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Results of Trial of Molasses as Manure on Swamp Paddy

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Introduction. On the Agricultural Research Station, Aduturai, there was a large quantity of molasses available as a bye-product, in connection with the trials for manufacturing white sugar by the open pan system with centrifugal machine. The trials were conducted during the years 1933—37. Part of it was fed to cattle, but the surplus let over could not be easily disposed of by sale in the locality. So, it was decided to try molasses as a manure on the swamp paddy on the station.

Soil and Cropping Season. The soil on the station is the alluvial clay of the Cauvery delta which cracks badly in summer months—March to May. The cultivation season starts with the receipt of water in the channels by the middle of June. The first crop which is a short duration variety of 3 to 3½ months occupies the ground from the middle of July to the end of September. The second crop, usually a long duration variety of 5 to 6 months, is planted by the middle of October after harvesting the first crop and is harvested by the middle of February. In lands cropped with only a single crop, the sowing commences by the first week of July, transplanting being done 6 weeks later. This crop, generally comes to harvest in January.

The particular field F 5-a, where the experiment was under progress, was under double crop cultivation as detailed in the foregoing paragraph. Prior to starting of the trials, the field was devoted to the growing of bulk crops of paddy for seed multiplication without any experiment. The crop received green leaf at 2,000 lb per acre; bone meal was applied at the rate of 200 lb. per acre at the time of planting and Ammonium Sulphate at 50 lb. per acre was top dressed 15 days after planting.

Design of the Experiments. A preliminary trial was carried out in the year 1935 in a ten cent plot. Twelve sub-plots each measuring 38 ft. × 7½ ft. (0·66 cents) were laid out in this field, with small bunds and 2 ft. inter-channels separating each plot. Six of the sub-plots received molasses at 2,000 lb. per acre and the other six plots were left as control, the arrangement being A B B A fashion as shown below:

7½'

38'						
	A	B	B	A	A	B
	B	A	A	B	B	A

A control.

B molasses at 2,000 lb. per acre.

The molasses was diluted with twice its volume of water and applied to each sub-plot with the help of an ordinary garden rose-can in the puddled soil, 13 days before transplanting the paddy crop. It was noticed that there was active fermentation of the manure for about 20 days, accompanied by the evolution of bad smelling gases. The paddy variety used in this experiment was Co. 1 a (pure line) strain evolved at the Paddy Breeding Station, Coimbatore, the planting being done 6" either way in lines with one seedling per hole. The yield figures are given below and from them it will be seen that the controls gave slightly higher yield than the treated plots, though the difference is not statistically significant.

	Molasses at 2,000 lb. per acre.	Control.	Difference of means.
Mean yield of 6 repetitions	17·9	19·2	1·3
Percentage of control	93·6	100·0	S. E. 1·05
Acre yield in lb.	2,734	2,934	Difference of means not significant.

During the same year, a more elaborate experiment was laid out in a bigger double crop field in F 5 a, measuring 46·9 cents in area. In this field, sub plots measuring 45′ × 13′ were laid out in two rows of 9 plots each, each plot being separated by inter channels 2′ in breadth. The application of molasses was done in two different doses (A) at 1,000 lb. per acre and (B) 2,000 lb. per acre, with unmanured plot as control. All the three treatments were randomised giving six repetitions to each treatment.

13′

45′

A	B	C	B	C	A	C	A	B
B	A	C	A	C	B	C	B	A

Channel 2′

The manure was diluted as in the first case and applied to the puddled soil a week before planting. The fermentation of the material and the evolution of bad smelling gases were noted for about twenty days in this case also. The variety used in planting was Adt. 2, a strain evolved on the station from the famous White Sirumani of Tanjore. The yield figures given below show that the increased yields of 2·5 per cent. and 2·8 per cent. given by 1,000 lb. and 2,000 lb. applications were not statistically significant.

	Molasses at 1,000 lb. per acre.	Molasses at 2,000 lb. per acre.	No. manure.	Gen. mean.	Z. Test. S.E P.O.01	Critical difference P.O.01.
	A	B	C			
Mean yield of 6 repetitions	27·6	27·7	26·9	27·4		
Percentage on General mean	100·6	101·0	98·2	100·0	2·09	Not Sig
Percentage on control	102·5	102·8	100·0			
Acre yield in lb.	1,935	1,942	1,888			

In the 1936—37 season, the experiment was repeated using the same plots as in the previous years, but the manurial doses were increased by applying 2 tons to the plots which received 1,000 lb. of molasses per acre and 4 tons to those which received 2,000 lb. per acre during the previous season. Both the crops received molasses at the above rates. Molasses was applied in the puddle to the first crop a week in advance of planting, the planting being done six inches either way. For about three weeks after the application of the manure, there was vigorous fermentation and evolution of foul smelling gases. Plants were also found to sicken and die away in numbers. The dead plants were counted in the differently treated plots and it was found that there were on an average 85 dead plants in each 2 ton plot, 350 in the 4 ton plot, while the number of dead plants in the unmanured plot was only 34. This clearly shows that it is not safe to plant the seedlings before the active fermentation of the molasses has taken place and completely subsided. The yield figures obtained are given below from which it would be seen that both 2 and 4 ton applications have given significantly higher yields than the controls, although the difference in yield between 2 and 4 ton applications is not significant when the loss in yield due to gaps is ignored.

But when the loss due to gaps is computed by the method of co-variance, it is found that even then the increase in yield of both 2 ton and 4 ton application is not significant though the 'Z' test is satisfied.

Recorded yields.

	1 Molasses at 2 tons per acre. A	2 Molasses at 4 tons per acre. B	3 No. manure.	Gene-ral mean. C	S. E.	Z. test P. O. ·01.	Critical difference. P. O. ·01.
Mean yield of 6 Repetitions.	42·2	41·6	37·7	40·5			
Percentage on General mean.	104·2	102·7	93·1	100·0	1·50	Sig.	4·7
Percentage on Control.	111·8	110·3	100·0				
Acre yield in lb.	3,004	2,963	2,689				
	Conclusion.	1	2	3			

Calculated yields including gaps (Yields adjusted by Co-variance.)

Mean yield of 6 Repetitions.	42·2	41·6	37·7			Sig.	
Percentage on control	111·9	110·0	100·0				
Acre yield in lb.	3,328	3,282	2,978				493
	Conclusion	1	2	3			

Thaladi or Second Crop. As already stated, molasses was applied at the same rate as for the first crop, but with this difference that the manure was applied to the plots 4 weeks in advance of planting in the puddled soil. During this period, the fermentation of the manure was complete when the crop was planted and there was no sign of fermentation with the

result that there were no abnormal deaths in the manured plots. Due perhaps to the absense of deleterious decomposition products, the crop grew quite normally in the manured as well as in the unmanured plots. The yield figures given below disclose that two ton application, for some unknown cause—had no effect on the yield, while four ton application gave 20·7% extra yield.

	1 Molasses at 2 tons per acre. A	2 Molasses at 4 tons per acre. B	3 No manure C	General mean.	S. E.	Z test P. O. ·01.	Critical difference. P. O. ·01.
Mean yield of 6 Repetitions.	30·6	36·7	29·9	32·2			
Percentage on General mean.	95·0	114·0	92·9	100·0	3·22	Sig.	10·52
Percentage on Control.	102·3	120·7	100·0				
Acre yield in lb.	2,179	2,571	2,129				
	Conclusion	2	1	3			

During the 1937—38 season molasses was applied to the plots in the month of May, when summer was at its height and the land was completely dry and heavily cracked. The soil was untouched until the third week of June, when the plots were irrigated with channel water and ploughed for planting. The field was planted on 2nd July, exactly two months after the application of molasses. By applying the molasses to dry soil, there was no fermentation or evolution of foul smelling gases—and there were not any abnormal deaths of transplanted plants in the treated plots as in the previous cases.

So it seems to be a healthier and safer practice, to apply the molasses to the field when the soil is dry—rather than when it is in a puddled state. Moreover, the yield figures obtained also seem to point to the fact that it is advantageous to apply molasses to the dry soil, the beneficial effect of such application perhaps being due to increased activity of nitrogen fixing organisms in the soil.

	1 Molasses at 2 tons per acre. A	2 Molasses at 4 tons per acre. B	3 No manure C	General mean.	S. E.	Z test P. O. ·01.	Critical difference. P. O. ·01.
Mean yield of 6 Repetitions.	35·5	41·7	25·5	34·2			
Percentage on General mean.	103·8	121·9	74·6	100·0	1·62	Sig.	7·26
Percentage on Control.	139·2	163·5	100·0				
Acre yield in lb.	2,801	3,289	2,015				
	Conclusion	2,	1,	3.			

During the same season, the residual effect of molasses, if any, was tested on the second crop. Plots getting four tons of molasses gave a

significant increase of 19 % over the control, while the increase given by 2 ton plot was within the limits of error.

Mean yield of 6 Repetitions.	27·9	28·9	24·3	27·0			
Percentage on General mean.	103·3	107·0	90·0	100 0	3·15	Sig.	14·10
Percentage on Control.	114·8	119·0	100·0				
Acre yield in lb.	1,994	2,065	1,732				
	Conclusion	2,	1,	3.			

Discussion of results and conclusions. From the results of the above experiments, it is possible to draw the following conclusions.

1. The minimum dose of molasses required to give an appreciable increase in yield seems to be in the neighbourhood of 4 tons per acre—though in the 1937—38 season even a 2 ton application gave a fairly high yield over the control.

2. The best time for the application of molasses to a paddy field seems to be summer and when the soil is dry. Perhaps such application helps the nitrogen fixing organisms in their activity. But this method could be adopted only in the case of the first crop in double crop areas and to Samba (single crop), while in the case of a second crop, which follows immediately after the harvest of the first crop, it has necessarily to be applied in the puddle, as the Kuruvai crop is generally harvested in standing water and as it is also harmful to allow the fields to dry before planting the second crop. In such cases, molasses will have to be applied immediately after the harvest of the first crop, to allow it to complete its fermentation before planting a second crop. Where it is not possible to allow sufficient time for fermentation to complete before the second crop is put in, it is better to avoid the application of molasses to such fields altogether, as otherwise abnormally high death rates occur among the transplants.

Economics of manuring rice crop with molasses. Even assuming that a 4 ton application of molasses to a paddy field ensures an increase of 60% or 1,200 lb. of grain per acre by applying it to the dry soil in summer, it may not be economical to purchase and transport it to fields far removed from the place of production, as the cost of packing and transporting a liquid manure like molasses will be prohibitive. The molasses also should be obtainable at about Rs. 5 a ton, ex-factory, so that with the cost of transport included the cost of manuring should not exceed Rs. 8 a ton, if there should be a return of 25 per cent. on the capital invested on manuring, calculating the value of 1,200 lb. of paddy at 32 lb. a rupee. If molasses can be sold at a more remunerative price for other uses—there seems to be no future for it as a manure for paddy from an economic point of view. Even putting the price at Rs. 8 a ton, the initial expenditure on manuring comes to Rs. 32 per acre, whereas ordinarily the rice growers need not spend more than Rs. 6 to 10 per acre for manuring their paddy

crop with green manure and bone-meal and top dressing with Ammonium sulphate to get an increased yield of 1,200 lb. of grain per acre. The actual doses of the above manures recommended for application to Tanjore rice fields are 4,000 lb of green manure costing Rs. 2, 50 lb. of bone-meal costing Rs. 1-8-0 and 40 lb of Ammonium sulphate costing Rs. 4-14-0, or Rs. 8—6—0 on the whole; in round figure Rs. 9 per acre. In view of these facts, it is problematical whether molasses would ever be a popular manure for paddy crop, so long as it is available in the liquid state only. If it could be put on the market as a dry powder packed in gunnies, just as any other concentrated manure, by treatment with quicklime or any other chemical means, then the cost of packing, transport and of application to the fields could be considerably reduced.

A Simple Method of Preserving Seed Coconuts*

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Seed coconuts harvested during the summer months from February to May alone are considered suitable for raising seedlings. They are sown in the nursery either at the commencement of the south-west monsoon rains in June or in some places with the north-east monsoon rains in October. During this interval, they generally get over-dry losing the water ('milk') inside and thereby become unfit for sowing. If the nuts are sown immediately after the harvest in summer, the watering charges will be high. Therefore it is necessary to preserve the seed nuts properly for some months till they are sown in the seed bed.

Usually no particular method is adopted or special care taken by *ryots* for preserving their seed coconuts. They are generally dumped in some odd place in the house or the holding till they are required for sowing. Since the seed nuts are harvested only when they are dead-ripe and the nuts have to pass through the hot summer months they become too dry and lose their germination capacity unless they are properly preserved.

A simple method for preserving seed nuts is as follows:—

As soon as the nuts are harvested or as early as possible after harvest, they are removed to a shed or verandah protected from direct sunlight. A layer of dry sand about three inches thick is spread on the floor and the seed nuts are placed on the sand close to one another with the base or stalk-end up. They are then covered up completely with dry sand till it fills up all inter-spaces among the nuts and stands some three inches above the nuts. The nuts are left in the sand till they are required for sowing; and they keep quite well without the milk or water in the nut drying up even for a period of five to nine months.

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