To our readers

Dear readers,

There is a growing demand for green technologies that produce safer foods for human health and protect the environment. Recent awareness about toxic residues in the foods has sensitized the masses regarding the clean development mechanisms. Organic farming is much talked about and many practices are being adopted to produce safer and healthy food. Considering the fodder as a prime component of the soil-plant-livestock-human food chain, its safer production and optimum productivity are aimed at IGFRI, Jhansi. During the kharif season, some of the experiments conducted at the research farm were evaluated for the effect of organic amendments.

The 'Bhumi-sanskara' by 'Angara' and 'Amritpani' before sowing the sorghum crop helped significant increase in the population of fungi, actinomycetes and bacteria which facilitated improved edaphic function in terms of soil respiration, soil microbial biomass carbon and dehydrogenase activity. The soil organic matter increased by 50% of the control. It has demonstrated the value of these locally available cheaper amendments for regulating soil health and soil biota that can assure sustainability of production and safeguard critical ecological functions.

In another study, where amendments viz., Panchgaviya, Agnihotra powder were used as seed treatment for disease and pest control, the crop growth and productivity were much improved besides effective disease control. A farmer using some of such preparations at the advice of Scientists of IGFRI has claimed more than double grain yield of soybean. The study on role of farm yard manure in improving soil biology resulting in higher forage yields has shown that organics improve the total soil biology for healthy crop growth and production. We started the soil biology and fertility research three years back and now with Jaivik Krishi programme it will be possible to educate the farmers to produce, handle and use amendments that help in producing healthier foods. Scientific evaluation of such amendments and practices are aimed at demystifying the myths.

Our multi-disciplinary Stylo project has also helped us in identifying better species/varieties for rehabilitating degraded soils and producing high quality feed for the livestock. We consider S. seabrana as the new hope for such lands. The potential of stylo to produce dry matter at elevated CO₂ levels coupled with high temperature shows its value for future. We have already committed ourselves to the work on some of the perennials viz., Hybrid Napier, Guinea grass, Stylo and Leucaena at the beginning of this year.

Our research agenda and the resolution that we adopted at Palampur are other steps ahead in the direction of effective planning for country's prosperity in the area of fodder and grasslands. Let us work together to achieve this mission.

(P.S. Pathak)
National Group Meeting of All India Co-ordinated Research Project on Forage Crops

The National Group Meeting (kharif 2004) of All India Coordinated Research Project on Forage Crops was held at CSK HPKV, Palampur during June 1-3, 2004 to discuss the results of the experiments conducted at various centres of the project and to formulate the technical programme for kharif 2004.

Chief guest of the inaugural session, Dr. Tej Pratap, Vice Chancellor of CSK Himachal Pradesh Krishi Vishwavidyalaya in his inaugural address provided an exhaustive account of agriculture scenario and forage status in the country as a whole and in hilly region, in particular. He enlightened the participants regarding the new challenges related to genetic resource upgradation and the development of the varieties and production technologies. He called the scientists to come-out with feasible and economically viable technologies, which can help the Indian farmers to harness maximum sustainable production.

The chairman of the inaugural session, Dr. S.P. Tiwari, ADG (Seeds), ICAR conveyed good wishes on his own and on behalf of the ICAR authorities to the participants. Dr. P.C. Katrich, Dean, College of Agriculture, CSK HPKV, extended a warm welcome to the dignitaries and distinguished participants. Dr. R.C. Thakur, Director of Research CSK Himachal Pradesh Krishi Vishwavidyalaya in his remarks gave an account of forage research in India and advocated to pay more attention on forages for sustained animal productivity.

Dr. P.S. Pathak, Director, IGFRI and Project Coordinator (Forage Crops) welcomed the dignitaries and the participants on behalf of AICRP(FC) Coordinating Unit. He also communicated good wishes expressed by the Deputy Director General (Crop Science & Horticulture), Dr. G. Kalloo to the participants.

The inaugural session was followed by the presentation of extended account of the research highlights of the project during kharif 2003-04.

The plenary session of the group meeting was chaired by Dr. P.S. Pathak. The major recommendations were as:

1. Bracharia (Urochloa) trial should be conducted at 7 locations viz., Jhansi, Rahuri, Jorhat, Ranchi, Coimbatore, Hyderabad and Dharwad strictly under non-irrigated condition.

2. In Stylosanthes, three trials (as proposed in session V) should be replaced by two trials were finalized for Kharif 2004. First trial will be conducted at 8 centres in the dry region viz., Anand, Jhansi, Ludhiana, Jalour, Rahuri, Hyderabad, Coimbatore and Dharwad, while the second trial will be conducted at three centers in wet region viz., Jorhat, Bhubaneshwar and Ranchi.

3. The availability of nucleus seed and its source may be ensured at the time of finalizing the Breeder Seed Production Programme.

4. The wide variation reported from centre for quality traits like crude protein per cent need attention of the scientists. For accuracy more precaution is required during sampling of the plant material, stage of crop harvest and in analytical procedure.

The meeting ended after passing following resolutions:

- To adopt the message from farmers; feeding practices in forage research resource allocation for improving the technologies to assist better livelihood opportunities.

- Target production for lean months by adopting crop intervention in the existing cropping system/conservation and value addition.

- Matching tonnage with quality - Farmers' issues and technology imperative - Striking a balance.
**Organic/ Vedic Management of Diseases and Pests of Forages**

The adverse effects of excessive use of agro-chemicals in Indian agriculture are being felt. This has caused degradation of land resources, declining biodiversity, pollution of environment and their harmful effects on human and animal health and soil flora and fauna. Therefore, efforts are being made to replace chemical pesticides from the agricultural production system by adopting organic farming.

As an effort in this direction, an experiment was conducted in sorghum cowpea forage production system using cow dung + urine + neem leaf mixture, *agnihotra* powder and *panchgavaya*, as seed treatment (ST) and foliar spray at 30, 45 and 60 days after germination of crop. The preparation of these organics started 15 days before the sowing. Cow dung, urine and grinded green neem leaf suspension was prepared by mixing them in 4:3:1 ratio and fermenting for 15 days. The mixture obtained was filtered through fine muslin cloth. The resultant mixture was used after diluting it to 5 per cent with water. *Agnihotra* powder was prepared by performing *agnihotra* at the time of sunrise and sunset. In this performance, the cow dung cakes were burnt smokeless in the *agnihotra* patra and rice and cow ghee was offered with chanting mantras (At sun rise- 'Suryay swaha suryay idam namam' 'Prajapatye swaha prajapatye idam namam'. At sun set - Agnaye swaha agnaye idam namam' 'Prajapatye swaha prajapatye idam namam').

The *panchgavaya* was prepared by mixing cow dung, urine, milk, curd and ghee in 4:3:3:2:1 ratio and kept for fermentation for 15 days. The seed treatment was done by dipping seed in 5 per cent suspension of cow dung + urine and *panchgavaya* and addition of *agnihotra* powder @ 50 g/kg seed w/w. These treatments were compared with standard recommended chemical treatment and untreated control.

The experimental results revealed that all the organics used were effective in reducing the pests and disease and increased green forage yield to a varying degree (Table). Seed treatment, appears to be more effective against seed and soil borne diseases and nematodes as there was significant reduction in the incidence of anthracnose in cowpea and zonate leaf spot in sorghum (MP-Chari) before application of foliar spray.

The higher population of beneficial rhizosphere microflora such as fungi (*Trichoderma, Paecilomyces* and *Aspergillus*), bacteria, actinomycetes and bacterial and fungal feeder nematodes (>58%) were obtained compared to control. Root knot nematode incidence in cowpea were reduced (53-60%) and more than 50 per cent egg masses infection with...
Paecilomyces lilacinous and Trichoderma were recorded. Higher activity of earth worms were recorded in treated plots compared to untreated control. The seed treatment with Agnihotra in cowpea resulted in higher seedling vigour index (1804) as compared to control (1639) where as in sorghum it was 1562 as compared to 1479 in control. Nodulation in cow pea also increased significantly (15.16-26.10/plant) as compared to 8.90/plant in untreated control.

Treatments tested, per cent disease incidence and green fodder yield (kg/ha).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cowpea anthracnose</th>
<th>Sorghum zonate leaf</th>
<th>Green fodder yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST* carbendazim and spray dithane M- 45</td>
<td>6.67</td>
<td>10.00</td>
<td>294.43</td>
</tr>
<tr>
<td>ST Agnihotra powder + spray Cow dung, urine</td>
<td>10.00</td>
<td>10.00</td>
<td>286.10</td>
</tr>
<tr>
<td>ST Cow dung, urine + spray Panchgavya</td>
<td>16.67</td>
<td>13.33</td>
<td>277.77</td>
</tr>
<tr>
<td>ST Cow dung, urine + spray Agnihotra</td>
<td>6.67</td>
<td>20.00</td>
<td>272.21</td>
</tr>
<tr>
<td>ST Panchgavya + spray Cow dung, urine</td>
<td>10.00</td>
<td>16.67</td>
<td>272.21</td>
</tr>
<tr>
<td>ST Agnihotra powder + spray Agnihotra</td>
<td>6.67</td>
<td>10.00</td>
<td>269.43</td>
</tr>
<tr>
<td>ST Cow dung, urine + spray Cow dung , urine</td>
<td>10.00</td>
<td>20.00</td>
<td>255.55</td>
</tr>
<tr>
<td>ST Agnihotra + spray Panchgavya</td>
<td>6.67</td>
<td>16.67</td>
<td>241.66</td>
</tr>
<tr>
<td>ST Panchgavya + spray Panchgavya</td>
<td>0.00</td>
<td>13.33</td>
<td>241.66</td>
</tr>
<tr>
<td>ST Panchgavya + spray Agnihotra</td>
<td>3.33</td>
<td>13.33</td>
<td>238.88</td>
</tr>
<tr>
<td>Untreated Control</td>
<td>30.00</td>
<td>33.33</td>
<td>230.55</td>
</tr>
</tbody>
</table>


** Farm Yard Manure Supports Soil Meso Fauna Build-up **

Soil meso-fauna are known to play a major role in maintenance of land fertility and respond differently in various land use systems and to management practices. The results of the experiment to observe the effect of mineral fertilizers and farm yard manure in cowpea + maize (kharif) - lucerne (rabi) crop sequence taking up the population build up of collembola and acari as indicator of soil fertility for four years, indicated that the collembola and cryptostigmata population was consistently higher in FYM treated plots when, compared to NPK/ no fertilizer plots (Table 1). The correlation between forage yield as result of FYM application and population build up of collembola and cryptostigmata was highly significant (Table 2).

The results confirm potential role of FYM in crop production system for yield enhancement, a part of which could be attributed to higher population of these organisms. The study suggests that the activities of soil fauna may be managed for augmentation of forage yield vis-a-vis sustainable land use.

Table 1. Soil meso-fauna populations affected by fertilizer treatments in cowpea + maize - lucerne cropping sequence

<table>
<thead>
<tr>
<th>Soil Meso-fauna</th>
<th>Cowpea+Maize</th>
<th>Lucerne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collembola (10^3/m^2)</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>Cryptostigmata (10^3/m^2)</td>
<td>394</td>
<td>534</td>
</tr>
</tbody>
</table>

NPK = Mineral fertilizer; FYM = Farm yard manure; NF = No fertilizer (control)

Table 2. Correlations between population and forage yield as a result of fertilizer applications.

<table>
<thead>
<tr>
<th>Yield</th>
<th>Collembola</th>
<th>Cryptostigmata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif</td>
<td>0.99**</td>
<td>0.88**</td>
</tr>
<tr>
<td>Rabi</td>
<td>0.70**</td>
<td>0.84**</td>
</tr>
</tbody>
</table>

** Significant at the 1 per cent level

(Sharmila Roy and S. A. Faruqui)
2004 - Yet Another Severe Drought Year

The weekly rainfall distribution during kharif at Jhansi for the year 2004 and the normal values is shown in figure. The onset of monsoon was early and commenced in 24th standard meteorological week (SMW) with 34.1 mm rainfall. There after a sudden break in monsoon condition was prevailed for nearly one month (25th to 28th SMW). This dry spell experienced 90% less rainfall than the normal. The first peak appeared during 29th SMW and received 77.8 mm of rainfall due to low pressure and upper air cyclonic circulation in central India, but the low pressure weakened and thus two successive weeks were deficit of rainfall by more than 84% than its normal values. There was a sudden increase in rainfall in 32nd SMW and persisted up to 34th SMW. This period (8th - 26th August) experienced excess (12%) rainfall. Rainfall for the ensuing period i.e.35th week onwards remained dry, however the week 38th received rainfall of 28.5 mm. The total rainfall received during kharif season was 419.8 mm (2nd July to 15th October). It was 46.5% less than the normal kharif rainfall (781.8 mm) and hence the year has been characterized as severe drought year. Previously severe drought occurred in 1971 and 1978. The earlier large drought (31-40% deficit of rainfall from average) occurred during 1985, 1993 and 1999. The frequency analysis revealed that severe drought occurred once in 11 years. The mean maximum and minimum temperature during the season was found to be 35.0 and 24.9 °C respectively corresponding to their normal values of 34.4 and 24.0 °C. The weekly anomaly ranged between 0.4 and 4.9 °C in maximum temperature and 0.1 and 3.1 °C in minimum temperature. Thus, kharif has also been characterized as warm season due to excess of 213.8 °C heat unit anomaly than normal.

(Suchit K. Rai, Pradeep Behari and Atar Singh)

Stylosanthes hamata - A Potential Range Legume for Higher Biomass Yield under Elevated CO₂

Stylosanthes hamata was grown under three environmental condition i.e. elevated CO₂ at 600 ± 50 µmol m⁻²s⁻¹ (C₆₅₀), OTC (C₀TC) with ambient CO₂ and open field (C₆₀₀). The photosynthetic rate (Pₚ) of stylo grown under C₆₅₀ increased significantly. The increase was to the tune of 36.45% and 13.95% under C₆₀₀ and C₀TC respectively over the open field grown crop. The leaf area index (LAI) also showed a significant change in C₆₅₀ over open field condition. The canopy photosynthesis (Pₚ × LAI) increased up to 64.86% and 46.67% in C₆₀₀ and C₀TC respectively over open field grown crop, indicating its higher biomass production in terms of fresh and dry. The increase in fresh biomass was 39.33% in C₆₀₀ and 23.06% in C₀TC and the dry matter increase was to the tune of 39.79% (C₆₀₀) and 31.02% (C₀TC) over the open field condition. The Pₚ/CINT, which indicates the carboxylation efficiency is less in C₆₀₀ indicating the higher assimilation CO₂ for unit dry matter production. The transpiration rate (E) also responded as per the photosynthetic rate. The photosynthetic water used efficiency (Pₚ/E) showed a higher value (2.153) in C₆₀₀ followed by C₀TC (1.685) and open field (1.275) showing the interactive effect high level CO₂ in the efficient utilization of water for the higher productivity under elevated CO₂.

(M.J. Baig, R.K. Bhatt and H.S. Tiwari)
Stylosanthes research and development at IGFRI, Jhansi is at a very exciting stage. The versatility in adaptation and usefulness of this legume under different agro-ecological conditions has made it very attractive to various clientele. Stylo has been a very important pasture legume for grasslands and wastelands in recent years. This, in fact, is the only legume available for such purposes. Among the successful species, *Stylosanthes* have become essential components of many degraded land development programs. As a component of Agroforestry and silvipastoral systems, *Stylosanthes* plays a significant role in the stabilization and sustainable utilization of degraded lands. For instance, Stylo is used with grasses for soil conservation and land stabilization. The potential of stylo for soil improvement through nitrogen fixation and carbon sequestration provides added nourishment to the associated vegetation.

Germplasm augmentation for different habitats and production situations is the major research priorities for this genus. Large number of genotypes of *Stylosanthes* from different countries introduced at IGFRI, Jhansi are evaluated for their growth performance, biomass production, seed yield and quality characters. Among many, *Stylosanthes seabrana* has been identified as the most promising genotype in terms of establishment, quality and regeneration potential under semi-arid condition and therefore found suitable even for drier area. The seed yield production potential was also observed higher in *S. seabrana* over the other genotypes/species of stylo in Jhansi condition. In general, 200-250 q/ha fresh biomass has been obtained.

(P.S. Pathak, R.K. Bhatt and A. Chandra)

Seed Purity Analysis in Some Pasture Species

Well grown pasture species produced large quantity of seeds much more than which can be harvested, but the harvested seed yield depends on the time of seed maturation and seed collection. New seeds developed progressively at different times according to the emergence of tiller as each may then flowered over a period of some days or weeks. The continuous flowering complicates the pattern and turn over of seeds that are produced from the standing crop and again depends on the retention and the seed shedding (loss) percentage. Due to continuous seed production and seed shedding, only a little quantity of seeds harvested from the standing crops, which we call the harvested seed yield - usual criterion for assessing the total seed yield in grass species.

The physical purity of the seed in lot of grasses depends on the yield potential of a variety, isolation distance between the varieties/species, management practices, harvesting and processing. As we know that *Chrysopogon fulvus, Cenchrus ciliaris, Pennisetum pedicellatum, Panicum maximum* and *Setaria sphacelata* are apomictic in nature and therefore, there is no problem in maintaining the genetic purity during the quality seed production. The seeds harvested, collected and processed in these grass species have been analyzed for impurities, such as admixture as soil particle, flower stalks, broken seeds, pieces of leaves, chaffs, other crop seeds and weeds. The physical purity status of seed lots is judged by the pure seeds in term of filled seeds.

The working sample for purity analysis was calculated on the seed test weight basis of the filled seeds (2500 Nos.). As all the grass species contain different percentage of filled seeds, therefore, the percent of empty seeds was also added for taking the samples for purity analysis and on this basis, the quantity of working sample was calculated for different grass species. *Stylosanthes hamata* maintained maximum filled seeds followed by *P. pedicellatum* and *P. maximum*. The working sample for purity analysis in *C. ciliaris, C. fulvus, P. maximum, P. pedicellatum, S. sphacelata* and *S. hamata* calculated in the experiments as 6.24, 9.30, 1.96, 5.00, 3.40 and 7.62 g, respectively.

(R.K. Bhatt and R.K. Tripathi)
IGFRI ACTIVITIES AT A GLANCE

International Training Course on Forage Development and Seed Production sponsored by the Government of Ethiopia was organised from September 6 to October 14, 2004.

The Research Advisory Committee Meeting was held at the Institute on June 12, 2004 under the Chairmanship of Prof. V.P. Gupta.

Study visit on Forage Development and Seed Production was organized for Ethiopian Delegates from September 7-12, 2004.

संस्थान में सितम्बर 14, 2004 से आयोजित 'हिंदी चेतना मास' का उद्घाटन ज्ञा प्रेम शरक पाठक, निदेशक द्वारा किया गया।

Retirements from IGFRI

Sri Mathura Prasad, T-5 retired on May 31, 2004

Sri Hari Singh, T-4 Driver retired on June 30, 2004

Sri Thakur Das, Chowkidar retired on July 31, 2004

We wish them a happy and healthy life.

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Published by: Director, IGFRI, Jhansi and Printed at: Mini Printers, Jhansi. Ph.: 2447831, 2446820