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From Director's Desk.....

Amelioration of temperate/alpine pastures for livelihood support to pastoral communities

Temperate areas in India are primarily situated between 2000-4500 m altitude with significant diversity. The temperate/alpine pastures spread in the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. Areas in Kashmir valley have flat agricultural land with irrigation facilities whereas in Himachal Pradesh and Uttarakhand, the valleys are very narrow where terraced farming is the only alternative. Most of the temperate areas experience a hostile and prolonged winter offering only a short summer of 4-5 months when the entire agricultural activities are carried out. The family land holdings are small. These constraints have resulted in the adoption of animal husbandry as a secondary source of income at lower altitudes and the primary occupation at comparatively higher altitudes. In the temperate and alpine region of Himalaya, livestock forms an important livelihood support system to these pastoral communities. There are 21.5 million heads of livestock in the five mountain states, of which there are 8.1 m cattle, 3.0 m buffalo, 4.6 m sheep, 4.7 m goat, 0.4 m pig, 0.2 m mithun, 0.06 m yak and 0.3 million pack animals (horse, mule and donkey). The dependence of human beings on animals increases as the environment becomes more hostile. Arunachal Pradesh, Jammu & Kashmir, Himachal Pradesh, Sikkim and Uttranchal are the states where human beings are heavily dependent on their livestock for their livelihood support. The major pastoral communities in the regions are *Gaddi, Gujjar, Dokpas, Lepchas*, *Bhutia* and *Brokpas* etc. Notwithstanding animal husbandry is important source of livelihood for farmers in the temperate areas, the forage cultivation has remained almost neglected. Grazing in forest areas, sub alpine and alpine pastures is the main source of animal feeding. But the indiscriminate use of these grazing areas along with increasing animal population has resulted in critically low biomass availability, which in turn adversely affect the livestock production.

Recently collaborative research projects involving RRS-IGFRI Palampur, RRS- CSWRI Garesa and NRCY, Dirang have been initiated to assess the present status of the temperate/ alpine pasture, livelihood support of pastoral communities, migratory route and grazing system of livestock in changing climatic scenario. Total 9 field experimental sites are established in high latitude (6500m – 14200m) of Jammu & Kashmir, Himachal Pradesh, Sikkim and Arunachal Pradesh. IGFRI, Jhansi gives support and with the modern techniques of GIS and remote sensing and intensive field survey/Ground Truthing.

The survey and mapping work of grazing resources (grasslands of temperate/alpine pastures) was completed for Himachal Pradesh. ArcGIS and ERDAS Imagine software were used for the interpretation, analysis and mapping of grasslands. Intensive ground truthing and field samplings were carried out to generate the geo-spatial information on grasslands. The area under grassland in the state constituted only 16.53% (917702.73 ha) of the total area. Grasslands occupied 15.38, 21.56, 17.99 and 15.32 percent area of geo-climatic zone 1 (Low hill sub tropical), zone 2 (Mid hill sub humid), zone 3 (Mid hill temperate wet) and zone 4 (High hill temperate) respectively. The study reveals that about 9595 sq. km (4.32%) area is under productive grasslands and whereas other grazing lands including schrubs and other unpalatable grasslands were 10455 sq. km (9.81%) of the total geographical area in J&K. The area under grasslands in Jammu, Kashmir and Ladakh were 3.53, 13.22 and 5.76 percent respectively together contributing about 6756.5 sq. km or 6.34%.

The ***Monpa*** is the main pastoral community involved in yak rearing in West Kameng and Tawang district of Arunachal Pradesh. Yak farmers are locally called as ***Brokpas***. In Sikkim, the ***Bhutia*** is the main pastoral community involved in yak husbandry. Yak rearing regions in North Sikkim are Lachen and Lachung blocks. Yak farmers in Sikkim are locally called as ***Dokpas***. Brokpas and Dokpas are considered as the poorest of the poor farmers living a nomadic life. They migrate along with their livestock through difficult hilly terrain in search of animal fodder. During summer they migrate to the higher altitudes and in winter return back to lower altitudes along with their livestock.

For developing technologies for Pasture development seven NTPP experimental sites (GPS location N01 to N07) were selected at Spituk, Leh. It was observed that *Salix* plantation is well established at NTPP experimental site, Spituk. Lupin, *Dactylis*, Alfalfa, Rye grass sown in the area have germinated and established very well. The soils at the GPS location N05 and N07 were found alkaline in nature having pH of 7.68 and 7.85, respectively whereas soils in other locations, are more alkaline (>8.5 pH). Electrical conductivity varied in the range of 0.08 to 27.0 dsm^{-1}. Organic carbon (%) varied from 0.05 to 1.58. Except for the location N07, where available N was found to be 582.67 kgha-1, rest of the soils were found to be deficient in N content. GPS locations N01, N02 and N03 were poor (<18 $kgha^{-1}$) in available P and N04, N05 and N06 were medium in available P i.e., 18.51, 22.73 and 19.6 kgha-1, respectively, while N07 had highest available P (37.8 kgha-1). Available K in GPS locations N01 (77.06 kgha-1), N02 (70.87 kgha-1), N03 (51.07 kgha-1) was low but it was higher in other locations of the NTPP site. The average forage production was observed 2.35t/ha from NTPP experimental site. Average FW (%) and DM (%) in the NTPP experimental plots were aroung 8.84 t/ha and 26.58 t/ha, respectively.

Under the temperate pasture development programme, two high altitude sites were taken up in Arunachal Pradesh at Lhagyala Gonpa and Merkmu Mandala in West Kameng District with the help from the Department of Animal Husbandry and Veterinary Services, Arunachal Pradesh. Temperate grasses viz., *Dactylis glomerata* and *Trifolium repens* were transplanted in the test plots to assess their suitability and production potential. Both the grasses are successfully growing in these pasture sites.

Temperate grass Dactylis glomerata and legume Trifolium repens growing at pasture development sites; Lhagyla Gonpa, Morshing, Kalktang Circle, West Kameng, Arunachal Pradesh (2,800 metre MSL altitude) and Merkmu, Mandala, Dirang Circle, West Kameng, Arunachal Pradesh (3,000 metre MSL altitude)

Future research should include, development of suitable grazing systems, identification of compatible grass-legume mixtures, socio-economic aspects and ethnobotany of the nomadic tribes, introduction of high yielding fodder trees and bushes, breeding better varieties of pasture species and adequate quality seed production of pasture grasses and legumes

Canavalia: A potential fodder legume for future

Canavalia is an under-exploited legume, also known as Sema, Sword Bean, Jack Bean, Kathia Sem, Runner Bean and Coastal Bean. It is considered to be a cheap source of protein (23-33%), vitamin and minerals for both human and livestock. This bean is not eaten very frequently but has a potential to become an important food and fodder source. Besides, this legume is grown as cover crop and green manure. The seeds and green parts are used for animal feed. The young pods are extensively utilized in Asia as a green vegetable. People of ancient India ate them traditionally but they were less popular among the general population. Mature seeds are cooked and consumed by the tribals and poor people particularly in southern India. It possesses good medicinal property against many diseases including Parkinson's disease.

The genus *Canavalia* has 48 species. All the species of *Canavalia* are perennial climber with numerous branches and trifoliate leaves, auxiliary racemose inflorescence. Four species of *Canavalia* namely *C. gladiata, C. virosa, C. ensiformis* and *C. brasiliensis* are reported to be used for fodder. It is also reported that Jack bean (*C. ensiformis*) and sword bean (*Canavalia galdiata*) are two major pulses contributing to agriculture. It is found naturally along hedges around fields and roadsides. The plant *C. gladiata* is believed to have originated in the Asia continent and spread throughout the tropics. These are now cultivated on a limited scale throughout Asia, West Indies, Africa and America. Seeds of *Canavalia ensiformis* are considered one of the lesser-known grain legumes that grew well on the highly leached nutrient-depleted lowland tropical soils. It is drought resistant and can withstand semi-arid conditions. Average yield of *Canavalia gladiata* ranges from 720-150 Kg / ha which can be compared with a soybean yield of 600-1000 Kg / ha. For use as a vegetable the pods can be harvested in 3 to 5 months when the pods are about 12.5-15 cm long before they swell and become hard. Mature seeds are produced in 6 to 10 months.

However, there are very few reports on morphological evaluation of *Canavalia* species for food

and forage purposes. There are many reports from foreign countries that the species of genera *Canavalia* are utilized for forage purposes. Having large size of leaves, bold seeds and perennial nature of the plant, it may become a good fodder legume in India in future particularly in the lean period. In view of this, we have collected and conserved 10 indigenous and 7 exotic accessions of four species of *Canavalia* namely *C. gladiata, C. virosa, C. ensiformis* and *C. brasiliensis* and these are being evaluated for food and forage yielding traits. Recently, we have collected one new plant type of *C. chathartica* syn. of *C. virosa*, from the natural grassland of Rammarhi watershed area of IGFRI, Jhansi during an exploration visit that is also under evaluation. Morphological features for quantitative traits among four species have been given in Table1.

Table

1	Plant length (m)	1.2-4.8	2.3-6.2	1.2-2.3	3-11.7
2	No. of Branches	2-11	2-14	2-6	4-15
3	No. of leaves	54-118	67-112	32-89	85-164
4	Leaf length (cm)	4-16	3-15	8-12	6.8-8.0
5	Leaf width (cm)	2.5-9	2-7.9	5-8	5.1-5.8
6	Pod length (cm)	3.5–22	10-16	14-23	12.5-14.0
7	Pod width (cm)	2.8-4.2	2.5- 3	2.5-3.6	2.6-3
8	Seed length (cm)	2.0 - 3.2	1.5-2.4	1.2-1.8	1.5-2.0
9	Seed width (cm)	0.4-0.5	0.4-0.5	0.3-0.5	0.3-0.4
10	Seed hilum length (cm)	1.8-3.1	1.0-1.8	0.5-1.0	0.8-1.6

(a) (b) (c)

Fig. Species of genera *Canavalia* (a) *C. gladiata*) (b) *C. brasilensis* (c) seeds of *C. gladiata*

New accession of *Canavalia cathartica* Syn.*Canavalia virosa* (Jacq.) DC. commonly known as Kathia sem (fig.) has been explored and collected from the Ram marhi water shed area of natural grassland of IGFRI, Jhansi during exploration visit. Plant samples were collected and voucher specimen (No.3802) has been preserved in the herbarium of forage species in the GSM Division. This accession has more number of pods as compared to *C. gladiata* and *C. ensiformis*.

Fig. New accession of Canavalia cathartica syn. Canavalia brown-black seeded explored from the natural grassland of Jhansi

(Archana Singh and SN Ram)

Incidence of lucerne seed chalcid (Guss.) in Dharwad

Incidence of lucerne seed chalcid, ***Bruchophagus roddi*** (Guss.) was noticed during early summer months of 2013 on major ruling on lucerne varities *viz*., RL-88, Anand-2 and on exotic germplasm accessions at SRRS, Dharwad. Up to 70% of seeds were infested by B. roddi. The chalcid incidence was visible from last week of February and continued till second week of May, the peak period for seed setting. The adult of this species is a tiny, black wasp measuring length of 1/10 inch. The adult female has a needle-shaped ovipositor, used to insert eggs into immature developing green pods. Damage is visible even on the developing pods. A single larva (grub) develops within each seed and destroys the seed, leaving only the seed coat. It pupates inside the seed and when the wasp emerges from the seed, a hole is externally visible on the pod. The pest over-winters as pupae inside the seeds. The adults emerging in May/June lay eggs in the lucerne seeds. Several generations of the chalcid are completed in each year.

(NS Kulkarni and S Karthigeyan)

Differential expression pattern of MET1 gene suggested epigenetic regulation of apomixis in *Panicum maximum*

Genetic control of apomixis is complex and is governed by genetic as well as epigenetic regulation. We generated a population in guinea grass that segregated for mode of reproduction. Obligate apomictic and obligate sexual plants were subjected to differential expression analysis of MET1 gene. RNA were isolated from different developmental stages (pre-meiotic, meiotic, post-meiotic and mature stage) of embryo-sac development in apomictic and sexual guinea grass. Semi-quantitative reverse transcriptase PCR analysis of MET1gene was performed. RNA was converted into cDNA and comparison on four developmental stages of spike/embryo sac was made in two sets including Tubulin as control in apomictic and sexual progenies. Data revealed that in all stages expression of MET1 gene was higher in obligate apomictic phenotype, whereas reduced expression in obligate sexual plants was noticed. The results suggested the epigenetic regulation of apomixis in *P. maximum*. Regulation and consequences of methylation in epigenetic regulation including other genes is being investigated.

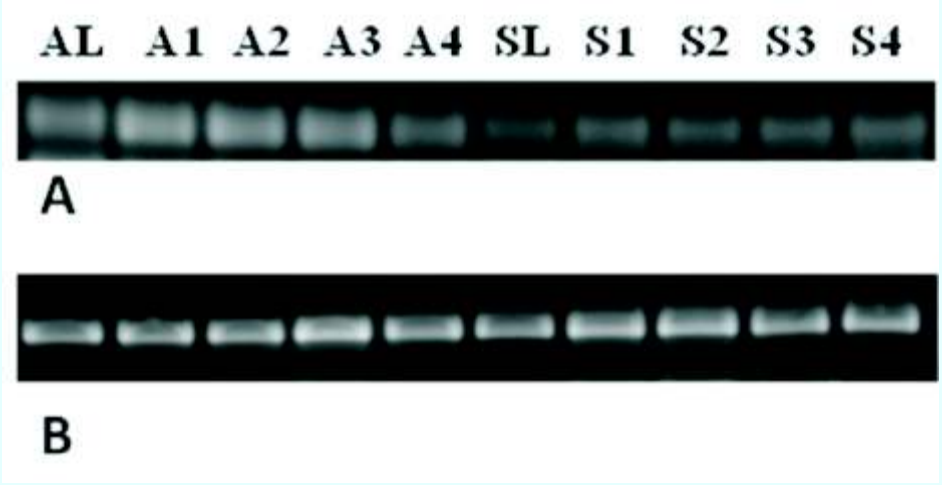

Fig. (A) MET-1 gene expression pattern at different developmental stages in apomictic and sexual *Panicum maximum*. **(B)** Tubulin gene expression pattern at different developmental stages in apomictic and sexual *Panicum maximum*. (AL: Apo leaf, A1, A2, A3 and A4: four different stages of embryo sac development; SL: Sexual leaf, S1, S2, S3 and S4: four different stages of embryo sac development)

(K K Dwivedi, A Radhakrishna, M K Srivastava and P Kaushal)

Cattle Egret (*Bubulcus ibis* Linn.) noticed to predate on alfalfa weevil, *Hypera postica* Gyllen. (Coleoptera: Curculionidae)

Lucerne or alfalfa (*Medicago sativa* L.) is prone to the attack of weevil**,** *Hypera postica* Gyllenhal (Coleoptera: Curculionidae). Both the adults and larvae feed on the leaves and stem. Plants attacked by this weevil have a ragged appearance with small holes and irregular patches eaten in the leaves by the larvae. Larvae do the most damage. During the spring season of 2013, in lucerne fields of our central research farm, it was observed that the larvae and adults of *H. postica* were predated by cattle egret (*Bubulcus ibis* Linn.). Cattle egret or Bagula or gai bagula (*Bubulcus ibis* Linn.) is distributed throughout the Indian sub-continent. They are gregarious and are seen with grazing cattle and seize insects disturbed by cattle movements. They are reported to predate on a wide range of prey particularly grasshoppers, blue bottle flies, Cicada, crickets, flies and other insects (adults and larvae both) as well as as spiders, frogs, earthworms, lizards and fish. This communication is the first report of cattle egret (*Bubulcus ibis* Linn.) as predatory on lucerne weevil, *Hypera postica*.

Cattle egret predating on alfa alfa weevil

(NK Shah, NS Kulkarni and PK Tyagi)

Infestation of shoot fly, *Atherigona soccata* Rond. (Anthomyiidae: Diptera) on *Sehima nervosum*

Sen grass (*Sehima nervosum*) is a predominant indigenous grass of Indian sub continent. During a survey in and around Jhansi region, India it was observed that there are sporadic incidences of shoot fly, *Atherigona soccata* Rond. (Anthomyiidae: Diptera) on *S. nervosum*. The incidences were noticed during September – October. An average infestation of 14-15% was noticed on *S. nervosum*. This communication publishes the record of shoot fly incidences on Sen grass (*Sehima nervosum*). The larva (maggot) is the damaging stage which feed on the growing points of the shoot of the seedlings/plants up to 7-8 leaf stage. The result is a typical "dead heart". Shoot fly females lay cigar-shaped eggs singly on the lower surface of the leaves, at the 1-7 leaf stage. One to three eggs are laid per leaf. The eggs measure 0.8 x 0.2 mm. They hatch after 2-3 days. The young larvae crawl down inside the leaf sheath. Then they bore into the base of the young shoot, killing the growing point and the youngest leaf. This leaf turns brown and withers (dead heart). The full grown (third instar) larvae are 8-10 mm long and have a white or yellowish colour. The larval period takes 7-12 days. The contribution reports the first record of shootfly (*A. soccata*) on sen grass (*Sehima nervosum*)

Deat heart caused by shoot fly

(D Bahukhandi, N K Shah, D Vijay and N Manjunath)

Berseem hay formation using green energy of solar dryer

Solar energy is tapped through Solar panel & used for hay making at FM&PHT (Farm Machinery & Post Harvest Technology), IGFRI Jhansi. Solar dryer consists of two chambers of transparent acrylic sheets having dimensions 3.5 x 3.5 x 2.25m. A solar battery comprising of ten number of panels, each using ten glass tubes consisting of circular solar cells was used as air heating device in this solar dryer. The hot air, coming out from solar battery was used into the solar chambers for heating. Circulation of air from solar battery to hot air chamber is achieved using a blower of 746 W. This blower was operated by electrical energy provided externally. Circulation of air was diverted to either chamber through control valve. In monsoon and winter season these solar chambers heated by solar energy provide a good set up for drying of material.

This solar dryer was used for berseem hay making on experimental basis during winter season. Three different loads per batch of freshly harvested berseem was spread on the 'A' frame structure inside the hot air chamber and same quantity was spread on a similar structure kept in open sun. Open sun drying was used as control method. Loads of 50, 100 and 200 kg of freshly harvested berseem was kept in each batch for drying. Freshly harvested berseem had moisture content in the range of 77.1 to 92.7 g/100g of berseem used for drying in the month of late February and 1st week of March. The temperature recorded in the solar chamber was highest at 61ºC at 1:30 p.m. without any material kept for heating in solar chambers, whereas outside it was 38ºC. However, when batch of 50 kg berseem was kept for drying, the material thickness varied up to 10 cm on the drying structure. In this condition, maximum temperature rose to 42 ºC at 1:30 p.m. In the process of drying, air circulation

were kept running from 9 am to 5 pm. It took 4 days with 8 hours of drying every day to dry the material. With 100 kg batch of berseem kept for drying, thickness of spread berseem was up to 16 cm and maximum temperature recorded was 43 ºC. It took 5 days (40 hours) to dry the material. Whereas, with 299 kg batch of berseem the spread thickness varied from 22 cm and maximum temperature recorded was 41 ºC inside the hot air chamber. It took 7 days (56 hours) to dry the material. In all the cases, dried material had moisture content in the range of 7.5 to 8.2 g/ 100g of berseem. With the increase in quantity of material, more time is required for drying whereas in control condition it took 9 days for the material to dry. Solar dryer is useful to dry the material during low temperature season. It is also suggested to dry high value crop or material in the solar dryer.

(P K Pathak, P N Dwivedi, C S Shay, V D Chhavda, RK Sharma)

Research Advisory Committee Meeting, 2013

The 20th RAC meeting was held on April 25-26, 2013 at IGFRI, Jhansi under the Chairmanship Dr. Y.S. Ramakrishna, Ex Director CRIDA and Dr.E A H Roberts Chair on NRM Tea Research Association, Tocklai Experimental Station, Jorhat. Drs. P.K. Ghosh, I. D. Tyagi, P.S. Pathak, K. S. Ramachandra, S.N. Shukla, and Sunil Kumar also attended the meeting. Dr. S. K. Dhyani, Director NRCAF was the special invitee. Chairman stressed upon the need to take up the research activities on National Livestock Mission during 12th Plan. He advised to take the research activities to enhance the availability of fodder to boost the milk productivity of available livestock population in the country. The committee advised to strengthen the seed sector and opined to find ways to take new varieties and technologies to farmers and adoption of new varieties by private sector. RAC stressed to undertake conventional breeding programs for development of suitable varieties for different agro- climatic regions. Short duration, photothermo insensitive, high forage yielding varieties resistant to biotic and abiotic stress should be attempted. Work on Nano technology may be initiated for enhancement of productivity in forage crops in different areas such as water, nutrient use efficiency.

(S. Sinha & G.P. Nigam)

Human Resource Development

Foreign visits for participation in conference/training

Dr. N.S. Ekka, The Netherlands, 22 April - 22 July, 2013

Dr. P.K. Ghosh, Jordan, 21 – 23 May, 2013

National Group Meet Kharif 2013 of AICRP-Forage Crops

National Group Meet Kharif 2013 of All India Coordinated Research Project on Forage Crops was jointly organised by ICAR and Assam Agricultural Univesity, Jorhat held at Jorhat, Assam during May 10-11, 2013. The meeting was chaired by Dr. K. M. Bujarbaruah, Vice-Chancellor, AAU, Jorhat. Dr. R. P. Dua, ADG (FFC), ICAR, New Delhi was the chief guest. The other dignitaries present included Dr. P. K. Ghosh, Director, IGFRI, Jhansi, Dr. G. N. Hazarika,

Director of Research (Agriculture), AAU, Jorhat and Dr. A. K. Roy, Project Coordinator (Forage Crops). Plenary session was chaired by Prof. S. K. Dutta, DDG (Crop Science), ICAR, New Delhi. RSDGG-1 and TNGG-62 entries of guinea grass developed by TNAU, Coimbatore and IGFRI-RRS, Dharwad, respectively were identified for release as variety.

विक्रय हेतु उत्तम श्रेणी बीज

चारा फसलें	प्रजनक दर (रू. प्रति कि.)	टी.एफ.एल. दर (रू. प्रति कि.)
cjlhe %	260	140
tb %	42	25
Xokj %	350	300
ykfc;k %	75	60
pjh %	80	50
?kkl %		
fxUuh	400	400
nhukukFk	250	250
/kkeu ?kkl	400	250
vtu	400	300
LVkbyk	300	250
/kcy ?kkl	400	260
Lkccy	250	200
?kkl dh TkM %		
¼ufi;j@fxUuh½	: 0-75@fLyi	
¼vtu@/kcy@/kkeu@yEik½	: 0-50@fLyi	

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New Appointments

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Date of Joining 11.04.2013

Mr. Aniruddha Maity
Date of Joining 11.04.2013

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