IGFRI Newsletter

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Director's Desk……..

Farmers from South Asia are pumping black carbon, popularly known as soot, in to their skies through rice residue burning. This along with other pollutant gases and particles results in a brownish haze or brown cloud in the atmosphere and forms harmful smog in the cities of the affected region. These have many environmental and health related consequences. The paddy straw is mainly burnt so those fields become ready for wheat sowing quickly and cheaply. Burning leaves a soil that is easy to plough in readiness for the next crop. Many farmers believe that burning minimizes weed, pest and disease infestation and also increases soil fertility by adding the ash.

In order to reduce the burning of paddy straw in the field, multiple action approach is required that involves technological interventions, policy formulation and their application at the farmer's field level. The annual rice straw production in India varies from 100 to 125 million tones. Burning of rice straw is common in the field where harvesting is done using combined harvester that harvests the crop from about 30 cm height above ground level. In a combined harvested field, two types of rice residue remain after operation. One is bruised straw that has been harvested along with panicle and comes out from the machine after threshing is over. The other is standing stubbles in the field after the movement of combine harvester. The loose straw that has come out from combine may be collected well using field balers that are commercially available. Paddy bales are good basic input material in paper, pulp card board industry, boilers, power plants and packing industry. The bales are also suitable for long distance economic transportation to areas where it is used as animal fodder.

Left over standing stubbles in the field creates hindrance in sowing of next crop using any seed drill and if the quantity is more, straw does not decompose fully in the field even after the cropping season is over. There is the need to add decomposing agent in the field along with use of proper machinery for sowing next crop. Effective microbial consortia should be sprayed for its quick and increased decomposition. Suitable machinery including strip till drill and happy seeder are useful in such a situation to sow the wheat crop in standing stubble condition. Strip till drill performs tilling in the strip ahead of sowing tines so that standing stubble does not hinder the operation and sowing. Whereas, Happy Seeder cuts the standing stubbles, tills the soil, sows the seed and covers the seed with the straw-soil mulch. Both of these machines are suitable for quick sowing of wheat in standing stubble field condition after harvesting of paddy, provided straw load is less in the harvested field.

Rice straw can be better utilized by making it suitable feed material since this is not used as conventional feed in many parts of India. Rice straw can be treated with urea solution and conserved as feed material for feeding during lean season. A shorter growth period variety of rice would increase the time available after harvest and before sowing wheat. This would leave enough time to deal with the residue in ways other than burning.

Immobilization of Chaya leaf peroxidise on Calcium Alginate Beads

Peroxidases are important components of cellular defense mechanism against oxidative stress caused by both biotic and abiotic factors. In addition, they are also used in several industrial processes and diagnostic kits. Horse radish peroxidases (HRPs) are used in various ELISA kits. We have partially purified the guaiacol peroxidase (GPX) from Chaya leaves using various biochemical techniques. The enzyme was immobilized in Calcium alginate beads. The peroxidase activity was retained in the beads. The beads were stored in different concentrations of alcohol (0, 50, 70 and 100%) and at two different temperatures (4°C and RT). The activity in the beads were measured regularly. It was found that storage in 70% alcohol at 4°C was the best. Interestingly, the beads retained the peroxidase activity even after 3 years of storage in 70% alcohol at 4°C. Thus, these beads may be used in the ELISA kits and other kits using peroxidase as enzyme without the requirement of freezing temperature.

Fig. 1 Calcium alginate beads of Chaya peroxidase

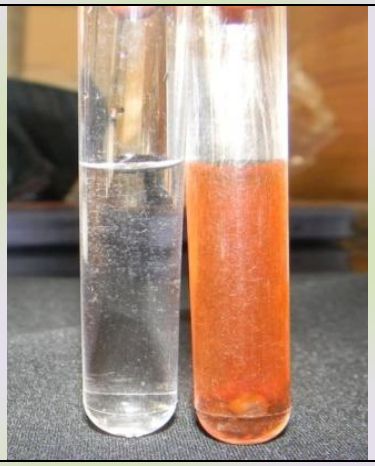

Fig. 2 Peroxidase activity in calcium alginate beads

(M.K. Srivastava, Shachindra Kumar, A. Radhakrishna, K.K. Dwivedi and Anil Kumar)

Agrobacterium-mediated genetic transformation of callus derived from *Sehima nervosum*

We hereby report successfully the callus induction and transformation in *Sehima nervosum*, commonly called sen ghas, for the first time. Callus was derived from seed explants of this grass on Murashige and Skoog medium with various concentrations of 2,4-D followed by infection of embryogenic calli with *A. tumefaciens* strain EHA105 harbouring binary vector pCAMBIA1305.1 with *GUS* gene. The highest percentage (90%) of transformation efficiency was obtained in the calli inoculated with *Agrobacterium* for up to 30 minutes at OD_{600} of 1.0, followed by 83% and 81% at OD_{600} of 0.6 and 1.0, respectively (Fig 3). This information may be important in view of generating transgenics in this important crop. Furthermore, this exceptionally high response to callus and transformation in this crop showed its potential as a model crop to undertake biotechnological approaches for perennial range grass improvement.

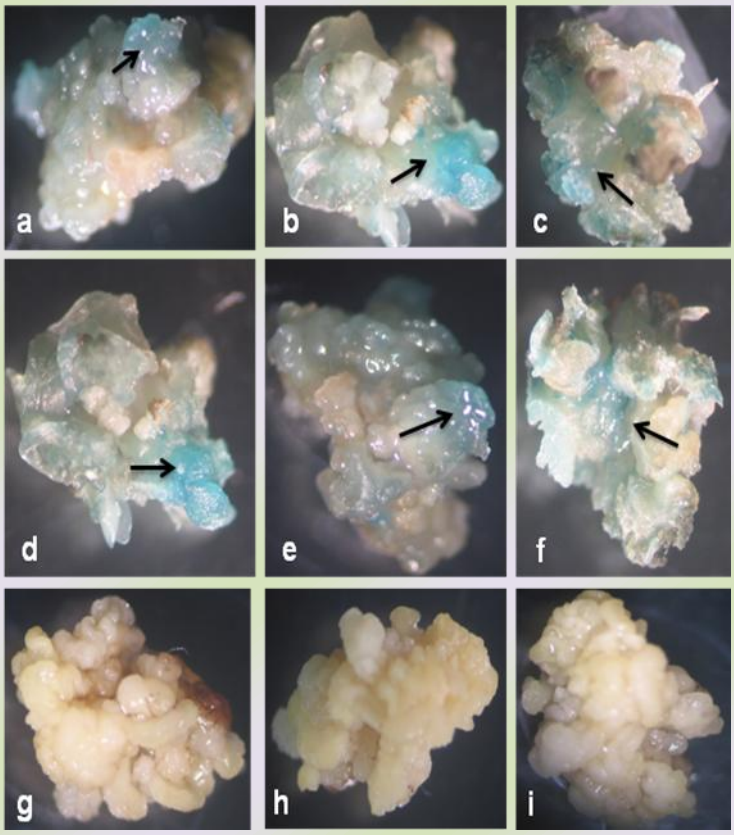

Fig. 3 *Agrobacterium*-mediated transient GUS gene expression in *Sehima nervosum*: (a, b, c, d, e and f) Transient GUS gene expression in embryogenic calli (indigenous blue color) after co-cultivation with *A. tumefaciens* strain EHA105/pCAMBIA-1305.1 (arrow indicates); (g, h and i) No GUS gene expression in control.

(K.K. Dwivedi, R. Katiyar and A. Radhakrishna)

Pseudo-vivipary in *Pennisetum pedicellatum*- First report

Vivipary is a method of propagation in several species, where the seed germinates while it is still attached to the mother plant and young seedling falls after considerable growth. Whereas, in pseudo-vivipary the components of spikelets turn into plantlets without roots. Vivipary is prevalent in Poaceae crop species *viz*., rice, barley, oat, rye, maize etc. However, pseudo-vivipary was reported only in 21 genera of Poaceae family. In *Pennisetum* genus earlier in *P. setaceum* and *P.polystachion* pseudo-vivipary was reported. However, this is the first report of pseudo-vivipary in *Pennisetum pedicellatum*. *Pennisetum pedicellatum*, commonly known as Dinanath grass, having both annual and perennial forms. Pseudo-vivipary was observed in the perennial forms during the month of July, 2014 and 2015at different locations of the central farm of Indian Grassland and Fodder Research Institute. The inflorescence in *Pennisetum pedicellatum* is a spike containing numerous spikelets (Fig.4). In general, apomictic seed formation occurs in these spikelets. Due to pseudo-vivipary the spikelets revert back from reproductive development to vegetative development resulting in formation of plantlets having leaves without roots (Fig. 5 & 6) attached to the mother plant for their development. It was interesting to note that tussocks which produced

seeds in the previous season produce these plantlets. The changes in weather conditions during June-July months of 2014 & 2015 might have triggered this reversion from reproductive to vegetative stage. Therefore, in depth studies to understand this new phenomenon in Dinanath grass is further needed.

Fig.4 Normal spike of Dinanth (perennial)

Fig.5 Psuedo- vivparous spike of Dinanth (perennial)

Fig. 6 Spikelet of pseudo- viviparous spike

Livelihood Improvement and Capacity building of SC farmers through forage based livestock production in Bundelkhand

This project proposed scaling-up of adoption of fodder production and utilization modules among SC farmers and their capacity building will help them to improve their livelihood through improved livestock rearing practices. Hundred SC farmers from five villages namely Pipra, Kaina, Biharipura, Devendrapura and Babai were selected for implementing interventions. Round the year fodder production (4 sites) and forage-food cropping sequence (10 sites) were introduced which recorded 315q/ ha and 390q/ha green fodder yield respectively in Kharif season. Seasonal fodder crops introduced at farmers' field were Pearl millet (AVKB-19), Maize (African Tall), Sorghum (MP Chari), Berseem (JB-1 and Wardan) and Oat (Kent). Silage (05 sites), mineral mixture (30 animals) and medicines to control of endo and ecto parasites (82 animals) were introduced at farmers' field and average increase in milk of selected animals/ animal/ day was 10% and 15%. Forty three farmers and farm women were exposed to various improved technologies related to fodder production and utilization, animal breeding, feeding, health care, management, clean milk production etc. through gender based training programmes.

Fig. 7 Seasonal fodder crops

Fig. 8 Round the year fodder production system

Fig. 9 Silage making demonstration

Fig. 10 Capacity Building Programme

(Sadhna Pandey, Khem Chand, S.R. Kantwa, K.K. Singh and Sachendra Tripathi)

Summer School on "Recent approaches in crop residue management and value addition for entrepreneurship development"

A 21 days summer school on "Recent approaches in crop residue management and value addition for entrepreneurship development" sponsored by the Education Division, ICAR New Delhi was organised by the Farm Machinery and Post Harvest Technology Division from 14th July to 3rd August, 2016. Summer School was inaugurated by Dr NS Rathore, DDG (Edn) as a Chief Guest. Total 22 participants including two women trainees from 9 states of the country and from 13 disciplines of agriculture were participated in this summer school. Dr NS Rathore emphasized the importance of this training programme in context of fodder production and its management in the country. In his speech, he focussed on mechanization of fodder production, processing and utilization to ensure economic and efficient farm operation. Director, IGFRI outlined the reasons for low productivity of livestock and importance of crop residue management and value addition. A total of 67 theory classes/practical sessions/group discussions and field visits were organized during the course, out of which 52 lectures were presented including the four guest lecturers. The programme was organized by Dr PK Pathak as a Course Director, Drs SK Singh and CS Sahay as Course Coordinator and Drs RK Sharma, Manoj Chaudhary and A Maity as Course Co-coordinators.

Fig. 11 Glimpses of Summer School

Rice Residue Burning Scenario: Possible Approaches by Mechanization

Asian farmers produced 92 % of the world total rice [Foreign Agricultural Service – USDA, 1998] with two countries being dominant *viz*. China and India. Indian alone produced 57 % of the total rice crop. Straw makes about 50 % of the dry weight of the rice plants with a variation of 40 to 60 % according to cultivar and cultivation method. Rice straw has high potential as a source of lignocellulosic biomass since its yield is high in unit area of crop. About 5.6 to 6.7 tones/ha of dry straw is an average production with rice crop. For every ton of grain harvested, 1.35 ton of straw is left in the field. The proportion of recoverable straw depends on type of harvesting (manual or mechanical).

Rice straw demand is less in other uses including Industry. As feed material, its quality is low and it is not preferred as feed in many parts of the country. Removal of rice straw from the field is a cost involving operation. So, farmers prefer to burn it in the field which is cheap and it also helps avoid propagating fungal stem rot disease caused by *Sclerotium oryzae*. Large scale burning has created hazardous effect on the environment creating serious health concerns in the affected areas.

Incorporation of straw in the soil is full of problems as it tends to clog field implements. The straw is resistant to decay and can interfere with subsequent year operation if not ploughed to lower depths than the operations require. Soil incorporation of straw may reduce yield in the following crop and poorly drained soils.

Rice straw has potential to be used as Fuel, Fibre and Feed material in off-field conditions. It needs to be removed from the field for all possible uses. In-field baling is required in the field for its use in fibre and fuel Industry. Existing balers are suitable to pick loose straw from the field and bale it.

Fig. 12 Picking loose straw from field and baling

Table Cost of baling with field baler

Particulars of operation with field baler	**quantity**
Fixed costs, Rs/h	770
Running costs, Rs/h	491
Cost of tying material Rs/h	190
Total cost of operation, Rs/h	1451
Estimated baling capacity of loose straw with rice stubble standing in field condition, tonne/h	2.5
Cost of baling, Rs/q	58.0
Hours of use of baler in the season after harvesting of rice, h	200
Production capacity of machine in the season, tonnes	500
Command area of one machine, ha (with rice straw productivity of 6.7 tons/ha)	74.6

With the rice stubbles standing in the field, the capacity of baler would reduce and is expected to deliver about 2.5 tons of bales per hour. The cost of baling thus is Rs.58 per quintal. However, if whole straw is needed to remove from the field, a cutter bar needs to be fixed in front of existing balers taking power supply from telescopic PTO shaft.

Rice straw is a marginal feed material. It may be treated with ammonium hydroxide or sodium hydroxide at the time of standing stubble harvesting and baling to conserve the bales as feed material. In this condition a liquid tank needs to be added to the baler and spray guns with calibrated rate may be provided to serve the purpose. In this condition, baler would make bales of enriched rice straw that can be conserved, chaffed later and used as feed material.

(C.S. Sahay)

Glimpses of IGFRI Activities

Independence Day Celebration



Dr.I.P. Abrol, Ex-DDG visited IGFRI


Hindi Saptah

Retirements		
 Sri Aziz Khan Saman Wetan Shramik 30/07/2016	 Sri Dinesh Kumar Sirotiya Technical Officer 30/07/2016	 Sri Dayal SSS 30/07/2016
 Sri Janki Saman Wetan Shramik 30/07/2016	 Sri Dhani Ram Saman Wetan Shramik 30/09/2016	 Shri Narayan Saman Wetan Shramik 30/09/2016

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Editorial Committee: Drs. N. Das, G. Sahay, D.R. Palsaniya, Mr. Shailendra Sinha and Mr. Pawan Kumar
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