient period 1000BC), agroforestry as a vistas of science introduced recently only.

Agroforestry is not a new system or new concept, the practice is very old but the term is definitely new. Various agroforestry systems both traditional (viz. Shifting cultivation, Taunga, Homestead etc.) and introduced (viz. Agrisilviculture, Agrihorticulture, Hortipasture, Agriaquaculture, Agri&silvihorticulture, Silvipastre etc.) are in practice in different countries of the world especially in the developing countires including India. Undoubtedly, a lot of confusion as to what is Agroforestry? Most of the people suppose that their must be at least one definition and often some imaginative and fascinating elucidations of the concept of agroforestry were proposed. Agroforestry means practice of agriculture and forestry on the same piece of land.

Bane et al., (1977), proposed the first definition of agroforestry which as follows :

"Agroforestry as a sustainable management system for land that increases overall production combines agricultural crops, tree crops and forest plants and/or animals simultaneously or sequentially and applies management practices that are compatible with the cultural patterns of local population."

King and Chaudler, (1978) reconsidered the definition proposed by Bane et al., (1977) and modified as :

"Agroforestry is sustainable land management system which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants and/or animals simultaneously or subsequently on the same unit of land and applies management practices that are compatible with cultural practices of the local population."

Nair. (1979) defined agroforestry as :

"Agroforestry as a land use system that integrates trees, crops and animal in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to the farmers."

According to Lundgren, (1982),

"Agroforestry is a collective name for land use system and technologies in which woody perennial including tress, shrubs, bamboos etc., are deliberating combined on the same land management unit with herbaceous crops and/or animals either in some form of spatial arrangement or temporal sequence. In agroforestry system there are both ecological and economic interaction amongst the different components."

Young, (1989) proposed the following definition,

"Agroforestry is collective name for land use system in which woody perennials (trees, shrubs etc.) are grown in association with herbaceous plants (crops, pastures) and/ or livestock in spatial arrangement or rotation of both and in which there are both ecological and economic interaction between the trees and non tree components of the system.

Sanchez, (1995) defined,

"Agroforestry is a collective name for [illegible]

and nearby forest. In addition *Sterculia vilosa*, *Largestromeia speciosa*, *Bischofia javanica*, *Trewia*

" ... trees growing in home land, farm land

AGROFORESTRY ACTIVITIES IN ASSAM

Introduction :

There are various interpretations of the terms currently used in agroforestry. The presence or absence of three components or elements is used to classify the various agroforestry systems: the agricultural components, the animal components and the forestry components. The various combinations of these three components lead to the identification of silvipastoral, agrisilivicultural and agrisilvipastoral systems.

AICRP on agroforestry for Assam under the Jurisdiction of Assam Agricultural University is located in lower Brahmaputra valley zone and comprises the district of Kamrup. Nalbari, Borpeta, Dhubri, Goalpara, Kokrajhar and Baingaigaon, account for 25.75% of the state total area. Soil consists of new alluvium on both banks of Brahmaputra and old alluvium towards the foothills. Soil are sandy loam in texture, acidic in reaction, though a large area in the riverine tract is natural. The average annual rainfall in this zone is about 1800 mm. Rainfall in the south Eastern part of the zone is low and it increases towards the North and West. The shallow rivers flowing from Bhutan Hills with torrential current cause enormous loss of animal lives, properties and crops every year. The maximum temperature rises upto 36°C in July-August and minimum falls to 10°C in January.

Traditional Agroforestry Activities :

The diagnostic survey conducted as per guidelines of ICRAF revealed that the majority of the farmers are found to be concentrated solely on agriculture.

Rice is the dominate crop followed by wheat, jute, potato, pulses, oil seeds, sugarcane, sesamum, turmeric, zinger, coriander, maize, cowpea and grasses as rainfed crops. Wheat is grown as irrigated crop. On the comparatively high lands, farmers preferred to grow plantation crops like mango, guava, jackfruit, silikha, amlokhi, drumstick, koroi, woodapple, citrus, and banana with pineapple and different kind of vegetable as under storey crops till the shedding is adversely affecting their growth.

The farmers of all categories rear animals like cow, bullock, buffalo and goat to meet their various requirement. Common grazing land is not available for which the animals have to depend on stall feeding. The edible crop residue, grasses, legumes and leaves of various trees contribute the roughages for the animals. Some of the fodder tree used by the farmers are *Artocarpus heterophyllus, Artocarpus chaplasha, Ficus hispida, Ficus gibbosa, Ficus religiosa, Streblus, asper, Anthocephalus cadamba, Leucaena leucocephala, Albizzia sp. Terminalia tomentosa* and Bamboo species. Under feeding of the animals is of general observation.

Firewood is the only source of fuel and is obtained from trees growing in home land, farm land and nearby forest. In addition *Sterculia vilosa, Largestromeia speciosa, Bischofia javanica, Trewia*

nudiflora, Terminalia arjuna, Albizzia procera, Albizia lebbek, Dysoxylum binectarifeum, Albizia lucida, Toona ciliata, Dalbergia sissoo, Cassia fistula, C assia javonica, Salixs spp, Tectona grandis, Dilenia indica, Azadirachta indica, Delonix regia to meet their demand for fuel, timber and agricultural implements and also as wind barrier. *Bombax ceiba* is grown as commercial enterprise.

About 10% of farmers grow trees as monoculture, 75% grow trees and agricultural crops concurrently on their holding. Alley cropping is also adopted in a traditional way. Very little care is extended to the naturally generated trees.

Integration of trees such as *Anthocephallus cadamaba, Azadiachta indica, Albizia lucida* on the border of agricultural land is a common practice for fire wood. Even agricultural crop like *Cajanus cajan, Sesbania aculeata* and *Tephrochia candida* are raised for fuel and manuring. Bamboo is cultivated for hut construction and bamboo based cottage industries.

The main constraints in cultivating agricultural crops are small size of holding, inadequate water supply during winter, excess rain water and sometimes uncertain food during summer, non availability of animal power and labour, lack of proper scientific technology and improper fertility management.

Some of the traditional agroforestry systems prevailing among the farmers are as follow:

Agri- Horticultural : Castor/Sesamum/Arahar/ Turmeric/Ginger-Guava/Citrus/Coconut/Arecanut.

Horti- Silvi- Pastoral : Jackfruit/Cadamba- Guinea/Napier/Local grasses.

Silvi- Pastoral : Simalu/Caddamba- Ulu/Kahua.

Silvi- Horticultural : Arecanut/Modar- Betelvine/Black pepper/Pine Apple.

Horti- Horticultural : Jackfruit/Guava/Citrus- Banana/Pineapple/Papya.

Present Research Activities :

Present research activities on agroforestry is mainly concentrated on :

1. Finding the most suitable combination of different components of agroforestry.
2. To work out the best arrangement of the components keeping in view the productivity and sustainability of the system.
3. To work out harvesting schedule keeping in view the production of all components.
4. To find out the economic feasibility of the system compared to monoculture.

Keeping in view of the above objectives, 20 tree species, 10 indigenous fruit tree species and 5 tree fodder species were evaluted for different agroforestry systems. Among these *Acacia auriculiformis (16.80m), Gmeline arborea (12.97m), Bombax ceiba (12.09m), Albizzia lebbek (12.21 m), Tectona grandis (12.50 m), Dalbergia sissoo (12.33m), Cassia javonica (15.29m) and Leucaena leucocephala (10.00 m)* are fast growing as recorded in 7 years old plantation.

Out of 10 indigenous fruit trees grown on 22-5-91, *Phyllanthus emblica, Terminalia belerica, Terminalia chebula and Amoora wallichi* showed fast growth.

Trewia nudiflora, Lagestromia flosreginae, Cassia siamea, Acaica auriculiformis and Syzigium cumini thrived well under water logged conditions.

Hybrid napier, guinea, seteria, broom grasses can be profitable growm in the interspaces of coconut orchad upto 7th year of coconut plantation. Grasses could be planted in the interspaces except the competative zone (around 2 m from the base of coconut).

Turmeric, ginge, betle vine and black pepper are identified as the most profitable combination with Arecanut and moder.

Future Strategies :

The scope of scientific agroforestry is vast in the surveyed localities to meet the shortage of fuel. food, fodder, fibre and timber. Screening of plant species suitable to thrive under waterlogging, poor drainage and in marginal soils is prior importtance.. Falconer and Arnold (1988) reported that forest and farm trees by providing food, fodder, fuel and source of cash income played a critical support role tc ..gricultural production in developing countries through agroforestry systerm management, In the above context, the following priorities are identified for future work.

1. Boundary planing materials/plants.
2. Integration of medicinal plants.
3. Suitable tree/agroforestry package for problem soil.
4. VAM/ Rhizobium including allelopathetic studies.
5. Silvipastoral research including animal component.

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NEW STAFF MEMBER

Dr. K.S. Dadhwal, Principal Scantiest joined the Centre from Central Soil and Water Conservation Research and Training Institute, Dehradun.

DISTINGUISHED VISITORS

1- Dr. G.B. Singh, DDG (NRM), ICAR, Krishi Bhawan, New Delhi.
2- Dr. P.S. Pathak, ADG (AF), ICAR, Krishi Bhawan, New Delhi.
3- Dr. R. Deb Roy, Ex Director, NRCAF, Jhansi
4- Dr. G.P. Lodhi, Prof. & Head, Department of Plant Breeding, CCS HAU, Hisar.
5- AVM S. Sahani, NGO., Jhansi
6- Dr. Vinod Shankar, Head, ASP Division, IGFRI. Jhansi
7- Dr. Bhag Mal, Director, IGFRI, Jhansi
8- Dr. A.K. Sharma, Incharge, Regional Station, CSWCR & TI, Datia (M.P.)

KISHAN GOSHTHI

Kishan Goshthi was organised on 28th, March 98 at village sakarea of District Tikamgarh (M.P.) and more than 300 farmers participated in the kishan goshthi.

HUMAN RESOURCE DEVELOPMENT

- Dr. K.R. Solanki, Director, delivered Key Note addresses in the National Seminar on Integration of Livestock and Agroforestry System in Wasteland Development at TNVAU Chennai, 19-21 Jan, 1998.
- Dr. K.R. Solanki, Director, Participated in International Seminar on Cold Chain Technology in Farm Section at hotel Oberai, New Delhi, 20-21 March 1998.
- Dr. K.R. Solanki, Director inaugurated ,as chief guest, the Seminar on Agroforestry and Wasteland Management for Sustainable Fodder development at IGFRI, Jhansi, 11 March 1998.
- Sh. A.K. Shankar, Scientist (Pl. Physiology) of the Centre was deputed on training on Use of Modern Equipments to Deptt. of Biochemistry, IARI, New Delhi.

Supervision and Guidance : Dr. K.R. Solanki, Director, NRCAF, Jhansi

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