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Co 0238 – AN EXTRAORDINARY SUGARCANE VARIETY BENEFITTED MILLIONS BY REAPING BILLIONS

The sugarcane variety Co 0238 developed by ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal, has revolutionized sugar production in the country. It gives high yield (> 81 t/ha) with sugar recovery of > 12 percent. It has generated accumulative gross value of ₹ 1.208 lakh crores (~ $ 17.01 billion) whereas the total addtional benefit due to sugar and by-products was equal to ₹ 288.18 billion during 2014-15 to 2017-18, bringing livelihood-security and prosperity to millions of farmers in sub-tropical states especially Uttar Pradesh, Haryana, Punjab, Bihar and Uttarakhand. (Fig. 1)

Prologue

Sugarcane is the second most important commercial crop in the country. It is grown in about five million ha area and sustains the sugar industry which is the second largest agro-industry. At present, the crop engages about 12.34 million farmers and farm workers. The sugarcane productivity and sugar recovery have however hovered around 59.6-71.7 t/ha and 10.03-10.55 per cent, respectively in the country during 2001-02 to 2013-14, whereas productivity and sugar recovery in subtropical part of India (including U.P., Punjab, Bihar, Haryana and Uttarakhand) varied from 52.3-60.3 t/ha and 8.98 - 9.21 percent, respectively during the same period. The sugarcane variety Co 0238 (CoLk 8102 x Co 775) developed by ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal and released for commercial cultivation in North West Zone of subtropical region (Punjab, Haryana, Rajasthan, Uttarakhand, Central and Western U.P.) has revolutionized sugarcane cultivation in the sub-tropical part of the country.

Fig. 1. Performance of Co 0238 in farmers' field

Spread of Co 0238 in sub-tropical India

Being superior in yield and quality, the variety has spread at a considerable faster rate in the entire sub-tropical region of the country especially Uttar Pradesh, Haryana, Punjab, Bihar and Uttarakhand (Fig. 2). The area occupied by this variety increased from 2.70 (2014-15) to

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14.75 (2017-18) lakh ha in sub-tropical region, which is the highest ever area (30.3%) occupied by a single variety in the country in a very short span of time. Before introduction of Co 0238 in 2012-13, the share of sub-tropical region in sugarcane area and production of the country was 55.8 percent and 49.4 percent, which increased to 59.6 and 57.9 percent respectively during 2017-18.

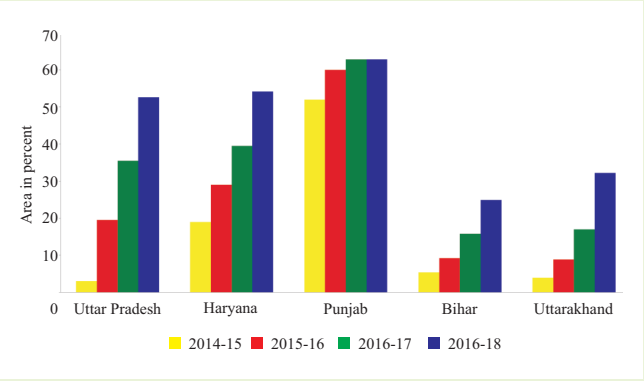

Fig. 2. Area of Co 0238 in percent

Impact of Co 0238 on cane yield and sugar recovery

The impact of Co 0238 on cane yield and sugar recovery per cent in sub-tropical states (UP, Bihar, Haryana, Punjab and Uttarakhand) was assessed during 2014-15 to 2017-18. Sugarcane area increased from 10 per cent (2.7 lakh hectare) during 2014-15 to 50.4 percent (14.75 lakh hectare) during 2017-18 (Fig. 3).

The average cane yield increased by 19 t/ha (i.e. from 60.0 t/ha in 2013-14 to 79 t/ha in 2017-18) and average sugar recovery improved by 1.49 units (i.e. from 9.21 per cent in 2013-14 to 10.70 per cent in 2017-18) in the above five states of sub-tropical India.

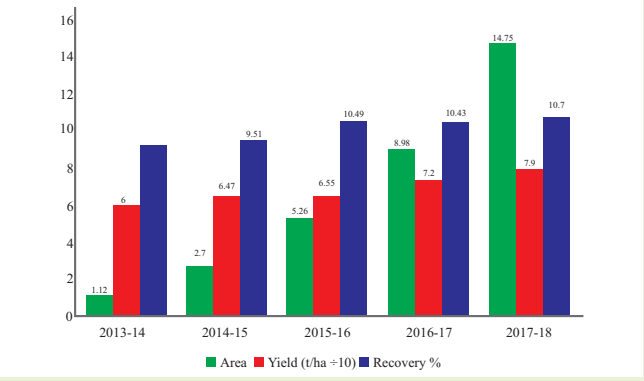

Fig. 3. Impact of Co 0238 on cane yield and sugar recovery in five states of subtropical India during 2013-14 to 2016-17

Economic impact of Co 0238

(i) Gross economic value: Economic impact of Co 0238 was assessed based on its area covered from 2014-15 to 2017-18. During this period, 275.06 million tonnes of cane of value ₹ 862.37 billion and 31.90 million tonnes sugar worth ₹1169.82 billion (Table 1) was produced in five sub-tropical states (UP, Punjab, Haryana, Bihar and Uttarakhand). In addition, Co 0238 also produced ₹ 35.76 million tonnes of fodder of value of ₹18.48 billion, 12.38 million tonnes of molasses of value ₹ 52.49 billion, 82.52 million tonnes of bagasse of value ₹ 162.57 billion and ₹ 0.83 million tonne press mud of value ₹ 1.63 billion. The cumulative gross value of Co 0238 from sugar and additional quantity of its by-products is estimated to be ₹ 1207.93 billion during the four years of its cultivation.

(ii) Additional profit to farmers and sugar mills: Due to increased cane yield, Co 0238 has produced additional 45.01 million tonnes sugarcane of worth ₹ 140.76 billion during 2014-15 to 2017-18 (Table 2). Similarly, higher sugar recovery of Co 0238 led to production of an additional 6.74 million tonnes sugar worth ₹ 250.07 billion (Table 2).

Apart from sugarcane and sugar, owing to its higher productivity and sugar recovery, Co 0238 produced additional fodder (5.85 million tonnes worth about ₹ 3.05 billion), bagasse (13.50 million tonnes of value ₹26.43 billions), molasses (2.03 million tonnes fetching ₹8.37 billions) and press mud (0.135 million tonnes worth about ₹ 0.27 billions) during the period of 2014-15 to 2017-18.

The total additional benefit due to sugar and by-products was equal to ₹ 288.18 billion in four years through cultivation of Co 0238 in the five states of sub-tropical India (72.05 billion per year). During this period, Co 0238 has led to additional return of ₹143.81 billion to the farmers (from additional sugarcane and fodder) in UP, Punjab, Haryana, Bihar and Uttarakhand states. As a result, the profit of farmers in five subtropical states increased by about ₹ 45,405 per hectare.

Disclaimer: Impact analysis has been done on the basis of data received from offices of respective states' Cane Commissioners.

Socio-economic impact

- Increased income to farmers
- Increased profitability of sugar mills through improving the sugar recovery percentage.
- Increased investment in sugarcane agriculture due to improvement in income of farmers.
- Better education for children.
- Improved housing.
- Improved the quality of life of cultivators.
- Purchase of new tractors and farm implements.
- Thicker canes of Co 0238 led to adoption of wider row and trench method of planting by farmers which will pave way to mechanical harvesting in sub-tropical India in the coming years.

Co 0238 thus has brought in a Sweet Revolution and has benefitted the farmers and sugar industry in the country.

Crossing the zonal boundaries, this wonder variety is all set to swing its magic wand in the adjoining states in the coming years.

ADVISORY FOR RED ROT MANAGEMENT IN SUGARCANE

There have been many reports on social and print media about the incidence of red rot disease in the variety Co 0238, particularly in Central UP. On inspection of infected fields in 3 sugar mills (Nigohi, Ajbapur and Hariyawa) during October 11-12, 2018, mixture of atleast two other varieties (which are similar in characters and difficult to distinguish by non-breeders) was observed. Majority of the red rot infected clumps were of other varieties. The variety Co 0238 has been evaluated for prevalent pathotypes and isolates (CF01, CF02, CF03, CF07, CF08, CF09, CF11, Cf8436 (UPCSR), Cf8436 (RI), CfBln 05521, CfBO 138, CfCoSe 95422) of red rot by plug method during 2017 and showed MR / R reactions to all these red rot isolates. The variety has been evaluated against red rot, as a standard, under All India Coordinated Research Project (S) at different sugarcane research stations in the zone and has been rated as R / MR (except MS reaction at Shahjahanpur against one pathotype, i.e. CF09). These results indicate that Co 0238 has fairly high degree of resistance to red rot disease.

The seed supply records at ICAR-SBI, Regional Centre, Karnal revealed that only 574.11 quintal seed of Co 0238 has been supplied to 13 sugar mills, 6 farmers and UPCSR during 2007-08 to 2017-18 indicating thereby the spread of Co 0238 from farmers to farmers and not from the ICAR-SBI, Regional Centre, Karnal. Therefore, there is every possibility of varietal mixture at farmers' fields.

From the present scenario of red rot occurrence and spread of Co 0238, following management measures are suggested:

1. Mixture of red rot susceptible varieties in Co 0238 is the main reason for prevalence of disease in fields of Co 0238. Possibility of breakdown of resistance in any variety is more if inoculum load of disease is higher. This indicates the importance of pure / quality seed of Co 0238.
2. Quality seed may be brought from ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal and the same may be multiplied in a proper seed chain to replace all existing Co 0238 at present. Farmers need to be educated about the importance of pure/quality seed.
3. Produce from red rot affected plots should not be used as seed.
4. Crop rotation (paddy) may be followed for one year in red rot affected plots.
5. Such red rot affected plots may be harvested on priority basis and taking ratoon crop may be avoided.
6. As always suggested by me, since release of Co 0238, each sugar factory may have three major varieties in about 50%, 25% and 25% proportions. Entire area under a single variety would certainly lead to outbreak of any disease (including red rot) and / or insect pests.
7. All the other red rot susceptible varieties grown in the command area should be removed from cultivation to reduce the source of pathogen inoculum in the area.
8. Close inspection of nursery plots on regular basis to monitor the crop for its freedom from diseases and varietal mixtures.
9. Sett treatment with Thiophanate Methyl (0.1%) for 12 hours or the same treatment in Sett Treatment Device (20 minutes) has been found effective to eradicate sett borne infections of red rot. The same treatment prevents entry of soil borne inoculum and causing red rot in the planted setts and young crops till 90 days. The factories may advocate installation of sett treatment device for effective diffusion of fungicides inside the setts and manage red rot or smut in sugarcane.

The variety Co 0238, which transformed the entire sugarcane agriculture scenario in the sub-tropical India, has benefited both the farmers as well as the sugar industry. Therefore, all concerned should join hands to manage red rot in this variety. By following above measures, the life span of Co 0238 could be increased in the interest of both farmers and sugar industry. The ICAR-SBI, Coimbatore and ICAR-SBI, Regional Centre, Karnal would extend all possible assistance in this endeavour. You may contact ICAR-SBI, Regional Centre, Karnal scientists on following mobile numbers: Dr. Neeraj Kulshreshtha - 09315382163, Dr. Ravinder Kumar - 09813377502, Dr. M.L. Chhabra - 09416364031.

Table 1. Quantity of cane and sugar produced and their values since 2014-15

State	Cane produced (million tonnes)	Value of Cane (Rs. in billion)	Sugar produced (million tonnes)	Value of sugar (Rs. in billion)
Uttar Pradesh	226.73	713.32	27.10	996.51
Punjab	20.09	60.21	1.96	69.87
Haryana	17.00	54.77	1.76	64.07
Bihar	7.74	22.98	0.73	26.53
Uttarakhand	3.50	11.09	0.35	12.84
Total	275.06	862.37	31.90	1,169.82

Table 2. Additional benefit to farmers and sugar mills (2014-15 to 2017-18)

State	Additional cane produced (million tonnes)	Additional benefit to farmers (₹ in billion)	Additional sugar produced (million tonnes)	Value additional sugar produced (₹ in billion)	Yearly Additional Benefit (₹ in Crore)
Uttar Pradesh	40.01	125.15	6.284	233.554	5,838.9
Punjab	1.68	5.09	0.130	4.673	116.8
Haryana	1.54	5.04	0.210	7.68	192.1
Bihar	1.35	4.02	0.075	2.725	68.1
Uttarakhand	0.41	1.32	0.039	1.436	35.9
Total	**44.99**	**140.62**	**6.738**	**250.072**	**6,251.8**

Dr. Bakshi Ram, Director ICAR-Sugarcane Breeding Institute, Coimbatore

OUTREACH ACTIVITIES

MODEL TRAINING COURSE

A Model Training Course sponsored by Department of Agriculture and Cooperation, Ministry of Agriculture and Farmers Welfare, Government of India on 'Best management practices for sustained sugarcane productivity' was organized during 4-11 January 2018 (Fig. 4). Eighteen officers from the state department of agriculture from the states of Chattisgarh (2), Haryana (2), Himachal Pradesh (2), Jharkhand (1), Kerala (2), Maharashtra (2), Odisha (2), Tamil Nadu (2), Telengana (1) and Uttarkhand (2) attended the programme.

The course objectives were:

i. To impart knowledge about the recent advances in sugarcane production technology

ii. To provide hands on experience in techniques like varietal identification, juice analysis, identification of symptoms of pests and diseases etc.

iii. To provide field orientation to the scientific technologies adopted by the farmers

iv. To serve as a forum for exchange of information among the participants from various states through discussions

The course content was formulated in consultation with the subject matter experts available in each discipline. Based on the feedback obtained in the training programmes organized in 2017, necessary corrections were made and the course content was re-designed for the present course. Moreover, the course content was discussed with the participants on the first day and their consensus was obtained before commencement. Interim changes were made as and when needed.

The course content comprised complete details on sugarcane varieties, crop production and crop protection technologies and transfer of technology. Hands on experience were given to the extent possible

Fig. 4. Participants of the Model Training Course (4-11 January 2018)

apart from visits to laboratories, experimental fields, technology park, farmers' fields and sugar mill. We had 36 sessions, of which 27 were on theory and seven sessions were practical.

An outdoor visit was arranged for the participants to a Bud chip settling nursery unit and Jaggery unit in Vellode village, Erode district (Fig. 5) and farmers' fields in the vicinity wherein frontline demonstration on STT planting with drip fertigation in five feet spacing was on (Fig. 6). During the outdoor visit, the trainees were exposed to the functioning of a rural agri-enterprise unit and jaggery making. They were also taken to farmer's fields and factory personnel from Sakthi Sugars apprised them about the initiatives in transfer of technology.

A teacher made knowledge test was developed to analyze the impact of the training course. The same set of questions were administered pre and post training and the results are presented in table 1.

All the respondents felt that they were given adequate opportunity to actively participate in the discussion. The study material was supplied at the time of registration itself so that they could come prepared for the subsequent classes. Computer based learning was

Table 1. Pre and post training knowledge level of participants

Knowledge level (%)		Difference in Knowledge gain
Pre-training	Post-training	
70.80	95.20	24.30
Range: 50.0-86.36	Range: 86.36-100	

Fig. 5. Visiting Bud chip settling unit

Fig. 6. Visiting frontline demonstration plot

done in terms of use of power point and multimedia presentations. The trainees expressed their satisfaction regarding the training atmosphere and methodology. Majority (~ 90%) of the trainees were fully satisfied and the rest were satisfied. Adequate visual aids were used to support the course content. They also felt that the duration of eight days is sufficient to get an orientation towards the latest technologies. Majority of them expressed their satisfaction towards the practical orientation of the course. The overall grading of the course was done in a three-point continuum of Most satisfactory, Satisfactory and Not satisfactory. A total of 83.33% reported that they were most satisfied with the training programme in general followed by 16.67% who reported that they were satisfied.

T. Rajula Shanthy
Extension Section, ICAR-SBI, Coimbatore

STATE LEVEL TRAINING PROGRAM

Conducted a state level one-day training program on 'Recent advances in sugarcane cultivation' for 90 farmers from Coimbatore, Erode and Tirupur districts on 31.01.2018 sponsored by Directorate of Sugarcane Development, Lucknow. The training comprised theory classes, demonstration of machineries and visit to biocontrol laboratory (Fig.7 & 8).

Fig. 7. Participants of the one-day training

Fig. 8. Demonstration on Sugarcane Settling Planter

ONE DAY TRAINING

Conducted a one-day training program on 'Scientific sugarcane cultivation' for 15 sugarcane growers from Hosangabad, Madhya Pradesh on 14 February 2018.

Conducted a one-day training program on 'Organic sugarcane cultivation' followed by an Interface Meet for 93 farmers from Coimbatore and Erode districts on 17 March 2018 (Fig. 9).

Fig. 9. Farmers-Scientists Interface Meet

FARMERS-SCIENTISTS INTERFACE

Conducted a District level Scientists-Extension Workers - Farmers Interface Meet in collaboration with Shri Avinashilingam KVK on 29 March 2018 with the participation of 22 farmers and district level officials from the departments of agriculture, horticulture, animal husbandry and sericulture (Fig. 10).

Fig. 10. Interface Meet in progress (29 March 2018)

EXPOSURE VISITS

Conducted an exposure visit for 30 delegates from 16 countries organized by Kothari Management Research Centre, Coonoor on 12 January 2018 (Fig. 11).

Fig. 11. Delegates visiting Technology Park

PARTICIPATION IN EXHIBITIONS

We participated in 'Velaan thiruvizha 2018' organized by Shri Sakthi Institute of Engineering and Technology, Coimbatore during 6-7 January 2018 by putting up a stall. We participated in State level Farmers Day organized at TNAU, Coimbatore during 9-10 February 2018 by putting up a stall depicting the package of practices for cane cultivation in tropical states of the country (Fig. 12).

Fig. 12. Dr. Alagusundaram, DDG (Engg), ICAR & Dr. C. Ramasamy, VC, TNAU visiting ICAR-SBI stall

NATIONAL SCIENCE DAY CELEBRATION

National Science Day was celebrated as an 'open day' on 28 February 2018. Students of schools and colleges were invited for inculcating scientific awareness for nation building. A total of 849 students visited the institute. The students were taken around the institute's museum and Scientists and Technicians explained the exhibits with live specimens apart from video shows (Fig. 13).

Fig. 13. Students looking at the exhibits

VISITORS PROGRAMME

We had entertained 2,169 visitors during the period including students (1,891), farmers (184) cane development officers and university staff (94). They were shown the institute museum, technology park and the laboratories.

INITIATIVES FOR IMPROVING LIVELIHOOD IN TRIBAL VILLAGES

Surveys were made in nine villages in Paalamalai hill range and 21 tribal villages near Pilloor dam for selecting beneficiary tribal villages (Fig. 14). Based on the benchmark survey, six villages viz., Neelampathi, Ikkapatti, Mottiyoor, Ukkaiyanoor, Perukkupatti and Pasumani in Paalamalai hills with 463 tribal families and seven villages near Pilloor dam were selected finally. A mulit-crop thresher was given to Kuliyoor tribal village, wherein developmental activities are being done by the Institute since 2016. The mini tractor and flour mill given to them earlier are being used by the villagers in Kuzhiyur and nearby five tribal villagers. The flour mill has been put to use to grind over one metric tonne of wheat, ragi, Sorghum and other minor millets. This year, we have provided 23 sewing machines (Fig.15) for 23 tribal women in Neelampathi, Ikkapatti, Mottiyoor, Ukkaiyanoor, Perukkupatti and Pasumani who were Certificate holders in tailoring as a means to improve their livelihood and the activities are being monitored.

Bee-hives - A mode of income and a tactic to ward off elephants: To prevent crop damage by elephants and create business opportunities, we have given forty honey-bee hives to Paalamalai tribal villages in the Western Ghats (Fig.16).

Fig. 14. Survey in tribal villages

Fig. 15. Supply of Sewing Machines

Fig. 16. Supply of honey-bee hives

During our earlier interaction with the tribal villagers, we learnt that the villagers were worried about their livelihoods as the elephants pose a threat to their cultivation. Also, we could notice the availability of varied sweet smelling flowers like *Pavetta indica*, wild jasmine and a variety of creepers. So, we thought to make the villagers produce honey by rearing honey bees. Honey bee-hives were ordered from a cultivator in Erode and it was transported in the night as the bees are night blind and will not try escaping the hive and they

DEVELOPMENT OF TAILORING SKILLS AMONG WOMEN FROM MARGINALISED COMMUNITIES - SUCCESS STORY

Development of Tailoring Skills among the tribal women is a field action project which was started in April 2016, with the objective of training women from marginalised tribal groups and help them gain employment or self-employment. The women from these groups have responded to this activity enthusiastically as it is helping them to not only develop skills, but also gain self-confidence to earn money. Six sewing machines were earlier given to them, of which two tribal women had opened a tailoring unit in Melbaaviyur village and they reported that they earn Rs. 3500 to Rs. 4000 per month. As a follow-up of skill development, these tribal women had furthered their skill with training through a local tailor.They are guided to start their own ventures and further advance short term training will be given to them if needed. Taking cue from this success story, we have upscaled this activity in Paalamalai hills.

are also sensitive to change in surroundings. We foresee that the villagers can successfully shoo away elephants and get a substantial income from their venture into apiary. Another 50 bee-hive units were given to Agali village as well. Other items like 40 hp tractor, trailer, cultivator, rotavator, field operation kits, brush cutter, tarpaulin sheets, multipurpose pan, country plough etc. were procured for distribution to tribal villages.

(T. Rajula Shanthy, C. Jayabose, C.Sankaranarayanan, Arjun Tayade, Malakappa B. Medegar, Kannaian)

OTHER ACTIVITIES

NEW YEAR DAY CELEBRATION

New Year was celebrated in the institute on 1 January 2018. Dr. Bakshi Ram, Director of the institute presided over the function. He gave the New Year message to the staff of the institute followed by cutting New Year cake.

HINDI WORKSHOP

Quarterly Hindi Workshop was conducted on 20 March 2018, wherein Dr. Kaveti Rangan, Assistant Director, Official Language, BSNL, Coimbatore was the Chief Guest and he spoke on Noting and drafting in Hindi and Use of Hindi language in everyday life.

MEETINGS / EVENTS

Senior Officers Committee meeting held on 06.01.2018, 05.02.2018 and 15.03.2018.

Institute Joint Staff Council meeting held on 14.03.2018.

Selection Committee meeting held on 27.01.2018, 05.02.2018, 12.02.2018, 26.02.2018 & 21.03.2018.

Assessment Committee meeting held on 17.01.2018, 22.01.2018, 24.01.2018.

Farm Advisory Committee meeting was held on 06.01.2018, 05.02.2018 and 05.03.2018.

Assessment Committee meeting for CAS in respect of Scientists held on 08.01.2018.

Departmental Promotion Committee meeting held on 18.01.2018, 19.01.2018 & 25.01.2018.

Grievance Committee meeting held on 18.01.2018, 14.02.2018 & 14.03.2018.

Women Cell meeting held on 20.02.2018.

Quarters Allotment Advisory Committee meeting held on 17.02.2018.

Training Program for TSLs was organized from 01.01.2018 to 2.04.2018.

Martyr's Day was observed on 30.01.2018.

Women's Day was celebrated on 08.03.2018.

REPUBLIC DAY CELEBRATION

Republic Day was celebrated on 26 January 2018 by hoisting the National Flag by Dr. Bakshi Ram, Director, ICAR-SBI. Later, he addressed the staff of the Institute.

APPOINTMENTS

Shri M. Subbathal, TSL appointed as Skilled Support Staff w.e.f. 18.01.2018.

Smt. A. Arukkani, TSL appointed as Skilled Support Staff w.e.f. 09.02.2018.

TRANSFERS

Smt. K. Kanageswari, Assistant has been transferred from CSWRI, Southern Regional Research Centre-Mannavanur and joined at this Institute w.e.f. 05.02.2018.

PROMOTIONS

Dr. L. Saravanan, Scientist (Entomology) promoted to the post of Senior Scientist w.e.f. 07.01.2017.

Shri. J. Rajendran, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 01.01.2017.

Shri. M. Gnanavel, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 07.05.2017.

Smt. Mayalekshmi, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 11.05.2017.

Smt. A. Kala, SSS promoted to the post of Technician w.e.f. 31.01.2018.

Shri. Om Prakash, SSS granted 3rd MACP in Level-4 of 7th CPC pay matrix w.e.f. 14.01.2018.

Shri. Fate Singh, SSS granted 3rd MACP in Level-4 of 7th CPC pay matrix w.e.f. 14.01.2018.

RETIREMENT

Shri. J. Rajendran, Senior Technical Officer retired from service on superannuation on 31.01.2018 (AN).

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Phone : 0422 - 2472621, Fax : 0422 - 2472923
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Website : http://sugarcane.icar.gov.in

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