International Training on “Management and Utilization of Fodder Trees/Shrubs in Sub-tropical and Temperate Himalaya”

The FAO sponsored International Training on “Management and Utilization of Fodder Trees/Shrubs in Sub-tropical and Temperate Himalaya” was organized at this Institute, during Sept. 22-30, 1997. Ten participants, two from Nepal, one from Bhutan and seven from India attended the training course. The course was inaugurated by Dr. Mangala Rai, Deputy Director-General (Crop Sciences), ICAR, New Delhi on Sept. 22, 1997. The FAO, Rome was represented by Dr. John Morrison. Dr. Mangala Rai in his inaugural address emphasized on greater R&D efforts in this important resource area.

The curriculum for this training included lectures and technical demonstrations, followed by two field visits for exposing the participants to the current research activities in the area of fodder trees/shrubs. One session was allocated for the participants, wherein they presented the work being conducted by them or their respective institutions in the area of fodder trees/shrubs. Another session was devoted to panel discussion on fodder trees/shrubs.

A four day study tour was conducted in Himachal Pradesh to provide an opportunity to the participants for an appraisal of R&D activities pertaining to various aspects of fodder trees/shrubs, especially for the Himalayan region.

The closing ceremony and valedictory function was organized at India International Centre, New Delhi. Dr. R.S. Parewa, Secretary, Department of Agricultural Research and Education, Govt. of India & Director General, ICAR was the chief guest on this occasion. He urged for the establishment of a network among various countries of the Himalayan region for exchange of information in the area of forage resources. Dr. Peter Rosenegger, FAO representative in India and Bhutan, appreciated the role of IGFRI in organizing this training and stressed the need of developing future linkages between IGFRI and FAO.
Network Collaborative Programme on Crop Based Animal Production System

The Fourth Workshop of Network Collaborative Programme on Crop Based Animal Production System was held on Sept. 9 - 10, 1997 at IGFRI, Jhansi. Dr. M.L. Madan, Deputy Director General (Animal Sciences), ICAR, New Delhi, inaugurated the workshop. Other eminent scientists present, were Dr. Arun Verma, ADG (AN & P), ICAR. Dr. Bhag Mal, Director, IGFRI, Jhansi; Dr. R. Deb Roy, Ex-Director, NRCAF, Jhansi; Dr. K.R. Solanki, Director, NRCAF, Jhansi; Dr. K.C. Kanodia, Ex-Principal Scientist, Dr. C.R. Hazra, Project Coordinator (Forage Crops) and Dr. C.B. Johri, Veterinary College, Mathura and about 60 participants from collaborating Institutions. Major recommendations that emerged from the deliberations include:

- Palatability and consumption should be assessed along with preference index.
- Universal factor for soil nutrient losses should be tested and cost of soil and nutrient loss should also be included while working out the economics of systems.
- Carrying capacity should be worked out on monthly basis.
- The economics of production and utilization system should be estimated uniformly at all the coordinating centres.

Group Meeting of AICRP on Forage Crops

The Group Meeting of the AICRP on Forage Crops held at Punjab Agricultural University, Ludhiana during Sept. 15-16, 1997 was inaugurated by Dr. A.S. Khera, Vice Chancellor, PAU and chaired by Dr. Bhag Mal, Director, IGFRI, Jhansi. About 115 scientists and development workers participated in this programme.

On the basis of the deliberations, several recommendations have emerged. One variety of each of the following forage crops was identified for consideration of release by the Central Sub Committee on Crop Standards, Notification and Release of Varieties for Agriculture Crops.

- Guar IGFRI-1019-1
- Cowpea UPC-9202
- Maize APFM-8
- Bajra FMH-3

During the last rabi season, the centres of this Project produced 320 quintals of breeder seed of 18 different varieties in three different crops against an indent of 244 quintals.

Satellite Workshop on Stylosanthes ACIAR Project

One day workshop was organized at PAU, Ludhiana on Sept. 17, 1997 to discuss the Stylosanthes Project supported by ACIAR, Australia. This International Coordinated Network Project on “Use of High yielding Anthracose resistant Stylosanthes for Agricultural Systems” involving Australia, India, China, Brazil and Colombia is to be supported by ACIAR and the network will be co-ordinated by CSIRO (Australia). IGFRI is the participating Institute in India. The satellite workshop was primarily designed to give a brief appraisal of the Indian programme to all the participating centres in India. The meet was chaired by Dr. Bhag Mal, Director, IGFRI & Indian Co-ordinator. The Australian and International Co-ordinator Dr. Sukumar Chakraborty, highlighted the objectives of the programme, responsibilities of different countries and work area for the participating countries.

Participation in the International Colloquium/Conference

- Dr. A.K. Patra participated in the 13th International Plant Nutrition Colloquium held at Tokyo, Japan from Sept., 13 - 19, 1997. He presented a paper on “Prediction and measurement of nutrients leaching from a soil under fodder crops in the Indian semi-arid tropics”.
- Mr. D.S. Katiyar, Sr. Scientist participated in First International Conference on Sweet Sorghum, held at Beijing, China from Sept., 14 - 19, 1997. Mr. Katiyar presented a paper entitled "Genetic variability for yield attributes and sugar percentage in forage Sorghum".
Dear Readers,

Looking back to fifty years of India’s independence, we find that an appreciable progress has been made in the agriculture sector. The food grain production has increased four times, touching an all time high level of 198.7 million tonnes during 1996-97. During the same period, our human population has increased three folds. This has resulted an increase of 33.0 per cent in per capita availability of food grains. A major contribution towards this success story has been from the concerted efforts of a dedicated band of agricultural scientists. The existing scenario, however, is not a pointer towards complacency, as we still lag far behind many agriculturally/industrially developed economies of the world, in terms of productivity and profitability on a sustainable basis.

Parallel to increase in human population, there has also been an unabated increase in livestock population. Contrary to self-sufficiency in food grain production, much remains to be done to ameliorate the availability of feed and fodder resources for our ever-increasing livestock population. With current production figure of 70 million tonnes, India has emerged as the largest milk producer in the world. Again, the productivity and profitability is too low to be sustainable.

A greater concern is now emerging fast to improve the productivity of livestock by enhancing the availability of quality feeds and fodders. Due to constraint of land resources, attention has now been diverted towards the utilization of degraded/waste lands. Appropriate technologies for cultivation of fodder crops in such areas have been developed and demonstrated at different sites by IGFRI Technology for year round fodder production on arable lands has also been amply demonstrated. An additional source of nutritive fodder could be harnessed by planting multipurpose tree species on farm bunds/boundaries, around home stead and in village common lands wherever available. It will not be out of place to mention that 121 improved varieties of different fodder crops including pasture grasses and legumes have been developed, both for arable and non-arable farming situations by IGFRI and other research institutions in the country. These varieties have already been released and notified by the Govt. of India Central Sub-Committee on crop standards and varieties.

Effective transfer of proven technologies and the human resource development are the two important facets of the vehicle of progress. We are fully aware, committed and geared up, to disseminate the technologies for forage production and utilization to the user agencies including small holders and commercial dairy farms, through on- farm demonstrations, farmers’ fairs, exhibitions and farmer interaction workshops. IGFRI is efficiently fulfilling the HRD needs of user agencies in the field of forage research and development.

(BHAG MAL)

**Indo-UK Project Activities**

The final recommendation of MTR Mission has expressed great satisfaction for the good progress made under this project during the past three years. The mission has recommended DFID, UK for additional amount of £0.28 million for remaining period of two years. The key aspects of additional schemes are: focussed PRA, Seed Production Technology including provision for revolving fund, farm based adaptive research, strengthening of three IGFRI Regional Research Stations and Human Resource Development, etc.

**Visits**

- Dr. L.P. Mishra, Head (ST), Dr. P.D. Gupta, Head (Agril. Engg.) and Dr. V.C. Pachauri, Head (PAR) visited U.K. during August 2-18, 1997 to get acquainted with recent research programmes in the field of seed production and technology, farm machinery and animal nutrition respectively. The visit also helped in developing contacts for future collaboration.
- Shri A.K. Srivastava and Shri Doddamani Amalappa, Senior Technical Officers visited U.K. from July 5 to August 6, 1997 in field of maintenance of scientific data base and instruments, respectively.
- Shri D.S. Katiyar, Senior Scientist (Plant Breeding) participated in the First International Sweet Sorghum Conference in China during Sept., 9 - 19, 1997 under the financial assistance from the project.
GRASSLAND AND SILVOPASTURE MANAGEMENT

The Division of Grassland & Silvpasture Management was formed in July 1996 by merger of two erstwhile divisions viz., Grassland Management and Agro-Silviculture to facilitate multidisciplinary research for restoration and management of degraded lands. The parent division, Grassland Management was the first one established in 1964, in the beginning phase of the IGFRI. Late Shri P.M. Dabadghao, who as OSD laid the foundation of IGFRI, later on, became the first Head of this Division. This division consisted of three sections viz., Grassland Management, Grassland surveys & Ecology and Forest Grazing. The Forest grazing section was later on raised to the divisional status viz., Division of Agro-Silviculture. The Division of Grassland & Silvpasture Management has a strength of 19 scientists of different disciplines with Dr. B.K. Trivedi as its Head.

MANDATE

- Inventory, characterization and documentation of range resources.
- Ecological evaluation of range species for different land use systems.
- Technology generation for establishment, improvement, management and utilization of grasslands/silvpastures/hortipastures.

UNITS

- Resource Inventory
- Range Improvement and Management
- Silvopastoral Management
- Hortipastoral Management

SPECTRUM OF RESEARCH ACTIVITIES

The research activities of the division incorporate, inventory and monitoring of range resources, persistence and stability of legumes in pastures/silvpastures/hortipastures, standardization of techniques and compatibility of grass, legume, shrub and trees for marginal and submarginal areas/problem soils, management of pasture for quality seed vis-a-vis forage production, understanding of various interactions in holistic framework and ecosystem context, management of MPTS in silvpastoral system for lean period fodder supplies and synthesis and modelling of silvpastoral systems for different cliental and regional needs.

TECHNOLOGY GENERATED

- Techniques for regeneration of degraded pastures
- Establishment techniques for sown pastures
- Grassland management and Utilization techniques for quality forage and seed production
- Identification of suitable silvpastoral combinations and management options for increasing productivity of degraded lands.
- Standardization of establishment techniques and initial production pattern in hortipastoral system

RESEARCH ACHIEVEMENTS

Resource Inventory

- Distribution pattern and typification of the grass covers of the Bundelkhand region has been assessed on the basis of detailed surveys.
- Based on remote sensing techniques, landform vegetation cover relationship and ground verification, a plan of grassland classification, estimation of existing and potential production from degraded rangelands have been established.
- A number of under-exploited species of high forage value have been identified for lean period feeding/browsing.
- As a result of preliminary evaluation of Leucaena germplasm, L. leucoccephala spp. glabrata was found most promising for northern India.

Range Improvement and Management

- On the basis of climate, vegetation, soil and animal parameters, a score card method has been evolved for analysing the condition class of rangelands.
- In the course of successional hierarchy, Sehima - Heteropogon community for red gravelly soil and Chrysopogon - Tephrosia in rock crevices have been found to be stable disclimax communities.
- Moderate grazing coupled with nutrient application proved to be a good management practice for tropical grasslands.
Management studies of *Isitelema* dominated grassland revealed that defoliation + nutrient application increased soil moisture and soil nutrients. Grazing + nutrient application provided the quality forage for higher animal production and extended the maintenance period.

Among 18 pasture grasses, Bermuda grass and Dinanath grass were preferred most by cattle, sheep and goats. Caribbean stylo and shrubby stylo were the most preferred legumes.

Studies on flowering phenology and pure germinating seed (PGS) yield potentials in 22 range and cultivated grasses revealed that grasses flowering and producing seeds in October-November possess higher per cent PGS as compared to grasses flowering in rainy season (July-August) or during late winter (December onwards).

Application of potash is beneficial for reducing inter-specific competition in grass-legume mixture and also for increasing relative yield totals.

**Silvopastoral Management**

Fast growing woody perennials such as *Acacia tortilis, Albizia lebbeck, A. amara, Dichrostachys cinerea, Hardwickia binata, Leucaena leucocephala* and several pasture grasses and legumes including *Cenchrus ciliaris, Chrysopogon fulvus, Sehima nervosum, Dolichos lablab, Stylosanthes hamata* and *Macroptilium atropurpureum* have been identified to be compatible for silvopastoral production system.

Techniques for establishment of trees/shrubs, grasses and legumes have been standarised for raising silvopastoral systems on dry degraded lands.

Schedule of management with respect to several fodder trees/shrubs has been standardised for optimum fodder and fuelwood yields, specially during lean periods.

A minimum 2.5 times improvement in land productivity has been found by using silvopastoral system as compared to traditional system, prevalent in Bundelkhand region.

Studies on environmental impact of silvopastoral systems have shown that soil loss is reduced to 1.26 t/ha/yr under well established silvopastures as compared to 17.8 t/ha/yr on bare soil.

The impact assessment indicates that establishment and management of silvopastures generate 120 man days/ha/yr.

**Hortipastoral Management**

On dry degraded lands, jujube did not affect pasture production in first five years. A combination of jujube + *Cenchrus ciliaris* + *Stylosanthes hamata* was assessed to be best in terms of maximum yield.

On dry degraded lands under drip irrigation Kinnow exhibited satisfactory rate of survival in association with *Sehima* pasture. The yields of *Sehima* were higher around the trees which may be due to sharing of water and fertilizer supplied to the trees.
Genetic Enhancement In Cultivated Oats
*(Avena sativa)*

The existing practice of introduction of high yielding varieties leads to varietal/genetic uniformity which in turn can bring about epidemic disasters. This genetic uniformity can be effectively checked by using the enormous diversity represented by farmer’s varieties/land races/primitive cultivars and/or the incorporation of traits from wild/weedy relatives in the genetic system of elite varieties through suitable breeding techniques.

Oat genetic improvement programme at IGFRI aims at genetic enhancement of elite stocks by introgression of variability from land races and/or wild weedy relatives and exotic lines.

The major aspect is to incorporate promising traits from wild species like *A. sterilis* and *A. maroccorna* into cultivated *A. sativa*. A lot of genetic variability from wild species has been fixed and stabilized in cultivated background of *A. sativa*.

Recurrent backcrossing was followed in *A. sativa* x *A. sterilis*, since both the species are hexaploid in constitution. In case of *A. sativa* x *A. maroccorina* (4x) the resultant pentaploid hybrid was carried forward either by backcrossing, or through induction of amphiploidy (2n=10x=70) by colchicine. The resultant decaploid after chromosomal loss gave the hexaploid derivatives with introgressed traits from 4th generation onwards.

(R.N. Choubey, S.N. Zadoo, A.K. Roy)

<table>
<thead>
<tr>
<th>A. sativa</th>
<th>A. maroccorna</th>
<th>A. sativa</th>
<th>A. maroccorna</th>
</tr>
</thead>
<tbody>
<tr>
<td>2n=6x=42</td>
<td>2n=6x=28</td>
<td>2n=6x=42</td>
<td>2n=6x=28</td>
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<td>JHO-801</td>
<td>JHO-801</td>
<td>UPO-94</td>
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### Bio-physical Spreadsheet Modelling of tree-grass interaction in Silvopastoral Systems

A model is a simplified representation of reality in a system. Many complex interactions and results are depicted with simplicity to reach a decision. It predicts the consequences of an action that would be expensive, difficult or destructive.

Spreadsheets based modelling, integrates research findings in the form of mathematical relationships related with the growth/production aspects of component interactions in a system over any spreadsheet (MS Excel 5.0). Three silvopastoral systems viz.; I. Acacia tortilis + Cenchrus ciliaris, II. Leucaena leucocephala + Panicum maximum and III. Hardwickia binata + Setima nervosum have been assessed to quantify the above and below ground factors responsible for decay function of under storey grass production. Two types of situations-1. within four tree and -2. around single tree in two spacing (4x4, 4x3 m) have been taken for the study. The plots were divided into nine subplots (grids) and in each grid, Photosynthetically Active Radiation (PAR), Net Radiation (PY), PAR at grass canopy (GY), Soil moisture (SM), Soil temperature (ST), tree roots (Rt. Wt.) at three depths viz., 0-10, 10-20, 20-30 cm alongwith tree growth viz., diameter at 20, 130 cm height and crown spread were recorded at the time of grass harvest.

It was found that out of two spacings below ground factors viz.; tree root wt., soil temperature and soil moisture showed significant effect on under storey grass production in 4x4 m in both the situations. Following important relationships have evolved:

Grass (g/Sqm) = 21.0058 exp(0.6694 GY - 0.0326 Rt. Wt. (10-20) - 0.0103 Crown)  
Adj. R2= 0.4242, R2 = 0.5258

Grass (g/Sqm) = 1.1137 exp (0.258 SM(10-20) + 9.6615 PY - 0.006 Rt. Wt. (20-30))  
Adj. R2= 0.8984, R2 = 0.9365

Significant effect of tree roots on understorey grass production, when we go for a wider spacings (as being adopted in agroforestry systems), will be helpful in developing simulation models for other identical sites.

(T. A. Khan, G. Suresh and R. K. Bhatt)
Morphological Variation in White Clover

White clover (*Trifolium repens*), one of the most important forage legumes for subtropical, temperate and alpine regions, is not very popular with the Indian hill farmers. This may be because of its unreliable yield, lack of persistency under intensive grazing and propensity to cause bloat in cattle. In order to improve it, studies were initiated by collection of germplasm from different habitats and evaluating these for morphological characters under uniform conditions at Palampur. The live material collected was transplanted in Poly bags. The results indicated that different populations exhibit variability in both vegetative as well as reproductive characters. The maximum variability was observed for plant height (10.0 - 39.7 cm), petiole length (2.00 - 15.3 cm), no. of nodes/plant (22-113), length of internode (0.7-2.6 cm), stolon size (1.2-33.4 cm) and root length (2.0-21.0 cm). Significant variation was found in other characters like peduncle size (4.2-25.2 cm), flower count/head (13-81), seed count per flower (0-5) and per head (0-196). The populations collected from moist areas, were robust while those collected from drier areas were less vigorous and this character persisted under evaluation. This variability can be further exploited to isolate genotypes with higher forage yield and persistency.

(Sindhu Sareen and Bimal Misri)

Influence of Salicylic acid on catalase activity and its isoform

Salicylic acid has been implicated in the induction of systemic acquired resistance in many crops. To understand the mechanism of action of salicylic acid in four genotypes of cowpea the activity of catalase and its isoform pattern was studied using starch gel. The figure clearly demonstrated the inhibition of catalase activity as well as reduction in the number of catalase isoform on salicylic acid treatment (1-4 control, 5-8 treated with 0.02 % salicylic acid). Therefore, it can be suggested that salicylic acid acts via inhibiting the catalase activity.

( Amresh Chandra, P.K. Mandal, Anjali Chatrath and Pradeep Saxena )

VISITS

• Prof. R. Mead, Statistical Services Centre, University of Reading (U.K.) visited the Institute from Sept., 1 to 5, 1997 and interacted with the scientists of different disciplines, on the recent trends in application of statistics in Agricultural Research.

• Captain R.K. Marwah, Director (Personnel), ICAR visited the Institute from Sept., 19 - 21, 1997.

• Dr. M.L. Madan, DDG (AS) and Dr. Arun Verma, ADG (AN & P) visited the institute to participate in the NCP Workshop held during Sept., 9-10, 1997.

• Dr. Mangla Rai, DDG (CS) visited the Institute on Sept. 22, 1997. His engagements included inauguration of FAO training programme, field & laboratory visits and closing ceremony of Hindi week.
राजनाथ भिंडी को प्रोस्थान देने हेतु संस्थान में दिनांक 15.9.97 से 22.9.97 तक हिंदी सप्ताह का आयोजन किया गया, जिसका उद्घाटन डा. एर.पी. पाठक, प्राध्यापक, कुंदलेखन महाविद्यालय, बौद्ध के उप मंत्री द्वारा अधिकारिक कार्य हिंदी में करने की शर्त संभव था। सप्ताह के दौरान समाप्त में विभिन्न प्रकार की शैक्षणिक एवं कलात्मक कार्य किए जाते थे। इसका मुख्य लक्ष्य यह था कि हिंदी का विकास और समाज के लिए उपयोगी हो सके।

सप्ताह का समाप्ति दिनांक 22.9.97 को बुधवार अवसर उपमंत्री डा. मंगल राय, उपमंत्री विज्ञान (फसल विज्ञान), भारतीय कृषि अनुसंधान परिषद, नई दिल्ली एवं संस्थान के निदेशक डा. भारतीय कृषि अनुसंधान परिषद, नई दिल्ली में आयोजित किया गया। इसका लक्ष्य यह था कि संस्थान के निदेशक डा. मंगल राय और अन्य अधिकारी जीवन एवं कम्युनिटी के लिए हिंदी का विकास करने के लिए कार्यरत रहते थे।

संस्थान में घायल उपयोगी पर एक राष्ट्रीय हिंदी संस्थान में आयोजित किए जाने की प्रक्रिया चल रही है।

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