The 15th meeting of RAC was held on February 02-03, 2009 at IGFRI, Jhansi. The meeting was presided over by the Chairman, RAC Dr. R.M. Singh, Professor Emeritus, Institute of Agricultural Sciences, BHU, Varanasi. RAC members Drs. S.D. Rai, A.K. Misra, V.K. Mishra and Shri Sharma Puran participated in the meeting. The Chairman urged the members to identify new strategic areas for research, which may fulfill the needs of farmers, in particular the livestock owners, and help to boost the economy. The committee also advised the scientists to initiate Agro-climatological, soil microbiological and molecular marker studies in collaboration with NRCAF. The committee members commended the demonstrations of important varieties of fodder crops and range grasses and their production technologies laid out in the Technology Park. The committee also appreciated the release of different forage crop varieties suitable for various agro-climatic region of the country and production of 340.6 quintals seed under Mega Seed Project during 2007-08. Dr. R.M. Singh, Chairman advised that Cajanus cajanifolia x Attylosia should be included in the breeding programmes, besides Avena magna with 25% CP should be included in the hybridization programme for development of high protein oat lines. The members also advised to strengthen studies on livestock production under grasslands/rangelands. The committee highlighted the importance of taking up studies on feeding trials on Avena magna and QPM maize. Shri Sharma Puran commended the efforts of the scientists in improving the feed-fodder supply in the country. He also advised that important research findings should be published in vernacular language for the benefit of the farmers.

(K C Pandey and G P Nigam)
Livestock and climate change

The impact of climate change is being felt increasingly the world over. Increased uncertainties of the weather conditions are adversely affecting agriculture as well as livestock sector, which are important sources of income and employment for a large segment of people in the country. The increase in demand for livestock products has given an impetus to the growth in livestock sector and more and more people are now taking it up as a vocation. But the global change in climate may have far reaching consequences for milk, meat and wool production. The direct effect on livestock could be small but the indirect effect brought about by change in feed and fodder supply may severely alter the existing livestock production systems.

As the climate changes and becomes more uncertain, species niches i.e. plant and crop substitution will take place. This will modify animal diets and affect the ability of smallholders to manage feed deficits. Depending upon the location, system and species, the productivity of forage crops and grasslands will also change. In C4 species, temperature increases up to 30-35 °C may increase productivity of forage and pastures when nutrients and water are available in optimum quantity. In C3 plants, temperature has a similar effect but increase in CO2 levels will have a positive impact on the productivity of these crops. A 2.5 °C increase in global temperature will put 20–30% of all plant and animal species at a higher risk of extinction (IPCC, 2007). In cereal crops, harvest indexes will change and hence the quality of roughages and their availability will also be affected. The temperature and CO2 levels affect the optimal growth ranges for different species which in turn will change the competition dynamics of species in grasslands. An altered species composition in grassland may affect the carrying capacity and stocking pattern of livestock. In semi-arid grasslands, a reduced growing season may spell doom for the migratory livestock production being practiced for thousands of years. Similarly, the high altitude grassland will move further upward due to rise in snow line throwing haywire the usufruct rights over grazing field and the migratory routes of the nomadic graziers, bringing unrest among the settled farmers and the transhumant graziers.

In India, roughages are a major source of livestock feed. Increased temperature may result in increase in lignifications of plant tissues affecting the digestibility and rate of degradation of plant tissues. Thus, the quality of feed material may deteriorate which in turn will reduce livestock productivity.

The climate change has also increased frequency of major natural disasters. In coastal areas and adjoining inlands, devastating cyclones wipe away everything along its way. Floods are striking with increased vengeance and engulfing more areas for a longer duration of time. Similarly, the occurrence of drought has also increased, affecting more number of people and livestock.

Primary reason for the present upheaval is anthropogenic sources of green house gases (GHG). A part of the blame is passed on to the livestock sector too. While implicating the livestock sector as a contributing factor in the phenomenon of climate change, it is easily forgotten that the livestock have remained in harmony with the nature for thousands of years, adapting to the vagaries of climate. However, the rearing and feeding systems under intensive livestock production systems need to be evaluated in the context of climate change.

It had been estimated that although the majority of greenhouse gas emissions occur in developed countries, 80% of the global total agricultural mitigation potential lies in developing countries. The unique livestock production system integrated with crop husbandry offers window for reducing the GHG in India and elsewhere. The methane produced by cattle, buffalo, sheep and goats by enteric fermentation and voided by eructation can be reduced by improved feeding practices, understanding rumen ecology for effective manipulation, use of specific agents or dietary additives, and long term management changes and breeding strategies to reduce methane emission. Livestock manure hitherto has been given little attention in cutting the GHG, although it releases significant amount of N2O and CH4 during storage. Proper storage of manure will emit less GHG. Grazing land management and pasture improvement will not only cut down the GHG but also directly benefit the landless livestock keepers in terms of higher productivity and encouraging them to keep fewer livestock. Regulating grazing intensity, increasing the productivity of grasslands, nutrient management and preventing fire can also reduce the GHG. Similarly, developing machinery to collect wheat straw after combine harvest in wheat fields will not only prevent the burning of wheat stalks but also add to the feed basket of livestock in the country. All this calls for creation of fodder banks in the zone of vulnerability to mitigate the miseries of the livestock and restore the production of livestock.

Uncertainties surrounding the possible effect of climate change on livestock production will come to the fore in not too distant a future. It is time we gear ourselves to meet the challenges ahead by putting policies and
Adapting livestock production to the climate change demands adjustments in production systems through diversification, intensification and integration of crop-livestock husbandry to meet the exigencies, changing land use, adjustments in livestock stocking pattern in terms of number and species composition etc. Breeding varieties of fodder and cereal crops of shorter duration will help in meeting the demand of food and fodder. Promoting high producing indigenous livestock breeds will lessen the effect of harsh climate on their production performance. Introducing early warning system and other forecasting and crisis preparedness system in context of livestock will significantly reduce the losses. A better understanding of the causes and impact of climate change on livestock is the need of the hour.

(K.A. Singh)
Director

Cowpea lines identified for unique traits of nematode resistance and erect plant habit

Cowpea (Vigna unguiculata L. Walp) is an important short-duration annual legume with high forage quality. Three germplasm lines with unique traits of erectness (IGFRI-95) and nematode resistance (IL-14 and HY 60p) have been identified. The IC numbers obtained from NBPGR New Delhi for HY 60-p, IL-14, and IGFRI-95, respectively. The process of registration of these lines with unique traits is in progress.

(Gitanjali Sahay, N Hasan, A Chandra, U P Singh and S A Faruqui)
Status of germplasm holdings at Regional Station, Dharwad

IGFRI-RRS, Dharwad have maintained germplasm collection of fodder crops for use in various breeding purpose. The germplasm collected, include bajra (45), sorghum (85), napier (66), Brachiaria (36), Panicum maximum (3), Stylosanthes (45), Medicago sativa (182). The 36 accessions of Brachiaria germplasm include different species viz. B.brizantha, B.humidicola, B.nigropedata, B.jubata, B.ruiziensis and B.decumbens. The germplasm of Brachiaria species have distant morphological variation.

The centre has collection of three Panicum maximum lines (G1, G2 and G3) possessing high lignocellulosic biomass with high recovery of Xylose and Glucose which provide ample scope for extraction of ethanol from these collection of Guinea grass. IC numbers IC 558122, IC 558123 and IC 558124 have been obtained for the three collections G1, G2, and G3, respectively.

In case of Stylosanthes, S. hamata, S. scabra, S. seabrana, S. guianensis, S. vicosa, S. humilis are important species being maintained. Besides, the centre also have germplasm collection of range legumes of different genera namely Chamicrista, Neonotonia, Clitoria, Macroptilium and Desmanthes, obtained from ILRI, Ethiopia.

In Lucerne (Medicago sativa), there are 156 germplasm lines, including 94 advanced breeding material of polycross and 26 annual medics of different species namely, M. scutellata, M. polymorpha, M. lupilina, M. orbicularis, M. rugosa, M. trucatula, M. soleirolii, M. dolia and M. suffruticosa.

The germplasm of the centre have been exploited in various breeding programs. As a result, DRSB-2 a fodder bajra composite for North Karnataka and DHN - 6 (Sampoorna) a Napier Bajra Hybrid was released for North Karnataka.

Sixty seven napier germplasm (Pennisetum purpureum) lines being maintained, have been categorized into profuse (16), moderate (30) and shy flowering (19) types. Studies have revealed that more than 90 per cent of the napier accessions exhibit isozymic polymorphism. About 250 napier bajra hybrids developed at this centre are being maintained along with 10 fodder bajra composites. In sorghum, 85 germplasm lines with substantial variability for forage traits along with eight sets of male sterile lines are also being maintained.

(K Sridhar, S Karthigeyan and U P Singh IGFRI RRS, Dharwad)

Guinea grass for bund stabilization and fodder production

Guinea grass is an important fodder grass of the humid and sub-humid tropics which can be grown as a component of agro-forestry systems. Guinea grass can also be used for stabilization of bunds and prevent soil erosion. On the dugout soil of farm pond at IGFRI-RRS Dharwad, root slips of guinea grass were planted at 50x50 cm spacing. In two years, the grass completely covered the soil surface thereby stabilizing the embankments and preventing soil erosion. It has high persistency and tolerance to drought. Besides, it has rapid regeneration ability with the onset of monsoon and shows good sign for bund stabilization. In addition to it, 650 q/ha of green fodder of guinea were also harvested in 6 cuttings. Farmers around the RRS-IGFRI farm have also adopted guinea grass in a big way by planting them along field boundary providing additional fodder without affecting the main crop.

(K Sridhar, Nagaratna Biradar, S Karthigeyan and U P Singh)
The saga of Mr. Malleshappa Halkiad from labour to successful farmer

At a time, when agriculture is largely considered an unprofitable enterprise by the farming community, the success story of Mr. Malleshappa Yallappa Halkiad of Kamplikoppa Village of Hubli Taluk in Karnataka may boost the morale of the stake holders involved. Mr. Malleshappa has transformed the way of agriculture from subsistence to commercial by shifting from conventional farming to diversified integrated farming system involving horticulture, fodder crops, forestry and livestock components along with soil and water conservation measures on his 1.4 ha farm. In 1998, on the advise IGFRI and BAIF personnel, he adopted some innovative technologies such as trench cum bund along the field boundary, bunding across the slope, farm pond, improved forage crops and livestock rearing. He also planted about 60 mango, 96 sapota saplings and 2000 forest trees of different species around the field. During the initial period of establishment, he adopted the pot irrigation to save the young plants. Fodder cultivation and livestock rearing were the core activity he had concentrated to boost income. He grows signal grass, *Pennisetum* trispecific hybrid, *Stylosanthes hamata* and *Desmanthes* on 0.70 ha of the farm land up from 0.07 ha in the beginning. From this cropping scheme he is able to harvest about 25 kg green fodder daily. Fodder trees such as Subabool and *Sesbania* suffice his summer requirement. He now owns 14 animals including 4 cows, 3 buffaloes, a pair of bullocks, 2 calves and 1 buffalo calf without any extra expenditure. He believes that improved fodder varieties grow vigorously, yields more, are nutritious and highly palatable. Vermi-composting is another activity which has been integrated well with other farm enterprises. He sells about 3 to 3.5 tons vermicompost in a year and utilizes another 20 quintal for his own farm. His annual income for the year 2007-08 was Rs 1,60,000/- from the farm. He has now leased in 7 acre irrigated land and cultivate it by engaging family labours. Improvement in his economic condition reflected from his improved living standards. The tiles fitted kitchen floor with Astra model stove, biogas facility, toilet and bathroom facilities are indicators of the success path created by him. The success story of Mr. Malleshappa has inspired many small and marginal farmers around the vicinity to diversify the agricultural activity and integrated fodder production programme for successful livestock enterprise. IGFRI is always with farmers to catalyze the needed transformation.

(Nagaratna Biradar, K Sridhar and S Karthigeyan, IGFRI Regional Research Station, Dharwad)

Microwave seed treatment improved germination of *Desmenthus virgatus*

Under ICAR National Fund project an experiment was carried out to visualize the effect of microwave (MW) field exposure to the seeds of *Desmenthus virgatus*. Seeds were exposed to microwave energy with the dosage of 420-980 W/g FW. Exposure improved the germination from ~5% (untreated control) to ~50% (MW treated) (fig.1). Among these fields, best germination was observed at 980W/g as leachate conductivity was maximum at this level. Significant increase in imbibition coupled with higher hydrolyzing enzymes activities as observed in treated seeds led to better germination. On the other hand the activity of antioxidant enzyme namely peroxidase declined under treatment indicated non-experience of any level of stress by the exposed seeds. Almost six times increase in seed leachate conductivity in treated seeds compared to the control, indicating the loosening of the seed coat membrane (fig. 2). It is possible now to expose hard seeded fodder seeds with MW fields for better germination and also breaking the dormancy.

(amaresh Chandra and Chavi Baronia)
Improving soil health- Organics as source of micronutrients

Extensive use of high analysis fertilizers over the years has resulted in wide spread deficiencies of several secondary and micronutrients like S, Zn, Mn, Cu, Mo etc. Experiments were conducted to work out an effective strategy to address the problem of multi-nutrient deficiencies under intensive forage production system. In forage sorghum combined application of S+Zn+Mn resulted in significantly higher production of green (37.6 t/ha) and dry (9.9 t/ha) forage (Fig. 1). Application of 5-10 tonne FYM/ha also resulted in 6-14 and 10-17 per cent increase in green and dry forage yield in sorghum, respectively. Application of FYM @ 5 t/ha may overcome the micronutrients deficiencies in fodder crops, as it produced green and dry forage equivalent to S+Zn application. Application of S+Zn+Mn along with 10 t FYM/ha resulted in an increase of 13.2, 0.4 and 1.0 ppm S, Zn and Mn content in the soil, respectively, as compared to control. Effects of FYM levels on forage productivity and soil fertility were also evaluated in guinea grass + berseem intercropping system. The forage productivity was 15% higher in FYM applied plots than the inorganically fertilized plots. Application of 30 t FYM/ha to berseem and 37.5 t FYM/ha to guinea grass gave 203.9 t/ha green and 35.7 t/ha dry forage yield. Organic source of nutrients also resulted in the buildup of soil organic matter and micronutrient content in the soil. Different levels of FYM application increased the content of Zn, Mn, Cu and Fe to the extent of 1.5, 4.1, 1.5 and 24.5 ppm, as compared to the initial value of 0.65, 2.56, 1.0 and 16.1 ppm, respectively. On the other hand under inorganic fertilization, availability of all the micronutrient remained unaltered and in control there was sharp reduction in the available micronutrients status during 4th year of cropping. This indicates the importance of integrating organics with mineral fertilizers to reap good crop with improved soil health.

(S B Tripathi, S N Tripathi and Arvind K Rai)

Screening technique for Sclerotinia stem rot of berseem

Berseem crop is severely damaged by the stem rot disease caused by Sclerotinia trifoliorum (Erikss,) under cool and wet weather. The disease severity under favourable north Indian conditions some times reaches upto 70%. For the diseases resistance screening programme, a rapid screening technique was standardized using Wardan cultivar of berseem. Five inoculation techniques viz. colonized petal inoculation method, sclerotia and mycelial mat inoculation, colonized grain placement, mycelia suspension spray and sick nursery bed were employed for evaluation of infection efficacy in a pot culture during the first fortnight of January. Among the methods evaluated colonized petal inoculation method was highly effective in creating successful epiphytotics under artificial conditions. A visible infection was initiated on all inoculated site after 48 h of inoculation, and rotting of leaves, pedicel and stem increased with time (figure) This technique can be successfully applied for rapid screening of large number of germplasm at nursery stage for host pathogen interaction, virulence test and race characterization.

(K K Pandey, P Saxena, R B Bhaskar and PK Tyagi)
Quinquennial Review Team (QRT) meeting

The QRT comprising of Dr S.D. Rai, Chairman & Ex-ADG (Coordination), ICAR, Prof. I.D. Tyagi, Member & Ex Head of Department, CSAUA & T, Kanpur, Dr. H.S. Nainawatee, Member & Ex-ADG (Education), ICAR and Dr. D.R. Malaviya, Head, ST Division & Member Secretary, had a meeting at IGFRl, Jhansi during January 22-23, 2009. The QRT met for the Administrative and Financial review of IGFRl for the period 2003 - 07.

HRD activities at IGFRl

Training course

Visits conducted
January 26, 2009-42 farmers sponsored by Department of Agriculture, Karauli, Rajasthan.
January 27, 2009-29 students from College of Forestry, Sirsi, Karnataka.

Success story

Directorate of Seed Research, (ICAR), Mau - the leading institution working in the field of seed research has given an eye to the significant achievement in fodder seed production by IGFRl, Jhansi and has published as a success story in its publication: DSR Quality Seed Production - Glimpses of Success Stories By S Natrajan, Mrs. Sherry R Jacob and A B Mandal.

Dr. A.B. Majumdar, Principal Scientist, PAR Division has been elected as Vice President of Animal Nutrition Society of India for the period 2009 to 2011. Dr. Majumdar has also served ANSI as Central Executive Member for four terms earlier.
Winter school organised at IGFRI, Jhansi

A winter school on "Seed production technology and quality control standards in fodder crops", was organised at IGFRI, Jhansi from February 26 to March 18, 2009. The curriculum was developed to address the issues in totality from production, processing to quality control. 25 participants in the rank of Assistant/Associate Professor, Scientists, SMS & equivalent in the concerned subject under SAUs, ICAR Institutes, KVKs, central/state seed production farm/canlal universities/deemed universities etc. from different states participated in the training. They were enriched with the recent advances, problems & prospects of forage seed production, processing, seed & field standards, quality control, seed storage & health in national perspective. Some topics of general interest, to provide solutions to problems faced by personnel working in the field of forage seed production, were also included. The winter school was inaugurated by the Commissioner, Jhansi Division and on its completion, Director NRCAF - the chief guest, awarded the certificates.

(Dr. R K Bhatt, Course Director)