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Growth and Development in Sugarcane in Relation to Methods of Preservation of Sets

By

P. SEETHARAMIAH, B.Sc., Ag.,
(Agronomy Assistant, Sugarcane Research Station, Anakapalle)

Introduction :

Sugarcane is normally a twelve months crop. In this Province it is generally planted from February to April and harvested during the same months of the following year. Thus planting and harvesting synchronise.

After the introduction of Coimbatore seedling canes, types that mature in 10 months, or those that can stand in the field for over 12 months without deterioration, have come into cultivation, especially in the areas covered by sugar factories. Under such conditions, planting and harvesting may not generally synchronise due to cultivation of early and late types. It is within the experience of the ryots that if sets are planted prior to January, during the cold months, germination and growth are very poor; and if planting is delayed upto or after May low yields are recorded. Therefore irrespective of the period of harvest, planting is to be done during the months of February to April and for this purpose there is a great need to devise suitable methods to enable the ryots to preserve the sets, for a maximum period of two months and thus overcome the problem.

With this object in view, an experiment was conducted for three years on the Agricultural Research Station, Anakapalle and the results are reported hereunder.

2. *Material and method* :— The seed preservation experiments were conducted on Co. 419, the most popular variety in this Province.

The ryots of this Province are at present adopting a few methods to preserve the sets or overcome the problem by other methods.

(1) Short crop - in a separate plot, cane sets are planted in February or early in March; the canes here are cut after 6 - 7 months and the sets are re-planted in another plot. The canes from this plot are reserved for seed purposes only. (2) a portion of the crop at harvest time is reserved for seed purposes, and in such cases, the entire cane is cut into sets with three buds and planted as against the local practice of utilising the top half of the cane for cutting sets. (3) Sets are planted at harvest time and the seedlings are replanted later on. (4) Sets are preserved in heaps covered with trash. (5) Canes are preserved in pits (North west Frontier Province method) (6) Bundles of sets are planted vertically in a puddle and covered with trash (Kurnool method).

Of the above methods items 4, 5, and 6 can be easily practised by the ryots and as such they were tested against the local method of planting as detailed below.










- i. *Heap method*: - Top sets were left in shade, covered with trash, and kept moist for 15, 30 and 45 days from the date of harvest.
- ii. *North West Frontier method*: - Whole canes after cutting off the tops were put in a pit and covered up with earth for periods 15, 30 and 45 days from the date of harvest.
- iii. *Kurnool method*: - The top sets were planted vertically in a puddled plot, covered with paddy straw and kept moist, sets were preserved for 15, 30 and 45 days from the date of harvest.

Such preserved sets were planted at the end of the respective periods of preservation using the local method of planting top sets as control. In the control plots the sets were cut and planted immediately without being stored.

Germination, growth, maturity and yield were under study.

3. *Germination*: - The buds of the top sets at the nodes are small and dormant. When these were planted in the field germination started from the second week and progressed up to the fifth week.

In the three methods of preservation under test, it was noted that the buds showed growth of different degrees during the preservation itself and this varied with the method of preservation.

	KURNOOL METHOD	HEAP METHOD	N. W. F. METHOD
AFTER 15 DAYS PRESERVATION			
AFTER 30 DAYS PRESERVATION			
AFTER 45 DAYS PRESERVATION			

method of storage. In the "heap method" there was no visible growth of either the buds or nodal roots upto 30 days of preservation while in 45 days, the buds and nodal roots were just active. In the case of N. W. F. method, nodal roots developed throughout the length of the cane, but only the buds at the top end were active by the 15th day. By 45 days the buds elongated to 1/2" to 5" those at top ends being the longest. The nodal roots were 2" to 3" long at all the nodes. The buds were

etiolated. In the case of "Kurnool method" the buds and nodal roots were very active from the 15th to the 45th day, the buds and roots growing to a length of 4" to 5". The top buds were longer than the bottom ones, while the reverse was the case with nodal roots.

Since the buds sprouted during the course of preservation, planting in the field had to be done most carefully to avoid any damage to the developing buds.

Germination of normally planted sets was rapid upto the second week and progressed upto the fourth week. In the 'control', 'heap method', and 'Kurnool method', most of the buds germinated by second or third week while in "N.W.F. method", most of the shoots came up slowly and progressed upto the fourth week, after which a few buds only germinated. This was evidently due to the fact that in the N. W. F. method of preservation, the buds had already sprouted, and were etiolated, and they were too weak to push up the top soil, and emerge. The final germination counts as presented in Table I showed that the heap method, was either equal to or better than the control, while the 'Kurnool method' and "N.W.F. method" adversely affected germination.

Table I.

Treatment and duration:		Percentage Germination.			Mean.	
		I year.	II year.	III year.		
1.	Heap method	15 days	44.81	65.82	51.83	54.15
2.	do.	30 days	36.58	64.01	62.72	54.37
3.	do.	45 days	48.72	57.10	52.15	52.66
4.	N.W.F. method	15 days	19.39	50.54	35.39	35.11
5.	do.	30 days	23.43	38.91	31.88	31.41
6.	do.	45 days	21.85	31.25	22.11	25.07
7.	Kurnool method	15 days	44.48	51.21	36.53	44.07
8.	do.	30 days	57.48	50.37	62.89	56.91
9.	do.	45 days	52.68	38.44	45.76	45.96
10.	Control.		38.89	49.32	56.78	48.33
11.	S. E. of treatment mean.		3.02	2.00	1.94	
12.	Critical difference for significance.		8.76	5.81	5.63	
13.	Whether significant by "Z" test.		Yes	Yes	Yes	

4. *Growth*:— Height of cane from ground level to the last visible leaf joint was measured from June to February, once every month. The data are presented in Table II.

Table II. Maximum height of cane in inches.

Treatment.		I year.	II year.	III year.	Mean.	
1.	Heap method	15 days	137	153	138	142
2.	do.	30 days	137	145	139	140
3.	do.	45 days	133	145	133	137
4.	N.W.F. method	15 days	144	150	141	145
5.	do.	30 days	148	147	138	144
6.	do.	45 days	130	144	123	132
7.	Kurnool method	15 days	137	155	138	143
8.	do.	30 days	138	147	138	141
9.	do.	45 days	134	143	124	134
10.	Control.		145	154	140	146
11.	S.E. of treatment mean		3.32	1.94	3.32	
12.	Critical difference for Significance.		9.61	5.6	9.62	
13.	Whether significant by "Z" test.		Yes	Yes	Yes	

The heights of canes differed significantly between the treatments. The differences were more marked in the earlier stages, considering the rate of increase month by month, in general, the sets preserved for 45 days or 30 days by the different methods showed higher rate of growth during early stages even though they did not reach the same total heights as the control.

Measurements of length, the girth of internodes recorded at the time of harvest did not reveal any significant differences due to the treatments. Only the number of internodes was the variable factor contributing to the height of cane. The ratio of height measured in the field as detailed above and the length of millable cane recorded at the mill-yard was variable from 0.88 to 0.93, there being no significant difference between the treatments.

Average weight of individual cane showed a significant decrease with the length in the period of preservation and between the treatments. The "N. W. F. method" showed increase in weight of cane and this was evidently due to the sparse stand of crop resulting from low percentage of germination.

The relevant data are summarised in table III.

Arrowing:— Co. 419 does not generally arrow in this tract. During the year 1938-39, there was arrowing in this experiment. Percentage of arrowed canes, presented in table IV showed that arrowing in control is 5.62, while it is low in other treatments. Arrowing was found to decrease with the length in the period of preservation.

Table III.

Treatments.	Average length of internodes.			Average girth of Cane.			Average number of internodes.			Average weight of individual canes.		
	I st year.	II nd year.	III rd year.	I st year.	II nd year.	III rd year.	I st year.	II nd year.	III rd year.	I st year.	II nd year.	III rd year.
1. Heap method	4.7	4.7	4.7	2.6	2.9	2.7	26	30	30	3.57	3.96	3.53
2. do.	5.2	4.8	4.7	2.6	2.6	2.7	24	27	27	3.58	3.45	3.53
3. do.	5.0	4.8	4.7	2.6	2.7	2.5	24	27	25	3.25	3.70	3.42
4. N. W. F. method	4.5	4.5	4.7	2.9	2.7	2.8	26	30	29	3.99	3.80	3.74
5. do.	5.2	5.0	4.7	2.8	2.7	2.6	25	27	26	3.94	3.83	3.72
6. do.	4.7	4.3	4.5	2.6	2.9	2.5	24	29	24	3.70	16.00	3.72
7. Kurnool method	5.0	4.4	4.7	2.6	2.6	2.7	25	30	29	3.44	3.88	3.68
8. do.	5.0	5.2	4.9	2.7	2.6	2.5	25	25	26	3.34	3.41	3.26
9. do.	5.2	4.9	4.9	2.6	2.7	2.5	24	26	24	3.12	3.67	3.23
10. Control.	5.2	4.6	4.6	2.8	2.8	2.5	27	30	28	3.75	4.09	3.44

Table IV.

ARROWING.

TREATMENT.

Heap Method.	N. W. F. method.	Kurnool method.	Control.
15 days. 30 days. 45 days.	15 days. 30 days. 45 days.	15 days. 30 days. 45 days.	Control.

Percentage of canes arrowed. 2.90 1.41 Nil. 1.07 Nil. Nil. 3.94 1.48 0.91 5.62

Yield:— The mean yields of millable cane in tons per acre for the three years are presented in table V below.

Table V.
Yields (in tons per acre)

Treatment.		I yr.	II yr.	III yr.	Mean.
1.	Heap method 15 days	55.13	61.24	49.51	55.29
2.	do. 30 days	42.24	51.51	50.63	48.16
3.	do. 45 days	41.33	44.95	39.98	42.09
4.	N. W. F. method 15 days	47.81	54.84	52.12	51.59
5.	do. 30 days	41.39	47.94	40.04	43.12
6.	do. 45 days	28.13	36.41	30.52	31.69
7.	Kurnool method 15 days	56.01	59.61	49.22	54.95
8.	do. 30 days	51.47	47.34	46.60	48.47
9.	do. 45 days	38.87	36.51	35.08	36.82
10.	Control.	60.59	64.58	53.33	59.50
11.	S. E. of treatment mean.	3.75	1.69	1.49	
12.	Critical difference tons per acre.	10.89	4.90	4.33	
13.	Whether significant by 'Z' test.	Yes.	Yes.	Yes.	

The differences between the treatments were significant and the yields from 'heap', 'Kurnool', and N. W. F. methods were in the order of mention. Among the three periods of preservation 15, 30, and 45 days were in the order of merit.

7. *Chemical analysis of the juices:*— Brix, sucrose and purity were estimated in the cane juices from different treatments from November to February. The data are presented in table 6 below.

Table VI.

Chemical analysis of the juices.

Treatment.		I st year.			II nd year.			III rd year.											
		November.	February.	November.	February.	November.	February.	November.	February.										
		Brix.	Puri- rose.	Brix.	Puri- rose.	Brix.	Puri- rose.	Brix.	Puri- rose.	Brix.	Puri- rose.								
1. Heap method	15 days.	13.04	9.81	75.25	20.39	18.06	88.57	14.22	10.86	76.38	19.86	17.53	88.24	13.69	10.69	78.09	17.69	15.34	86.72
do.	30 days.	12.54	8.95	71.37	18.99	16.38	86.24	14.62	11.48	78.50	20.16	18.03	89.44	12.89	9.18	71.20	18.49	16.29	88.10
do.	45 days.	12.54	8.70	69.37	18.99	16.50	86.88	13.02	9.46	72.68	19.16	16.95	88.49	11.79	8.10	68.69	17.89	15.67	87.60
2. N., W. F. method	15 days	13.04	9.18	70.41	19.79	17.37	87.74	13.72	10.63	77.49	19.86	17.62	88.72	13.59	10.27	75.56	18.59	16.50	88.76
do.	30 days.	12.04	8.42	69.93	18.99	16.48	86.76	12.82	9.21	71.85	19.36	16.93	87.46	11.79	8.35	70.81	16.69	14.42	86.40
do.	45 days.	12.04	8.35	69.36	19.99	16.84	87.78	12.92	9.18	71.04	18.68	16.01	85.80	10.39	7.72	64.71	16.49	14.20	86.12
3. Kurnool method	15 days.	13.94	10.50	75.35	20.29	18.18	89.60	14.42	11.25	78.00	19.66	17.39	88.43	13.29	10.01	75.32	18.99	17.22	90.65
do.	30 days	13.44	9.91	73.74	19.89	17.37	87.30	14.22	10.86	76.38	20.36	18.14	89.08	12.89	9.58	74.32	18.89	17.20	91.03
do.	45 days.	12.04	8.10	67.28	18.89	16.23	88.94	13.52	10.26	75.90	19.46	17.03	87.50	11.79	8.22	69.71	18.39	16.51	89.78
4. Control.	...	13.04	9.81	75.25	18.59	16.08	86.48	14.32	11.10	77.52	19.46	17.41	89.45	13.99	10.88	77.76	18.79	17.11	91.05

Brix, sucrose and purity were the lowest in 'N. W. F. method' and they also decreased with the increasing period of observation. The low values for the three methods of preservation were more marked in the earlier stages, than at the time of harvest in February or March.

8 *Conclusions:* - The buds at the nodes of sugarcane sets are delicate structures and do not appear to lend themselves easily for preservation as in the case of true seeds. They germinate and give best results if they are planted immediately after harvest. If the sets are preserved by any of the methods described above, the buds and nodal roots develop to different degrees during the course of preservation and this adversely affects the growth in the early periods and maturity and sugar content at the time of harvest. If there is any long spell of interval between harvest and planting of any variety of cane, the sets may be preserved by the 'heap method' for periods not exceeding 15 days, but wherever possible, it is recommended that a separate shortcrop is raised for securing sets for planting. This latter method not only provides sets which germinate well and grow vigorously but also enables the cultivator to plant the crop at any time irrespective of the period of harvest.

9. *Summary:*— There is need to devise a method for preserving the sugarcane sets for periods upto 2 months. 'Heap method', 'Kurnool method' and 'N.W.F. method' of preserving sets for 15, 30 and 45 days were tested against the local method.

The sets sprouted to different degrees during the course of preservation. The buds at the top half of the cane tended to grow more, than the bottom ones and the reverse was the case with regard to nodal roots. When planted in the field, the 'Kurnool method' and 'N. W. F. method', adversely affected germination.

Height of cane differed significantly between the treatments. Height decreased with the increasing periods of preservation. The differences were more marked in the earlier rather than in the later stages of the crop growth. Length and girth of internodes did not vary but the number of internodes varied.

Average weight of individual canes showed significant decrease with the length in the period of preservation.

The percentage of arrowed canes was lower in the treatments than in the control. With the increase in the period of preservation, the arrowing further decreased.

'Heap method', 'Kurnool method' and 'N.W.F. method' were in the order of merit in respect of yield.

Brix, sucrose and purity were the lowest in the 'N. W. F. method' and these values decreased with increasing periods of preservation in all the treatments.

Wherever possible 'short-crop' method is recommended, failing which preservation by 'heap method' for short periods may be adopted.

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ANNOUNCEMENT

THE MADRAS AGRICULTURAL STUDENTS' UNION

31st COLLEGE DAY AND CONFERENCE

It is proposed to hold the 31st College Day and Conference at Coimbatore under the auspices of the Madras Agricultural Students' Union in the month of July 1948. Exact dates will be published in due course.

'Present Food Crisis and its Solution' will be the subject for symposium on the ensuing College Day Conference.

Members who intend reading papers at the Conference are requested to communicate to the Secretary, Madras Agricultural Students' Union, Lawley Road P. O., on or before 30th May 1948.

Those who want to move fresh propositions at the Annual General Body Meeting of the Union are requested to give due notice to the Secretary, so as to reach him not later than 30th May 1948.

Secretary,

Madras Agricultural Students' Union.