North India Organic Farming Conference was organized at Indian Grassland and Fodder Research Institute, Jhansi on February 9-10, 2008 in association with Organic Farming Association of India, Mapusa, Goa and IGFRI, Jhansi. The conference was inaugurated by Mr. D.P.B. Jagmohan, Commissioner of Jhansi Division and attended by 150 participants from U.P., M.P., Chhatisgarh, Rajasthan, Bihar, Jharkhand, Sikkim, J&K, West Bengal, Karnataka, Tamilnadu, Mahajarashtra, Gujarat, Delhi and Goa. The Chief Guest stressed the need for scientific collaboration between Govt. organizations, NGOs and farmers for better management of crop, fodder and livestock production.

In the inaugural session, the participants deliberated upon the sustainability aspects and the need to live in harmony with the nature. The drawbacks of the input driven Green Revolution with excessive use of fertilizers, pesticides and water resources were highlighted. The loss of diversity and the problems of monoculture caused concern among the participants.

The first Technical session was chaired by Dr. S.B. Tripathi, who highlighted the issue of severe depletion of micronutrients from soils because of over exploitation over four decades. The loss of indigenous varieties of crops because of promotion of fertilizer and irrigation responsive hybrids were also highlighted. Dr. M.M. Roy described the issue of 'Drought and fodder availability', focusing on Government policies and strategies. Dr. S.B. Maity in his presentation 'Why organic farming?', dwelt upon the standards of maximum residue limits for pesticides, antibiotics and hormones in meat and milk in the context of the feed. He stressed for the promotion of Gir and Shahiwal breeds of cattle evolved under Indian conditions. Dr. Anil Kumar spoke on 'Livestock management in flood prone areas' to make a strong case for advance planning and preparedness. He emphasized that while the state administration does ground surveys and relief operation in drought affected areas, hardly anyone ventures into flood affected areas, which are largely inaccessible during the flood period. While human beings get food packets air-dropped to them, no one bothers about the livestock. A large number of them starve to death during every flood, decimating the cattle population and upsetting strategies for organic farming. Dr. U.P. Singh made presentation on pulse varieties developed at B.H.U. useful for farmers all over the central and eastern regions of India. The varieties included Malviya Jyoti, Malviya Jagriti, HUM-12, HUM-6 (Green gram); Malviya – 6 and Malviya –13 (Pigeon-pea); Malviya Matar–2 and Malviya matar-15 (Peas); Rajmash (Frenchbean) and Malviya-Vishwanath (Lentil) etc.

The second and third sessions were interactive with farmers sharing their experiences of growing organic food by adopting various indigenous methods. Mr. Mahesh Sharma explained the usefulness of System of rice intensification or Madagascar method of transplanted rice using native rice varieties like HMT, Dhubraj, DRK and Saathi which use only 2 kg seeds per acre as against the traditional broadcasting of 36 to 70 kg. Mr. Shiv Narain Patel from Banda (UP) shared his experience with SANJIWAK [10 litres urine + 2kg dung +200 g system.
Sustainable growth in livestock sector is crucial for the overall growth of agriculture to provide income and employment. It contributes 4.36% to the overall GDP (24.72% of the agricultural GDP). During drought years livestock wealth comes to the rescue of the farmers. Over the years there has been a definite shift towards resilience on livestock for income and employment generation by a large segment of people. Where dairy co-operatives have been successful, the farmers have stayed back in the villages relying on dairy animals for major share of their income. In peri urban areas, educated unemployed youths keep 4-5 milking buffaloes to sustain their families. It is not inappropriate to say that cattle and buffaloes are now sustaining families in peri urban areas. Thus, the livestock production system is also undergoing a unique change towards intensification. The factors driving this change are increase in demand for livestock products because of changing dietary habits of people brought about by urbanization, increase in income and population growth.

But are we equipped to meet the surge in demand with due consideration for ensuring the livestock owners a fair price and simultaneously, making them affordable for the consumers. Fodder and feed constitute about 60% of the total cost of milk production. It has been established that the cost of milk production can be significantly lowered by improving feeding system based on green fodder and replacing ingredients of concentrate with leaf meal, enriched nutrient complete feed block etc. With favourable climate in the Indian subcontinent, we should take advantage of it by adopting round the year fodder production and conserving the excess for lean period feeding duly supplemented with leaf meal of leguminous fodder trees and range legumes.

There is need for proper fodder extension agency in Animal Husbandry department and milk cooperatives in all the states. Establishing and strengthening the fodder development agency will have a direct bearing upon the livestock productivity. The Punjab state which has the best managed fodder department has the highest per capita milk availability in the country. They have fodder development officers' right up to the block level which provide the technical advice and input to the farmers' to take up fodder production activities in a big way. On the other hand most of the states have only a skeletal administrative set up or no setup at all for fodder improvement. The farmers' are willing to take up fodder production but they do not know what to grow and where to get the quality seeds. In most of the states, the fodder production is under the veterinary department, for which this activity takes least precedence. Many a times, it is being managed by non experts in fodder who take the first opportunity to move out of this unglamorous work and whatever the little posts are there, most of them remain unfulfilled.

The utter neglect of this important activity of fodder resource development in the livestock production programme is a serious drag in realizing its potential in livestock sector. It gets only 15.7% of the research allocation in spite of the fact that it contributes 24.7% of the agricultural GDP. Of the 15.7% research allocation to livestock sector, the fodder research gets a meagre share although 60% of the milk production cost is incurred on feed and fodder. We should salute the zeal of millions of farmers who have made us the highest milk producer in the world. A second revolution in the livestock sector is the need of the hour to make it more cost effective through extensive use of green fodder. The demand for setting up fodder and grazing committee in all provinces was raised during the second cattle conference held at Shimla in 1937 which still remains unfulfilled. The situation as of now indicates that Punjab has 130 officials involved in fodder development, 5 states have 50-100 officials, 4 states 25-50 officials and the rest have less than 25 fodder development officials. Unless the fodder production programme is given the importance it deserves, accelerated growth in livestock sector will continue to elude us.

K.A. Singh
Director
Typology of livestock farms of Belgaum district of Karnataka

Livestock farms vary widely within and between the regions. Scientific classification of these farms based on various parameters would help to understand the differences among them and also to target the research and development programs. Typology is a logical and scientific mechanism to categorise the variations prevailing in a particular system. Typology of livestock farm of Belgaum district was done by surveying 160 farms and analyzing data of 9 quantitative variables to principal component analysis.

Based on the principal component analysis, the farms were categorized into 17 types (Table). Most of farms (37) belonged to type 10 characterized by big farms with less than 9 adult cattle units, poor fodder management and low livestock income. This was closely followed by type 2 having 36 farms, having similar characteristics as type 10 except that it belonged to small farms. Type 1 had 15 farms which was characterized by having no land holding. Thus, in Belgaum district majority of the farms belonged to type-10, 2, 9, 1 and 4. Most of the farms were characterized by poor fodder management and low livestock income. Hence, such farms need to be targeted for research and development programs to improve the fodder management and livestock scenario in Belgaum district of Karnataka.

(P. Pushpa and Nagaratna Biradar)

Table: Typology of livestock at Belgaum district

<table>
<thead>
<tr>
<th>Farmers' category</th>
<th>Livestock holding</th>
<th>Fodder management</th>
<th>Income group</th>
<th>Typology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Landless (15)</td>
<td>Livestock (any number)</td>
<td>-</td>
<td>-</td>
<td>Type 1</td>
</tr>
<tr>
<td>2. Small farmers (79)</td>
<td>Up to 9 adult cattle (54)</td>
<td>2aa Poor fodder management (38)</td>
<td>2aaa Low income (36)*</td>
<td>Type 2</td>
</tr>
<tr>
<td></td>
<td>2ab Better fodder management (16)</td>
<td>2abb High income (3)</td>
<td>Type 3</td>
<td></td>
</tr>
<tr>
<td>2b &gt;9 adult cattle (25)</td>
<td>2ba Poor fodder management (38)</td>
<td>2baa Low income (01)</td>
<td>Type 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2bb Better fodder management (16)</td>
<td>2bbb High income (19)</td>
<td>Type 5</td>
<td></td>
</tr>
<tr>
<td>3. Large farmers (66)</td>
<td>Up to 9 adult cattle (48)</td>
<td>3aa Poor fodder management (43)</td>
<td>3aaa Low income (37)</td>
<td>Type 10</td>
</tr>
<tr>
<td></td>
<td>3ab Better fodder management (5)</td>
<td>3aab High income (6)</td>
<td>Type 11</td>
<td></td>
</tr>
<tr>
<td>3b &gt; 9 adult cattle (18)</td>
<td>3ba Poor fodder management (11)</td>
<td>3bba Low income (03)</td>
<td>Type 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3bb Better fodder management (7)</td>
<td>3bbb High income (07)</td>
<td>Type 13</td>
<td></td>
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<tr>
<td></td>
<td>* Numbers in the parentheses indicate number of livestock farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small farmers: &lt; 5 acres; large farmers: &gt; 5 acres</td>
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<td></td>
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</tbody>
</table>

Agrobacterium mediated genetic transformation of Stylosanthes seabrana

Development of an efficient transformation protocol is one of the prerequisites for generation of transgenic Stylosanthes plants with certain desirable traits. In an attempt towards standardization of transformation protocol for Stylosanthes, embryogenic calli were co-cultivated for three days with Agrobacterium tumefaciens strain LBA-4404 harbouring pTOK-233. The plasmid contained scorable marker gene uidA for quick monitoring of the gene delivery process and nptII gene for selection of transgenic plants. When co-cultivated calli were subjected to GUS assay, GUS gene expression was observed in the transformed calli in the form of blue spots (Fig) but not in the untransformed controls. This standardized transformation protocol would be useful for the development of edible chara vaccine for animals.

(Suresh Kumar and Amaresh Chandra)
Enteric methane emission from Livestock sector

Livestock population and production have witnessed an increasing trend over past decades because increasing demand of food from animal origin. Global meat production is expected to increase from 233 m tons to 300 m tons and milk production from 568 to 700 m tons between 2000 to 2020. The highest growth rate in production and consumption of livestock products (meat, milk and eggs) is taking place in Asia. Establishment of thickly populated commercial dairies in the suburbs cities has made the livestock rearing more vulnerable to methane production primarily because of feeding system and manure management method.

Carbon dioxide, water, vapor, carbon flouro carbons (CFC), CH₄, N₂O and ozone in the atmosphere are the main green house gases. 59% of the methane production from agricultural sector comes form enteric fermentation, 23% from rice cultivation and remaining 18 % from manure pits, burning of crop residues and fertilizers application to soil. Since 1951 a constant increase in livestock wealth has been recorded. To feed the increasing livestock population industrial byproducts and unconventional feeds are increasingly being used as livestock feed. The utilization of feed resources (traditional and unconventional) varies with animal species and the nature of chemical entities present in them. Though enteric fermentation is the main source of methane production from livestock, animal manure and improper storage of feeds are other sources of green house gases. Anaerobic decomposition of manure results in more methane production than aerobically managed waste. National methane emission accounts for 18.1 Tg, of which agricultural sector contributes about 14.17 Tg. To the agricultural methane emission enteric fermentation and manure management accounts for 8.97 and 0.946 Tg, respectively (Ministry of Environment & Forest).

There exists a number of methods to reduce the enteric methane production through dietary manipulation (critical nutrient supplements, ionophores, probiotics, defaunating agendas, propionate enhancers, methanogenic bacteria inhibitors, and roughage concentrate ratio), feed and fodder processing and genetic modification of rumen microbes, breeding forages for higher propionate precursor contents. However, economically viable and practically feasible technologies is lacking which can improve the livestock nutrition besides making livestock rearing eco-friendly. Estimates of methane emission from Indian livestock have ranged from 7.25 to 10.4 Tg/year depending upon the availability and quality of feed resources. Methane inhibition not only reduces the energy tax of animal but also increases the energy value of feed. In view of the global concern for environmental safety/world ecology, this is an appropriate time to tap this valuable energy of CH₄ for livestock productivity.

India is richly endowed with livestock population comprising 185m cattle, 98m buffaloes, 62m sheep, 124m goats and 16m other livestock. It contributes nearly 20% of the world’s ruminant livestock population. In ruminants, dry matter intake (DMI) is a function of animal body weight. The DMI (% b.wt.) per day in cattle
and buffalo ranges from 1.8 to 2.8. It has been estimated that the DM requirement of all the livestock in India would be 654 MT against the availability of 479 MT. Cultivated forage crops, crop residues, dry fodder from self owned or community land and grazing from wasteland, degraded land are the major feed and fodder sources. Most of the states are deficient in DM requirement except Punjab, Haryana and Arunachal Pradesh.

The weighted average of annual methane emission for the breeding stock (37.11 kg) was the highest followed by breeding and working stock (34.71 kg) and working stock (29.41 kg). Young calf (< 1 year age) produced about 4.05 kg methane per year. Methane emission by breeding bulls (buffalo) is higher (57.04 kg) than crossbred (35.64 kg) or indigenous bull (30.99 kg). Methane emission from lactating cows (47.01 kg) was observed to be higher than the dry stock (25.72 kg). Dairy crossbred cow, indigenous cow and buffalo emitted about 44, 26 and 65 kg methane /head/ year. Methane emission from buffalo was higher than either crossbred or indigenous cattle, which maybe attributed to their higher, body size and feeding of low quality roughage based diets.

Enteric methane emission from Indian livestock has been estimated to be 8.49 Tg/ year. Contribution of crossbred cattle, indigenous cattle, buffalo, goat and sheep in methane emission through enteric fermentation was 7.84, 37.59, 46.01, 5.27 and 2.23% respectively. The other livestock (horse, mule, camel, donkey, pig, yak and mithun) contributed only 1.06 % of total methane emission. Methane emission from male cattle and buffalo is 2.22 Tg/year. Of the total emission from livestock 28.5% is contributed by male and the remaining by females.

Dairy crossbred cows, indigenous cows and buffaloes emitted about 63.8, 45.5 and 64.0 % of the total methane emission by the respective categories of female livestock. On an average, dairy animals emitted 58.6 % of total methane emitted by female animals. Methane emission from crossbred female cattle (0.56 Tg) was higher than their male counterpart (0.10 Tg) due to their higher population but it was similar in indigenous female (1.60 Tg) and male cattle (1.59 Tg). Female buffalo emitted 3.4 Tg against 0.53 Tg from male buffaloes due to their large population. 17.9% of the methane produced by sheep and goats were contributed by animals less than 1 yr and the remaining 82.1% by animals more than 1 yr.

The highest amount of methane from livestock was produced in Uttar Pradesh (19.40 %) followed by Maharashtra (9.36%), Madhya Pradesh (8.19%), Andhra Pradesh (8.06%) and Rajasthan (7.70%). The major source of methane emission in Madhya Pradesh, Maharashtra, Orissa and West Bengal are from cattle whereas, in Uttar Pradesh, Rajasthan, Andhra Pradesh, Punjab and Haryana are from buffaloes.

Methane emission per kg milk produced has been worked out to be 96.37 g CH₄ taking into account 8.49 Tg of methane produced and 88.08 MT of milk produced in 2002. Total methane emission from cattle, buffalo and goat is 8.21 Tg, based on which the methane produced per kg milk comes out to be 93.20 g. Considering the methane emission of 5.87 Tg from all female cattle, buffaloes and goats irrespective of their age and production status, the value comes out to be 66.64 g CH₄/kg milk and considering only lactating animals the value was about 47.28 g CH₄/kg milk. Methane emission per kg milk yield in crossbred cows is 23.03 g whereas, in indigenous cows it is 37.62 g. Buffaloes emitted about 45.05 g CH₄/kg milk which is higher than indigenous cows. Highest methane production (g/kg milk) was found in Assam and Orissa (80.10 and 85.80) as compared to other states.

**Researchable issues**

Several research areas can be explored to evolve strategies to reduce vulnerability of livestock to methane emission.

1. Screening of tree leaves and shrubs for their anti-protozoal and antimicrobial activities.
2. Exploitation of phenols and tannins and other anti-nutritional agents as potential methane inhibitor or possible rumen fermentation manipulator.
3. Chemicals of plant origin and plant extracts particularly from the unconventional resources should be tested for their defaunation and anti-methanogenesis properties.
4. Evaluation of forage specific processing techniques for reduced methane production.
5. Development of total mixed rations to harness eco-friendly and higher animal productivity through varied proportions of crop residues, tree leaves, legume and non-leguminous crops based on their precise chemical evaluation for varied carbohydrate and protein fractions, their utilization and interaction with anti-nutritional constituents.

It goes without saying that reduction of methane flux from livestock rearing (enteric fermentation and animal waste) through appropriate technologies related to feeding/nutrition and animal waste management will slash the methane concentration in environment. There is need to develop economically viable and practically feasible indigenous technologies that can be adopted under small and medium farm conditions.

*(Sultan Singh, K.K. Singh, M.M. Das, Anil Kumar and A.K. Misra)*
Densification of crop residues and grasses for fodder bank development

Crop residues and dried grasses have very low density and occupy large space during storage and transportation. Their handling consumes lot of manpower which renders their storage, transportation and handling an expensive venture. Experiment conducted at IGFRI have showed that paddy straw having 40 kg m\(^3\) density could be densified five times (165-200 kg m\(^3\)) with the help of IGFRI densifying machine. Similarly, densified dried grain had an average density of 290 kg m\(^3\) with a dimension of 41.8 x 30 x 30.8 cm\(^3\) (LxWxH). 10-12 such blocks produced per hour using IGFRI densifying machine. In January 2008, for the purpose of creating of fodder bank at this Institute, 13.5t of grasses were baled producing 1200 blocks. The process of making blocks of crop residues and dried grasses, involves feeding them into the machine run by electricity and tying them by wire inside the machine, producing densified blocks of 10-15 kg. The benefits of the densified blocks are, easy to transport from surplus to deficit areas during natural calamities, the cost of transportation is reduced by 4-5 times, the feeding materials could be carried in fewer trips, requires less space for storage, somewhat safe from fire hazard as compared to loose material and prevents nutrient loss during long term storage. Besides, nutrient enrichment/value addition is also possible in all type of crop residues, moreover, handling of block is convenient during feeding, storage and other operations.

(P.K. Pathak and P.N. Dwivedi)

Occurrence of wilt and loose smut in oats

Oats (Avena sativa L.) is one of the important graminaceous green fodder, rich in crude protein and grown during rabi season. During Rabi 2007-08, occurrence of two diseases namely sclerotial wilt and loose smut were found to be severe at the IGFRI experimental farm.

The sclerotial wilt is caused by Sclerotium rolfsii. It is also known as southern wilt, collar rot, foot rot or crown rot. The disease made appearance in the first week of February and progressed slowly until mid of April. The maximum disease incidence of 10 per cent in first week of April, 2008 in oat cultivar IGO3-209 was recorded. The infected plants showed yellowing and partial wilting at the initial stages (Fig. 1) which later on wilted completely and dried (Fig. 2). Close observation of this infected plant revealed white cottony mycelium on the infected portion of the stem as well as the adjoining soil (Fig. 3). At crop maturity, mycelium mat aggregated and converted into light to dark brown or black, small circular, mustard grain like sclerotia attached to the infected portion of stem and adjacent soil (Fig. 4). The sclerotia serve as primary source of infection for the next crop.

Another disease, loose smut is caused by Ustilago avenae which is a seed borne pathogen. The infected earhead in oat was converted into black powdery mass of sori. Numerous dark brown to black spores known as teliospores were present in sori. On rapture of sori, teliospores were blown by the wind or fell down leaving naked rachis (Fig. 5). Teliospores infect the gynaecium of healthy plants and carry the infection to next season through infected seeds. The smut incidence in oats varied from 1-8 per cent in different genotypes. Maximum disease incidence (8%) was observed in oat genotype EC-605836 followed by EC-605835 and EC-605838 in the third week of April.

(Pradeep Saxena, K.K. Pandey, R.B. Bhasker, Shahid Ahmad and P.K. Tyagi)
Gur fermented in a mud-pot for 15 days] as soil activator. Mr. Jayant Vaman Barve, a pesticide dealer- turned organic farmer informed that his organically grown grapes command premium in the market. Mr. Rajeshwar Singh suggested that farming should be planned in such a way that 20% of the land is reserved for horticulture, 10% for vegetable cultivation and the rest can be used for growing cereals, oil-seeds, pulses etc.

The fourth session was chaired by Dr. O.P. Srivastava, who emphasized the need for healthy soil for healthy crop. Organic manure are essential to bring back the living organisms of soil. The house then discussed the OFAI - Participatory Gurantee Scheme (PGS) for standardization of organic farms and the products. Miguel Braganza, Jayant Barve and Bharatendu Prakash described the procedure of standardization and organic labeling process in detail. Vijai Jardhari (well-known for Uttarakhand seed movement) highlighted the need for seed sovereignty for the farmers. This was followed by presidential remarks by veteran freedom-fighter Laxmi Narayan Naik, ex-MP. The house also discussed the various problems faced by the farmers in different regions of the country like drought, flood, hilly region etc. In the afternoon the farmers visited the IGFRI farm and appreciated the project on organic milk production involving indigenous cattle breeds like Sahiwal, Gir and Tharparkar, which address all the steps involved right from site selection to on farm fodder and concentrate production and utilization, livestock housing, welfare etc.

The plenary session was chaired by Dr. G.S. Kaushal, ex-director of Agriculture, MP. The need for strengthening the organic movement in the country was emphasized for long term sustainability of agricultural production and the overall well being of human race. The house came up with a number of suggestions to encourage organic farming:

1. Initiating model farm-centers for demonstration and training in organic farming
2. Sharing and publication of relevant literature
3. Encouraging PGS marketing, especially within our own region and country
4. Exchange of produce, seeds and experiences
5. Demonstration of better earning, healthy households and self-reliance in farming communities adopting organic ways
6. Developing an understanding of living soils and the importance of cattle in the context of organic farming.
7. Creating movement towards organic life-style and respect to nature.

(N. Das and S.B. Maity)

Bench grafting in custard apple

Custard apple (Annona squamosa L.; family: Annonaceae) is one of the most delicious fruit crop of semi arid ecosystem. The plant is hardy in nature because of leaf shedding phenomenon during moisture stress period. It is well adapted to arid and semi arid conditions with average annual rainfall upto 600. Annona leaves contains Annonine, which protects the plant from being grazed by animals. Therefore, it has great potential for introduction in agroforestry as well as hortipastoral system in semi-arid situations. Bench grafting technique provide scope for production of quality saplings with fairly developed root system for field establishment within short duration. The technique can be adopted by nursery owners and farmers interested in developing custard apple orchard of good cultivars like, Balanagar, Arka Sahan etc. Bench grafting in custard apple was performed on one-year-old root stock using cleft method of grafting. About one year old seedlings of locally available custard apple attaining pencil thickness was used as root stock. In May-June, it was cut at 7-8 cm height from base and a 'V' shaped incision (4-5 cm size) was made by a sharp knife. The tap root was slightly pruned at 12-15 cm in order to induce fibrous root development.

The scion was prepared from one year old shoot length 10-15 cm with 2-4 buds of desired cultivars having similar thickness. The basal end of scion was also cut into 'V' shaped wedge, matching the opening in the root stock. The scion was then penetrated into the root stock and firmly tied up with polythene strip. These grafts may be kept bundled in moist gunny bags for up to 2-3 days before planting. Under nursery condition, the grafts were planted in polythene bags having soil: FYM : leaf mould in ratio of 1:1:1. The grafts were then covered with polythene tube having size of 20x3 cm. The transpired water accumulates as vapour in polythene tube providing a sort of mist microclimate to the grafts and scion which sprout in 7-10 days. After about 20 days upper end of polythene tube was cut to allow straight growth of the sprout. Dormant scion shoots having 0.6 cm thickness used for grafting gave highest graft success (96.4%).

(Sunil Kumar and A.K. Shukla)
Training programme for Finance & Accounts manpower conducted by NAARM, Hyderabad at IGFRI, Jhansi (January 16-21, 2008)

IGFRI celebrates Republic Day 2008

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