IGFRI and RMSI organized National Symposium

National Symposium on "Forage resource and livestock for livelihood, environment and nutritional security" was held at Indian Grassland & Fodder Research Institute, Jhansi from September 10-11, 2011. Range Management Society of India and IGFRI Jhansi jointly organized the symposium. The symposium was inaugurated by Dr. V.S. Tomar, Vice Chancellor. Rajmata Vijayraje Scindia Krishi Vishwa Vidyalaya, Gwalior. About 150 participants, attended the symposium. Selected members of the society were conferred fellow of the society.

The two day deliberations focused on the issues like Policy perspectives for optimizing fodder resources; Forage crop improvement; Forage based livestock production systems; Forage seed technology; Forage production systems; Grassland, Rangeland and Forest Resource; Silvipasture, Hortipasture and Agroforestry systems, Public-private-people partnership; Technology transfer and Climatic change and Policy issues.

Following points emerged in two day deliberations:

- Development of forage resources and their increased production requires emphasis on investments for organization infrastructure, support prices for forage seeds and generation of authenticated forage resource data base in addition to formulation of appropriate policies on export-import of forage seeds and oil seed cakes, grazing management of livestock, utilization of edible crop residues and their quality with respect to feeding of livestock.
- Development of sustainable and cost-effective production technologies with participation of resource poor livestock farmers for their effective use to solve the problems of livelihood, nutrition & environment.
- Strengthening of seed production-supply chain and establishment of fodder bank and proper distribution system- as long term approach.
- Conventional breeding approaches for fodder crop improvement may suitability be supplemented with biotechnological approaches such as developing molecular markers in fodder crops and grasses, utilization of marker assisted selection technique for linking important traits in fodder, transferability studies on developed markers and comparative genomics approach using rice, maize and sorghum genome for effective time and product management. Additionally inter institutional association’s needs to be strengthened to utilize resources and techniques available in synergetic mode.
- Poor quality forage/crop residue based diets should be supplemented with deficient minerals to avoid micro-nutrient imbalances.
- Development of methane emission database on dry forages/ roughages based on chemical entities to formulate low methane producing diets of livestock.
- Traditional and eco-friendly techniques like biological pelleting and endo-zoochory are to be investigated for improvement of temperate and tropical pasture.
- Peri-urban areas have provided the scope for commercial fodder production. Issues like safe disposal of dung and slurry, regulated use of chemicals, regulation of the fodder market and safe use of the by product of other sectors having fodder values warrants immediate attention of researchers and policy makers.
- The rhizospheric interaction in different component of the cropping systems should be characterized for optimization of resource use efficiency and enhanced production of forage crops.
- Multinutrient deficiencies are appearing in different production systems which lead to the poor nutrition of the livestock. These deficiencies in the forage crops should be addressed through adoption of suitable INM approach.
- Common property resources are vital for fodder production and livelihood, however, enabling policy interventions at state level are required for common property resource and their management.
- There is vast potential of improving livelihood through adoption of integrated farming system modules and other natural resource management based interventions and women empowerment.
Thoughts from IGFRI ...

Focus of forage research in XII plan

The expected growth in GDP (> 9%) of our country may not be achieved without substantial (> 4%) growth in agriculture and livestock sector (> 6%) in particular. At present, the country faces a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% feeds. To meet the current level of livestock production and its annual growth in population, the deficit in all components of fodder, dry crop residues and feed has to be met from either increasing productivity, utilizing untapped feed resources, increasing land area (not possible due to human pressure for food crops) or through imports. Due to lack of sufficient post harvest and storage facility, surplus fodder is not properly utilized. This provides an opportunity to find viable options in short and long term for technological breakthrough in rainfed and irrigated mixed farming situations.

The changing scenario of fodder production in India over the past four and a half decades opened the possibilities of achieving a high level of productivity under optimum level of inputs. Recently there has been a rapid change in the way agricultural scenario is shifting. There is need to meet the demand of fodder for increasing number of livestock and also enhancing their productivity for which availability of feed resources have to be increased. On one hand livestock production is primarily a small farm production system characterized by low input – output. On the other hand, there is emerging emphasis on intensive and diversified cropping system, transformation of sustenance farming into market oriented contract farming, linking production to consumption under changing food habits towards livestock products and consciousness about quality food.

Mission of IGFRI is to generate and disseminate technologies for enhanced quality of forage and livestock productivity in socioeconomic and environmental perspectives. Keeping in view this scenario there is need to increase production to reduce the demand supply gap. Potential and possibilities that exist in the country, the production of annual/perennial forage needs to be stepped up further. Therefore, fodder research in the country in 12th plan need to address areas like genetic enhancement of forage legumes and range grasses, strengthening seed production through physiological and seed biology approaches, resource management in different farming situations of the country, farm mechanization and post harvest management, nutritional evaluation of feed and fodder for niche based systems, transfer of technology, human resource development and linkages with different stakeholders for mission mode programmes of forage research and development. The goal may be attained by reorienting our programmes in following way to face the challenges of R&D in new era.

- Genetic enhancement and development of varieties in range grasses and legumes for abiotic stress conditions and problem soils.
- Evolving short duration nutritious fodder and dual type varieties to fit in existing food based cropping systems.
- Optimization of forage productivity in different farming situations particularly in rainfed areas having emphasis on sustained system productivity as well as soil health.
- Development of forage and seed production models with emphasis on climate resilient crop husbandry and post harvest activities.
- Resource management in grassland and alternate land use system for enhancement of forage resources and restoration of degraded lands/problematic soil for livelihood support to pastoral communities.
- Seed production research of range grasses and legumes for formation of improved & pure germinating seeds and development of seed standards.
- Strengthening forage seed production network and linking it with efficient marketing for meeting the increasing demand of forage seeds.
- Standardization of fodder conservation technologies like hay, silage, feed block and bailing and developing fodder banks on pilot mode for fodder security during lean period and natural calamities in different agro-regions.
- Improvement of nutritive value of poor quality roughages and enhancing bioavailability of nutrients through supplementation of low cost unconventional fodder and feeds.
- Capacity building of different stake holders on forage crop- livestock production systems, development and management of horti/silvi pasture, focus on alternate land use for sustenance of natural resources, conservation of biodiversity through peoples participation, promotion of non-farm enterprises, and market linkages for livelihood enhancement.
- Developing linkages for technology transfer in participatory mode with vast network of ICAR institutes, SAUs, KVKs, NGOs, and milk unions & dairy federations.
- Accelerating production of fodder through promotion of comprehensive fodder programmes in mission mode for enhancing the availability of fodder throughout the year.
Dr. S.A. Faruqui takes over as Director, IGFRI

Dr. S.A. Faruqui has taken over the responsibility of Director, IGFRI, Jhansi on 20.08.2011. Born on July 1, 1950, Dr. Faruqui is basically an Entomologist who joined ARS in 1977. Besides Post Doctoral Research experience he obtained a MBA degree in 1995. He has received various trainings in India and abroad mentioning few like Agriculture Extension Methodology for Asia and the Pacific Region in Indonesia, agro-ecology under Indo-UK Collaborative Project on fodder production in UK and development oriented research in agriculture at the Netherlands. He is a Fellow of Royal Entomological Society, London; Entomological Society of India and Range Management Society of India. He has been associated and contributed immensely in organization of various national and international training programmes mainly 3rd International Rangeland Congress at Vigyan Bhawan, New Delhi. He has developed eco-friendly cost effective forage protection/production technologies, and has contributed significantly in the growth of IGFRI in the scientific, management, HRD programmes and administrative areas in different capacities. He has played key role in streamlining of various forage research on station & outreach programmes and activities of AICRP on Forage Crops (AICRPFC) & IGFRI. Since he joined as Project Coordinator (Forage Crops) in October, 2005, thirty five varieties in different forage crops and several region- specific technologies have been developed by different centres. He has been instrumental in creating infrastructural facilities at centres and providing a congenial environment for scaling up of forage production technologies for different stakeholders across the agro-eco regions. He has been successful in expanding the ambit of AICRPFC by having three new coordinated centres, one each at Srinagar, Raipur and Imphal during XI plan. By his vision and great efforts, forage R & D is making all strides to get desired focus in 12th plan for accelerated forage development in the country.

IGFRI family extends a hearty welcome to him with great expectations.

National Group Meet on Forage Crops organized at IGFRI

National Group Meet on AICRP on Forage Crops, Rabi 2011-12 was organized at IGFRI, Jhansi during 06-08, September, 2011. Dr. R. P. Dua ADG (FFC) ICAR, New Delhi chaired the group meeting. Scientists form different coordinated Centres across the country participated in this meet. During the meet, emphasis was given to strengthen the productivity, germplasm holding and to create variability for breeding new varieties with enhanced quality and development of dual purpose forage crop variety. Dr. S.A. Faruqui, Director & Project Coordinator presented the summary of research findings for Rabi 2010-11. The brief outcome of Group Meeting is as follows:

A. Identification of high yielding forage varieties :

The meeting of the Varietal Identification Committee of the AICRP-FC was held under the Chairmanship of Dr. R. P. Dua, ADG (FFC), ICAR, New Delhi. Out of the five proposals of three forage crops viz., Ricebean, Pearl millet and Oat, committee recommended four forage crop varieties for respective zones.

1. Ricebean : Variety KRB-19 and JRBJ-05-2

Ricebean variety KRB-19 submitted by BCKV, Kalyani and JRBJ-05-2 submitted by JNKVV, Jabalpur, have performed consistently superior to the check (Biddhan-1) for green forage and dry matter yield across the locations. The KRB-19 variety has been selected from the material collected from Tengaupal, Manipur state whereas other variety JRBJ-05-2 has been collected from Dindori (Madhya Pradesh). The variety KRB-19 has been identified for release in North-East Plain zone and JRBJ-05-2 in Central zone.

2. Forage Bajra : Variety AFB-3

Forage bajra variety AFB-3 submitted by AAU Anand, showed its consistent superiority for green forage and dry matter yield over the locations and years. The variety has been identified for release in Haryana, Punjab and Rajasthan.

3. Oat : Variety SKO-96

Forage oat variety SKO-96 submitted by SKUAST, Srinagar, performed consistently better than check and other qualifying entries over the locations and years for GFY, DMY and L/S ratio. This variety has highly resistance to leaf blight and powdery mildew. This variety has been identified for temperate and mid altitude areas of Hills in the states of Himachal Pradesh and Jammu and Kashmir.
B. Forage crop production

1. Among different forage based cropping systems, maize + cowpea (fodder) - sunflower (seed) - finger millet (grain) was found most remunerative (Rs 66,447/ha) cropping sequence for Mandya region of Karnataka.

2. Sowing of lucerne under line sowing + regular cutting for green fodder and leaving for seed production in second week of March every year was recommended for Maharashtra to realize the highest seed yield and net monetary returns with benefit cost ratio of 2.59.

C. Forage crop protection technology

1. Seed treatment with vitavax @ 2.5 g/kg seed + Trichoderma viride @ 5 g/kg seed followed by foliar sprays of Propiconazole@ 0.01% at 15 days interval after the appearance of the disease was effective in disease management in oat seed production and high net return in oat grown for seed production.

2. For the management of root rot in oat, allocation of pitcher compost @ 3% as soil application at the time of sowing gives net return of Rs. 8064/- over control in agro-climatic situation of Orissa.

**Conservation tillage management: A technique for sustainable fodder-food production**

At present, about 8 per cent energy is used in agriculture for different operations like tillage, irrigation, harvesting and threshing. The inputs such as fuel, electricity, machinery, seed, fertilizer and chemical take significant share of the energy supplies to the production system in modern agriculture due to intensive cropping. Due to high cost and limited availability of these inputs, efforts are required to reduce the requirement by efficiency utilization. To overcome the energy crisis, resource conservation technologies (RCT) like no till/zero tillage and reduced tillage systems can be adopted as a tool for reducing energy consumption during land preparation. Influence of various tillage combinations on the productivity and profitability of fodder-food cropping system (sorghum + cowpea – duram wheat) under limited irrigation conditions was studied at IGFR.

The mean system productivity of sorghum + cowpea - duram wheat system in terms of wheat equivalent yield (WEY) showed that treatment comprising conventional tillage in kharif and minimum tillage/zero tillage in rabi gave similar yield (93.20 and 93.03 q/ha WEY in minimum tillage and zero tillage in rabi, respectively) to treatment comprising of conventional tillage in kharif – conventional tillage in rabi (93.93 q/ha). Alternate year summer ploughing gave higher mean wheat equivalent yield (90.64 q/ha) than without summer ploughing treatment (87.74 q/ha). Besides this reduced tillage and zero tillage effectively reduced the cost of cultivation by saving of an average 35 and 65 litre/ha of diesel required for field preparation.

(End of text)
Organic nutrient management of guinea grass based cropping system

In irrigated area under round the year fodder production programme, guinea + (cowpea-berseem) cropping systems find important place. Both the legume components, cowpea (zaid / kharif) and berseem (rabi) intercropped in guinea, improve the forage quality as well as meet out the partial nitrogen requirement of the cropping system. In this cropping system the fodder production during dormant phase of grass in winter season get complemented with intercropped berseem and enable the cropping system to ensure fodder availability through the year. In organic production system options for nutrient management is mainly through harnessing the biological nitrogen fixation in cropping system and supplementing the balance of nutrient through other available source like FYM, vermicompost etc. In the filed plot experiment it was observed that application of FYM @ 67-72 t/ha/yr in two split (5:3 kharif: rabi) during initial 4 years (conversion period) is effective in soil fertility build up and meeting the nutritional requirement of Guinea grass + (cowpea – berseem) cropping system to produce 181-186 and 32.6-33.7 t/ha/yr green and dry forage yield, respectively. FYM application also increased the content of Zn, Mn, Cu and Fe in soil to the extent of 1.5, 4.1, 1.5 and 12.3 ppm, as compared to the initial value of 0.65, 2.56, 1 and 11.1 ppm, respectively.

(AK Rai, SN Tripathi, SB Tripathi, AK Dixit and Sunil Kumar)

Prevalence's of insect pests and diseases in different crops in Bundelkhand during Kharif 2010 season

Under fodder technology demonstration (FTD) programme, various varieties of fodder crops were demonstrated in Datia, Jhansi and Lalitpur districts of Bundelkhand region during Kharif 2010. In Datia, two villages viz. Sanora and Garera were selected. Similarly, Khiria Mishra and Bambah Kalaun in Lalitpur district; Badagaon and Sakrar (Mauranipur block) and Raunija and Ambabai (Badagaon block) of Jhansi districts were selected. A survey was also conducted to observe the prevalence and severity of the insect pest and diseases in selected locations. A large number of pests and diseases with variable incidences were recorded in these areas. The survey indicated that the grass hoppers, zonate leaf spot, anthracnose and Southern leaf blight were the major problems of these areas. Grasshoppers (Four species viz. Heirogluphus nigro rupatus, Acrida exellata, Cyrtocanthacrys tata and one unidentified), Beetles (Anomala demidiata), Zonate leaf spot (Gloeosporium sorghum), anthracnose (Colletotrichum graminicola) and Southern leaf blight (Dreschlera maydis) were the major problems of the sorghum and maize.

(Pradeep Saxena, Satyapriya, Maharaj Singh, JP Upadhyaya and PK Tyagi)
Seed Drill developed for sowing fine fodder seed like berseem

Crop management becomes labor, time and capital intensive when large scale production of berseem is taken up with dual purpose of fodder and seed production. Sowing of berseem by broadcasting limits the use of any machine or tool for weeding and thus making line sowing as prerequisite for intercultural operation. Line sowing facilitates weeding operation that in turn increases the purity of seed. A seed cum fertilizer drill for sowing of berseem crop was therefore designed under a collaborative project with IGFRI and Central Institute of Agricultural Engineering (CIAE), Bhopal. This seed cum fertilizer drill was manufactured under the guidance of IGFRI, Jhansi in the local market.

The main requirements of a seed drill capable of sowing berseem seed in pebble rich soil were i) flexible soil opening tines ii) an adjustable seed metering mechanism able to regulate the flow of small and light seed like berseem iii) minimum length of travel of seed in air after dropping from metering mechanism and iv) shallow (2-3 cm) depth of placement of seed inside the prepared seed bed. The conceptualized seed drill was manufactured with spring loaded flexible soil opening tines, metering mechanism at a height of 40 cm above the ground level, fine fluted roll metering mechanism, separate seed box for each metering mechanism and a common fertilizer box having agitators. The seed boxes were arranged in two row with metering mechanism fitted below each box. The metering mechanism had provision to adjust the row to row distance of 20, 30 and 40 cm. The power to the two shaft of metering mechanism and one shaft of fertilizer box agitator was given through ground wheel. The berseem seed drill also had provision to replace the fine fluted roll metering mechanism with coarse fluted rolls in order to make seed drill able to sow the coarse seeds of crop like wheat, gram and maize. Depth of sowing is controlled by the hydraulic device of the tractor. This enables seed drill to be used for general purpose of sowing food grain crops in addition to the main use of berseem sowing, thus increasing the utility of the machine. The seed rate for fine seed was adjustable in the range of 4 to 30 kg/ha.

(CS Sahay, PK Pathak and PN Dwivedi)

Soft X-Ray Radiography - a quick method for determining seed setting in grasses

Grasses have a great role in ecosystem by making the earth evergreen and conservation of soil by spreading their extensive elaborate root system. Grasses are major natural forage for wild as well as for domestic animals. Grasses are introduced either by seeds or vegetatively by slips. It is a fact that seed germination is very low in most of the range grasses. It has been proved that less germination is due to low rate of seed setting during seed formation. Determination of filled/unfilled or partially filled seeds is a time consuming and improper process although classic cleanings, specific purity and germination methods are well known and widely described in international rules for seed testing (ISTA). Hence an accurate and time saving method was applied by which filled/unfilled seeds may be identified/seen within a few minutes/seconds. This Soft X-Ray Radiography Method was standardized using soft X-Ray machine at National Bureau of Plant Genetic Resources (NBPRGR), Pusa Campus, New Delhi. In this process a small quantity of seed samples were exposed to soft X-Rays and the picture of the seeds were seen on the computer screen. Filled or complete seeds were seen as shining, whitish, while unfilled or partially filled seeds as dull gray or dark. The seeds of Deanaanth grass (Pennisetum pedicellatum), Guinea grasses (Panicum maximum), Anjan grass (Cenchrus ciliaris), Lampa grass (Heteropogon contortus), Chrysopogon fulvus, Brachiaria decumbens, Dicanthium annulatum etc. were tested for their filled/unfilled status. In all the grasses filling ranged from 06 to 44 percent, which was verified by seed germination and physical method also. Hence, for experiments with large number of samples this method is accurate and quick.

Seeds of different grass species: S. hirta (A), Pennisetum pedicellatum-BD-1 (B), P. pedicellatum-BD-2 (C), Heteropogon contortus (D), Cenchrus ciliaris-CAZRI-2178 (E), C. ciliaris-CAZRI-75 (F), Panicum maximum–BG-2 (G), P. maximum–BG-2-DC (H).

(Diwakar Bahukhandi, DR Malaviya and HC Pandey)
Karnataka farmers’ response for mobile type hay densification

Hay baling is a mechanized technology that reduces the volume of the dry fodder and bundles it for easy handling, transportation and storage. For popularizing this technology by using mobile type hay densification machine a trial in 10 villages of Dharwad having sufficient availability of sorghum stover and paddy straw was conducted during summer 2011.

Demonstrations were conducted by mobilizing heterogeneous group of farmers in a place accessible to all in sorghum growing villages Amminabhavi, Galagi, Marewad, Timmapur, Yadavad and in paddy growing villages Durgadkeri, Hulikoppa, Kallapur, Nichanaki, Veerapur between February and March 2011. Wide publicity of the demonstrations was given through Panchayats of respective villages and also by informing the village leaders. Machine received mixed response from the villagers of both the cropping group. Villagers of paddy growing area in general expressed that it is highly useful as it forms the multiple and convenient size bales saves the space, reduces wastage, runs on diesel (uninterrupted electricity still a luxury in many villages in this part), convenient to transport, reduces transportation cost and can be taken to the field itself. The demonstration of machine besides creating awareness also made farmers to ponder about the possibility of owning on community basis and hire it out for all on service charges. Increasing nutritive value by intermittently feeding legume hay (of greengram, soyabean, horsegram) with straw to the machine, an idea of the farmers themselves, was also tried while conducting demonstrations.

Contrast was the response from sorghum belt. Subjecting sorghum stover to densification machine damaged the pith and leaf sheath which are the most preferred characters for its high fodder value. The very fact of this made farmers to express their unhappiness about the utility of the technology besides mentioning that machine just bends the stover while pressing without completely breaking into suitable sizes before baling. Abrupt bending makes it difficult to the farmers to handle stover for further cutting into pieces (about 1’ length) before feeding. Completely dried two year old sorghum stover was also subjected to densification. Excessive dryness literally powdered the leaf sheath besides exposing the pith by damaging the outer cover. Villagers expressed that the machine requires modification if to be used for stover baling.

Improvement of local ber by top working in outreach programme sites of NICRA

A large number of wild ber shrubs growing on the neglected lands, uncultivated lands, roadsides and farm boundaries were top worked / and budded with better cultivar namely “Banarasi Karaka” and “Gola”. In April 2011, 44 wild ber shrubs growing at 9 farmers field at Kadesara Kalan of Disttolt Lalitpur a site under NICRA programme were beheaded retaining a clean trunk at height 0.75 - 1.5m. Beheaded shrubs started sprouting in end of May and shoots gained buddable thickness (pencil thickness) after 45-60 days. The budding was done in first week of July 2011. On each tree, 2-3 shoots were budded at a height of 15-20 cm from the base of shoot emergence with the scion of Banarasi Karaka and Gola and others remaining shoots were removed. Branches below the bud juncture were also removed and no shoot below bud union was allowed to grow. Bud union maturity takes place in 10 days approximately. Thereafter, the top of budded coppices were removed. Farmers were advised that the budded shoot should be maintained clean by removing side shoots emerging before the bud union from time to time. A success rate of 89% was noticed at one month stage which reduced to 68.18% after 92 days of budding. The improved bar is expected to provide income to farmers from the plants which were not having any commercial value.

(Nagaratna Biradar, Vinod Kumar and BG Shivakumar)
HRD News

Capacity building of Watershed Programme team

The Training programme on "Forage production and utilization" for watershed development team members of Department of Panchayat & Rural Development, Rajiv Gandhi Mission for Watershed Management, Government of Madhya Pradesh, Bhopal was organized during August 23 to 27, 2011 (22 participants) and Sept. 28-30, 2011 (26 participants). The training is expected to improve their skills to manage for betterment of fodder production in their respective watershed areas in different parts of Madhya Pradesh. The training which comprised of lectures and interactive sessions with well known experts along with exposure visits helped the trainees to deal with real world situation in a better way.

The participants were exposed to forage development technologies (intensive, rainfed and problem soils) suitable for M.P., horticulture, forage disease & pest management, range legumes suitable for watersheds, forage seed production technology, grazing and grassland management, watershed management, livestock management, forage based feeding system, low grade roughages enrichment technologies, technologies for forage conservation, management of forage quality by eliminating anti-quality factors livelihood promotion through fodder and dairying, participatory forage production, improving transfer of forage technology using ICT.

Capacity building of KVKs’ Staff on Fodder Production and Grassland Management

The third training of KVK Staff on Fodder Production and Grassland Management was held during July 12-18, 2011 for 16 KVKs at IGFRI, Jhansi (17 participants). The major objective of the training was to help them to understand fodder production technologies suitable to their respective KVK area in different parts of country.

List of KVK participated in training

<table>
<thead>
<tr>
<th>Zone</th>
<th>KVKs participated in training</th>
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<tbody>
<tr>
<td>Zone-I Ludhiana</td>
<td>Fatehgarh Sahib (Punjab), Kangra (HP)</td>
</tr>
<tr>
<td>Zone-III Barapani</td>
<td>Dimapur, Phek-Porba (Nagaland); Sivasagar, Golaghat, Kamrup (Assam) Lohit Chongkham (Arunachal Pradesh)</td>
</tr>
<tr>
<td>Zone IV, Kanpur</td>
<td>Gaina (Uttarakhand)</td>
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<tr>
<td>Zone-V Hyderabad</td>
<td>Shardar nagar, Babulnagow (Maharashtra)</td>
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<tr>
<td>Zone-VI Jodhpur</td>
<td>Sadau, Randheja (Gujarat); Jhalawar, Abusar, Karmoda (Rajasthan)</td>
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Visits Abroad

Dr. Prakash Narayan Dwivedi, Sr. Scientist (Animal Nutrition), Farm Machinery & Post Harvest Technology Division, presented research paper entitled "Feed pellets supplementation to goats during off season for livelihood security in rural areas of Bundelkhand region of central India" in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries at Nakhon Ratchasima, Thailand from 26-29 July 2011.

Published by the Director, Indian Grassland and Fodder Research Institute (Indian Council of Agricultural Research), Jhansi - 284 003
Telephone: 0510-2730666; Fax: 0510-2730833; E-mail: igfri_jhansi@yahoo.co.in Website: http://www.igfri.res.in
Printed at Mini Printers, Jhansi. 94151 13108

Editors: Sunil Kumar, AK Rai, AK Dixit, AK Saxena and Shailendra Sinha Photographs and Assistance: AK Singh