ON FARM RESEARCH AT IGFRI - POTENTIAL AND CONSTRAINTS

A workshop was organised at the Institute from March 2-4, 1998 to look into the potential and constraints of 'on farm research' to be undertaken by IGFRI. Dr. Robert Moss, EDG, Oxford acted as moderator. Selected IGFRI scientists participated in the workshop. Professors Roger Haggar, Bob Clements, Mike Theodorou, Mervyn Humphreys, William Eason from IGER, UK; Professor Don Loch fromCSIRO, Australia, Dr. John Witcombe from University of Wales, UK, actively participated in the workshop. The participants of the workshop discussed the implications of farmers as experimenters (indigenous knowledge), planning 'on farm experiments', designing 'on farm trials', trial management decisions, and implementing experiments. The participants identified some key areas where 'on farm research' may be carried out, but main emphasis was on the ongoing 'on farm trials', namely, Forage on Bund and Stay Green Sorghum trials. Along with these trials the concept notes submitted by IGFRI scientists for funding from the ongoing Indo-UK Fodder Production Project were also discussed as potential themes for future 'on farm trials'. The workshop was concluded by looking into major constraints to carry out 'on farm trials' under the present set up that is accustomed to 'on station trials' and how these constraints may be overcome. 'On farm trials' are more demanding in terms of time and energy from scientists than 'on station trials': therefore, there is a need to evolve suitable incentive package to encourage such workers.

WORKSHOP ON PARTICIPATORY PLANT BREEDING

A workshop on participatory Plant Breeding was held between March 5-11, 1998. The workshop was held in two phases, the theoretical part was conducted by Dr. John Witcombe from March 5-7, 1998 at IGFRI. Plant Breeders, Geneticists and Agricultural Economists of the Institute attended the deliberations. This was followed by on field studies in high production potential areas in Godhra (Gujarat), conducted by Dr. D.S. Virk (CAZS, Bangor).

The foreign consultants who attended and took active part in deliberations included Dr. M. Humphreys (IGER U.K.) Dr. Robert Moss (U.K.) and Dr. Don Loch (C.S.I.R.O. Australia).

The workshop gave an insight into the role of Participatory Varietal Selection (PVS) and Participatory Plant Breeding (PPB) for better dissemination of technology and adoption by the clientele. Case studies revealed that the adoption by farmers is better through PVS & PPB than by top down dissemination of technology.

It was felt that IGFRI should take lead in initiating Participatory Varietal Selection approach initially to be followed by Participatory Plant Breeding. Field visits at Godhra revealed that farmers in high production potential areas were not aware of improved fodder varieties developed by the IGFRI or elsewhere.
INDO-UK Project: Visits

- The Consultants visited for different activities under the project included Prof. R.J. Haggar (Feb 27-March 7 including visit to RRCs Avikanagar and Dharwad), Dr. M. Humpherys, Mr. P. Swinburne, Dr. W. Eason, Dr. M. Theodorou, Dr. R.O. Clements (March 2-7), Dr. T. Tafrey (March 3-5) from U.K., Dr. Don Loch (March 4-7) from Australia and Kuhu Chaterjee (March 5-7) from British Council, New Delhi.
- Dr. Sanghi from MANAGE, Hyderabad visited from March 5-6, 1998 in connection with preliminary discussion regarding HRD activities at this Institute under the aegis of this project.
- Participatory Plant Breeding field programme at Godhra was attended by nine scientists from the Institute and its Regional Station. They included Dr. S.N. Zadoo, Dr. S.N. Tripathi, Dr. R.N. Choubey, Dr. (Mrs.) Sukanya, Dr. D.R. Malaviya, Dr. D.N. Singh, Dr. K.S. Kohli, Mr. U.S. Mishra and Mr. Sanjeev Gupta. The general perception was that participatory plant breeding and participatory varietal selection have potential to be exploited in fodder crops too. The scope for introduction of new forage crops/varieties is immense. The farmers were enthusiastic for getting knowledge about forage crops and while doing so they expressed their desire to get seed of some forages such as berseem, oats, N.B. hybrids.
- Dr. R.B. Yadav and Dr. S.K. Soam proceeded to attend International training programme for Development Oriented Research in Agriculture being organized by the International Centre for development oriented Research in Agricultutre, Wageningen, The Netherlands. The course started on January 12, 1998 and would terminate on July 24, 1998.

Rainfall characteristics of Jhansi: Changing scenario

In Semi-arid area, the crop production is virtually dictated by the rainfall, hence, micro-orientation studies with regard to behaviour of rainfall become important. Studies conducted on rainfall characteristics on decadal basis for last three decades indicate a possible shift of pattern of rainy season over the years. The mean length of rainy season exhibits a decreasing trend i.e., one week/decade. Delay in few days in onset and also an early cessation of rains together reduced the effective rainy period by one week in each decade thereby allowing a shorter growing period for the crops. This short duration of rainy season will affect the production of traditional kharif crops in the region. An alternate approach based on short growing period of crops is, therefore, required for successful crop production.

(J.B. Singh and P.S. Tomer)

Biochemical and molecular approaches for disease resistance in fodder legumes

P.K. Mandal, A. Chandra, C.B. Singh, A. Chatrath, P. Saxena & K.C. Pandey

Use of pesticides against diseases in fodder crops is not recommended because of the environmental hazards and high cost. Keeping this in view, two different approaches have been adopted in this group of crops for improving disease resistance - 1. Induction of Systemic Acquired Resistance (SAR) and 2. Development of molecular marker for disease resistance for marker assisted breeding.

To induce SAR, salicylic acid - a non hazardous, low cost chemical, present endogenously in plants was sprayed at very low concentration (0.02%) on different genotypes of cowpea resulting in subsequent decrease in catalase activity. Absence of an isoform, increase in peroxidase activity and protein content was observed, which are most likely responsible for SAR in cowpea.

For development of molecular marker, isozyme patterns in different lucerne genotypes are being studied.

Poster received First Prize in the National Symposium on Biotechnology in Agriculture and Environment held at Chandigarh, from 25-26 March, 1998.

(Pranab Kumar Mandal)
Dear Readers,

The day when I took over the responsibilities of this Institution as Director, a little more than two years ago, is still fresh in my memory. IGFRI is a premier Institution with highly professional and dedicated workers and I always considered it as a family to which I belong. I had a dream and a vision to be fulfilled to further enhance the visibility of this Institute at National and International horizon.

Aiming at making the organisation fully prepared to face the stiff competition and new challenges ahead, a multidimensional strategy was formulated. Goals were redefined. The organisational structure was tailored to enhance system capabilities by consolidation of resources and facilities finely tuned with the multi-disciplinary and system oriented research approach. The targets of continuous HRD interventions for the individuals to sharpen their skills and reorienting them towards R&D efforts culminating into technologies having market orientation, sustainability and developmental relevance have been achieved to satisfactory level. During the last two years, thirty nine scientists and technical personnel have been deputed to specialized trainings, scientific interactions and exposure to International research and development establishments. About twenty more scientists are expected to get international exposure this year. A large number of consultants from abroad were invited to the Institute for in-house interaction. At the national level, forty seven scientists learnt the techniques of clientele need assessment through participatory research appraisal programmes. Similarly a large number of staff of various categories have been deputed for training for updating knowledge in different functional areas in the National Institutions of repute.

The International collaborations of the Institute have been of immense value in these HRD activities and also in creation of research support infrastructures. The efforts made up till now have started bearing fruits and I am fully confident that the IGFRI would continue to march ahead in fulfilling its commitment to the Nation and its people.

(BHAG MAL)

Indo-UK Project Activities

Three very important activities including two workshops "On-farm research" and "Participatory Plant Breeding" and a Brain Storming session on the aspects for extension of this project for the Phase II were conducted during the period.

The Brainstorming Session was conducted on March 6, 1998 in which Dr. Mike Wilson, Dr. Karl Goepert and Mr. A.H.K. Ghaun from Department for International Development, British High Commission, New Delhi, Prof. R.J. Haggar, Technical Coordinator Indo-UK Project, Dr. Don Loch from Australia, Dr. Bhag Mal, Director IGFRI, Dr. V.S. Upadhyay, Coordinator International Programmes IGFRI, Dr. C.R. Ramesh and Dr. R.K. Jain, Officers-in-charge Regional Station, Dharwar and Avikanagar respectively participated. The discussions were very encouraging and there was an unanimous view that the project be extended for 5-8 years to reach to a logical conclusion on all aspects of the project.

IGFRI Bids farewell to Dr. Bhag Mal

On March 30, 1998 a large gathering of IGFRI staff bid farewell to Dr. Bhag Mal, Director who is leaving to take up his new international assignment as Co-ordinator, South-Asia at IPGRI, New Delhi.

Dr. Bhag Mal, in his short tenure, of over two years has shown tremendous organisational capabilities to add new dimension in forage research and put the IGFRI on the world map in the field of Grassland research.

Dr. P.S. Tomer takes over as Director

Dr. Tomer, Head, Division of Crop Production, who has been associated with this Institute in various capacities since last more than thirteen years, has taken over as Director IGFRI, Jhansi from Dr. Bhag Mal. All of us at this Institute join in wishing him success for his new assignment.
PLANT ANIMAL RELATIONSHIP

The Plant Animal Relationship Division started operating in the year 1967 under the able leadership of (Late) Dr. R. Mukherjee to carry out research in forage evaluation, conservation and utilisation for optimum animal production. The Division is presently headed by Dr. V.C. Pachauri with twenty Scientists of various disciplines viz., Animal Nutrition, Agricultural Chemistry, Biochemistry, Organic Chemistry and Livestock Production & Management.

---

**UNITS**
- Animal Nutrition
- Forage Conservation
- Livestock Production Management
- Forage Quality Evaluation

**MANDATE**
- Evaluation of feed, forages and forage production systems for optimum animal production.
- Development of technology for forage conservation and improvement of low grade roughages.

---

**SPECTRUM OF ACTIVITIES**

Keeping in view projected demand and supply position of feeds and fodder, scientists of this division are engaged in the research programme related to forage utilization by ruminants. Following are the thrust areas:
- Exploring possibility of use of various alternate feed resources in livestock ration.
- Evaluation of different grazing system including silvopasture system.
- Transfer of technology to the livestock owners and interaction with the farmers to study extent of adoption of technology through participatory approach.
- The Division is equipped with modern equipments to analyse feeds and fodder for the nutritional evaluation. Besides this, animal herd comprising of about 200 cattle, 40 buffaloes, 100 sheep and 160 goats are available for conducting experiments.
- Network Collaborative Programme on Crop Based Animal Production System is also operational involving scientists of various disciplines. Analytical Laboratory for plant analysis caters to the need of scientists of the different divisions.

---

**RESEARCH ACHIEVEMENTS**

**Animal Nutrition**

Twelve varieties of sorghum viz., P-chari-4, P-chari-5, SL-64, SL-56, J-6, IS-4777, SL-439, Rio, SL-44, JS 73/53 and MP chari evaluated at 50% flowering stage revealed lowest NDF in Rio (56.60%) and highest in P-chari-5 (74.40%). The varieties P-chari-4, SL-64, SL-56 and Rio were rich in soluble carbohydrate and thus more suitable for silage making. Amongst pasture grasses analysed, *Dichanthium annulatum* possessed maximum CP (4.0%), IVDMD (49.11%) and lowest NDF (74.60%). Amongst fodder tree leaves, *L. leucocephala* was found to contain maximum CP and low NDF and ADF contents. The varieties of napier viz., Pusa giant, Coimbatore and Gajraj did not differ in CP (6.80%), dry matter digestibility (55.50%) and dry matter intake (2.25%).

Dry matter intake (DMI) of maize fodder by crossbred calves, buffalo calves and goats was 2.13, 3.56 and 2.23%, respectively. On supplementation with cowpea hay in the ratio of 1:1 and 2:1, the DMI by calves improved to 2.56% and 2.70%, respectively while CP digestibility improved by 15 and 11%, respectively. Studies on *Clitoria ternatea* hay fed to Barbari goats revealed DMI (g/kg W 0.75), DCP (%), TDN(%), DE and ME to be 76.43, 8.29, 57.7, 2.53 Kcal/g and 2.44 Kcal/g, respectively. Green sorghum (Var. PC-6) and silage with 50% allowance of concentrate and dry grass *ad lib* supplied 4.94 and 5.84% DCP and 60.65 and 56.60% TDN and the ration supplied 148% and 73% DCP and 127% and 71% of TDN of the standard requirement, respectively. DMI (% live weight) was higher in silage than in green sorghum (2.84 vs 2.25). Oat var. JHO-822 contained higher CP (12.02%), DCP (6.87%) and digestible energy (66.76%)
and lower NDF (57.85%). Berseem var. JHB-146 and JHB-15B-86 were nutritionally comparable with Wardan having DCP range between 9.17-10.02%. The varieties of Dolichos evaluated, (13-1, JLP-3 and JLP-4) showed that var. JLP-3 had higher DMI and DCP intake.

Studies in RDN and UDN indicated that where 60% CP of groundnut cake was protected with formaldehyde resulted in improvement in growth rate of heifers.

Effect of feeding proteins of different degradability on milk production of buffaloes indicated that persistance in the lactation was better on groundnut cake group followed by linseed and cottonseed cake groups. Higher concentration of serum protein of buffaloes given CSC was indicative of quantitatively higher protein absorption for small intestine. Subabool leaf supplementation has been found cheaper by partial replacement of mustard seed cake in the ration of growing lambs.

**Forage Conservation**

Good quality silage having fleig index above 60 points have been prepared from graminaceous fodders namely sorghum, maize, oat and hybrid napier. The dry matter intake and TDN of these silages ranged from 2.20 - 2.36% of live weight and 51.54%, respectively. Good silages have also been prepared from leguminous fodders like berseem and cowpea with sorghum kadb, dry grass or cereal fodders viz., cowpea + M.P. Chari (1:1), cowpea + maize (1:1), oat + berseem (1:1, 1:2), berseem + sorghum kadb (1:3), berseem + dry sehima grass (70:30), L. leucaeffala + sorghum (1:1) and L. leucaeffala + C. ciliatris (2:1, 1:1 or 1:2). Addition of 1% urea (on d.m. basis) to cereal fodders like sorghum var. PC-6 before ensiling was found beneficial (DMI-2.33%, DCP-8.13%, TDN-51.05%). Maize treated with formaldehyde @ 5.0 lit/ton (fresh wt.) was found to produce good quality silage (DCP=5.37%), TDN=53.98%, DMI=2.94%). Ammoniated grass (4% urea, 40% water) improved digestibility of dry matter (60.8%). Velvet bean hay was found to contain 6.29% DCP, 52.20% TDN and 2.00 Kcal/g DE and 1.64 Cal/g M.E. Gable method of hay making has been developed which is superior than other methods.

**Livestock Production & Management**

Herbages both under grazing system and cultivated fodders have been evaluated in terms of animal production. Live weight gain (LWG) in Barbari goats was about 150-250 g/day till autumn when maintained on natural grasslands domi-
Evaluation of *Leucaena* species for psyllid resistance

Fifteen accessions of *Leucaena* belonging to six species namely *L. collinsii*, *L. diversifolia*, *L. stenocarpa*, *L. pulverulenta*, *L. salvadorensis* and *L. leucocephala* were screened for the reaction to psyllid, *Heteropsylla cubana* under heavy natural infestation conditions. The six month old plants screened, indicated varying range of infestation and injury. The *L. collinsii* accession nos. 45/85 & 56/88 and *L. stenocarpa*-53/88 were found to be absolutely damage free even in presence of pest population on the plants. *L. salvadorensis*-34/86 and *L. pulverulenta*-22/86 showed negligible damage whereas rest of the material showed low to severe damage in the new growing shoots. The total germplasm base (496 accessions belonging to fourteen species) and the interspecific crosses are being evaluated to identify the resistance source within this important tree species.

*(S.A. Faruqui and S.K. Gupta)*

Coping with low and erratic rainfall

A field study was conducted as a inter-disciplinary team of six agricultural professionals in the eastern zone of Tigray region, Ethiopia during April 13-July 12, 1997. The study was part of a collaborative programme between Institute of Agricultural Research and the International Centre for development oriented Research in Agriculture, The Netherlands. The aim of the study was to assess the effects of low and erratic rainfall on the livelihood of the people and to suggest research contribution to alleviate these effects.

Method of study was mainly participatory, involving farmers and other actors relevant to the problem areas, aimed to generate the data and information that enabled the team to identify the wealth of indigenous knowledge underpinning farmers’ strategies to cope with a drought prone environment.

The combined information revealed that research has a big role to play in alleviation of the effects of erratic and insufficient rainfall in the eastern zone of Tigray region. The group identified four research themes, namely, fertilizer use & application, soil & water conservation measures, germplasm selection & improvement and animal feed & nutrition. The study recommended that for better impact and diffusion of future technologies, agricultural research should be more participatory and “on-farm”, involving farmers in technological development.

*(S.K. Sharma)*

Psyllid - predator complex in *Leucaena*

The *leucaena* psyllid *Heteropsylla cubana*, which was reported from this region about four years back has stabilized in the area. The field surveys have indicated the association of coccinellids, syrphid flies, spiders and mantids in considerably good numbers with this pest. The predator species identified are *Coccinella septumpunctata*, *Menochilus sexmaculatus*, *Brumoides suturalis* and *Episyrphus balteatus*. The predatory potential of this farmer friendly fauna is being assessed in the laboratory for utilisation in the management of the pest.

*(S.A. Faruqui and Ch. Padmavati)*
Traditional use of fodder trees in the Himalaya

The fodder trees and shrubs contribute green forage to the extent of 10-15% in monsoon, 80% in winters and 60% in summers to the ruminant ration in Himalayan hills. The fodder trees are grown by farmers on their farm bunds, terrace risers and homesteads besides being found on community land and forest.

During a recent survey conducted, it was found that the most preferred sp. in the Kangra hills are: Albizia lebbeck, Artocarpus chaplasha, Bauhinia variegata, Dendrocalamus hamiltonii, Ficus auriculata, F. racemosa, F. religiosa, Grewia optiva, Leucaena leucocephala, Morus alba, M. serrata, Quercus incana, Terminalia arjuna and Robinia pseudo-acacia.

The traditional wisdom for efficient fodder tree use is highly advanced in the region. The farmers are well aware of the detrimental effects of tree leaf fodder viz-a-vis stage of harvest and benefits of feeding the tree leaves at particular stage. They have perfected a calendar for the lopping management based upon the availability of biomass, status of anti-quality factors, palatability and nutritional value. The fodder trees are lopped and fed in the following sequence:

April-July: Morus alba, Morus serrata, Leucaena leucocephala, Robinia pseudo-acacia, Albizia lebbeck, Ficus auriculata, F. racemosa, F. religiosa.
July-October: Grazing in the natural pastures.
November-March: Bauhinia variegata, Grewia optiva, Terminalia alata and Dendrocalamus hamiltonii.

In order to meet fodder scarcity during summers the most preferred sp. are Artocarpus chaplasha, Ficus racemosa, Grewia optiva and Morus alba.

(B.K. Misri and Inder Dev)

In vitro Plant Regeneration in Trifolium glomeratum

Genetic improvement of Trifolium sps through biotechnological approach is an important area of research. Development of suitable protocol for in vitro regeneration of plants is a prerequisite for various biotechnological approaches such as somaclonal variation, protoplast fusion and transformation. As a part of this programme attempts for regeneration of plants in T. glomeratum were made.

Various plant parts from T. glomeratum were studied for callus induction and regeneration. Explants were excised from plants germinated from seeds in MS basal media and aseptically transferred to different culture media containing varying concentrations of growth hormone viz., NAA and BAP for callus induction. Prolific callus growth was obtained in media with NAA and higher molar concentration of BAP2 after 15-20 days of inoculation. Out of different explants roots, collar, hypocotyl, cotyledon, leaf petiole, best callus induction was obtained from cotyledon and petiole followed by collar. Roots and leaves did not respond. Prolonged culturing in the same media resulted in initiation of shoots after 40-45 days initiation of roots was noticed after 50-56 days of culturing in media without cytokinin.

(D.R. Malaviya, A.K. Roy and Pankaj Kaushal)

HRD Activities

- Training programme on 'Improved Fodder Seed Production Techniques for Cultivated Forages, Grasses and Legumes', sponsored by Technology Mission on Dairy Development, NDDB, Govt. of India, during Feb. 23-28, 1998, 19 participants attended this programme.
- National Diploma Course on 'Forage Production and Utilisation' concluded on March 31, 1998. The valedictory function was chaired by Dr. Bhag Mal, who gave away the Diploma Certificates to the trainees on successful completion of the course.
Division of Farm Machinery & Post Harvest Technology organized the Farmers Training Day on March 19, 1998 at Sijwaha Village, Jhansi. About 200 farmers participated in the programme where farm machinery developed by this Institute was demonstrated. Prof. R.C. Yadav, Director, Bundelkhand Institute of Engineering and Technology, Jhansi, in his inaugural address emphasised the need to adopt new and innovative techniques in their farming system. Dr. Bhag Mal, Director, IGFRI, Jhansi presided over the function. He requested the farmers to come forward and adopt new technologies being developed by IGFRI. Dr. P.S. Tomar, Head, Crop Production Division, Dr. Atar Singh, Head, Social Science Division, Dr. B.K. Trivedi, Head, GSM Division, Er. R.B. Varshney addressed the gathering and suggested means to get more food, fodder and milk from limited resources. Dr. P.D. Gupta, Head, Division of FM&PHT addressed the farmers and gave the performance detail of tools/implements.

ARS Scientist Forum Jhansi unit office was inaugurated by Dr. Bhag Mal, Director and Patron of the Forum on March 27, 1998. While complementing the scientist for their achievements he emphasised the need for speedy transfer of technologies on-shelf for the benefit of the forage farmers. The function was attended by ARSSF members of IGFRI & NRCAF. Sh. D.S. Katiyar, President and Dr. A.K. Roy, Secretary, Jhansi unit appraised the forum activities to the guest. On this occasion a Directory of ARS Scientists belonging to IGFRI and NRCAF was released by the Chief Guest. This was compiled by Sh. O.P.S. Verma, Sh. K.C. Pandey, Dr. P. Saxena and Sh. Premchand.

For any further information, you can reach us in person or through mail at:
Indian Grassland and Fodder Research Institute, Gwalior Road, Jhansi - 284003.
Telephones: (0517) 440908, 444385, 444771. Fax: (0517) 440833. E-mail: igfri@x400.nicgw.nic.in

Supervision and Guidance: Dr. Bhag Mal, Director, IGFRI, Jhansi

<table>
<thead>
<tr>
<th>Editors</th>
<th>Compilation</th>
<th>Assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.A. Faruqui</td>
<td>G.P. Nigam</td>
<td>M.C. Jetwani</td>
</tr>
</tbody>
</table>

Published by: Director, IGFRI, Jhansi
Printed at: Mini Printers, Jhansi