

Review Article:

**A review of results of manurial trials on Sugarcane
in Madras State***

by

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Introduction: Sugarcane (*Saccharum officinarum*) cultivated in an area of 1,43,000 acres in Madras State is mainly found in the districts of North Arcot, South Arcot, Tanjavur, Thiruchirapalli, Coimbatore and Mathurai. The crop is raised under irrigation, both under wet and garden land conditions.

Manurial experiments on sugarcane have been conducted during the past fifty years in Madras State, primarily in the research stations at Palur in South Arcot, at Gudiatham in North Arcot and at Central Farm in Coimbatore. However, during the past ten years, experiments were also conducted at Cuddalore, Nellikuppam, Kulithalai, Pandiyarajapuram, Vadapathimangalam and Rajathanikottai. The tract represented by Palur is typical of a strip of sandy loamy soil whereas Gudiatham represents a little heavier soil. The Central farm, Coimbatore represents the central districts and has two different soils viz., black and red soils.

The results of experiments conducted for the past fifty years are reviewed here taking into consideration only the salient points.

MANURING THE SEED NURSERY

Intensive versus poor manuring of seed nursery:

(a) Place of experiment: Palur. Year: 1930—40.

Manures tried : 20,000 lb. farm yard manure + 20,000 lb. groundnut
(per acre) cake + 400 lb. ammonium sulphate + 400 lb. super
phosphate + 100 lb. potassium sulphate *versus* 10,000 lb.
farm yard manure.

Result : There was no beneficial effect due to manuring of
nursery¹².

(b) Place of experiment: Gudiatham. Year: 1930—40.

Manures tried : Same as in Palur experiment.

Result : There was no beneficial effect. But the juice quality
and jaggery were found to be improved with farm yard
manure¹².

Conclusion : From the above two experiments it can be concluded
that heavy manuring of seed nursery does not benefit
the main crop.

* This review forms part II of manurial trials, the part I being on Paddy to be published in the Golden Jubilee Commemoration Volume of the Madras Agricultural Journal.

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MANURING THE FIELD

Unlike manuring seed bed, the field is manured invariably by the farmers. Some of the forms and levels of manures tried experimentally are given below:—

A. Nitrogenous Manures :

(a) *Forms of Nitrogen :*

Ammonium sulphate was compared with other forms of manure

1. *Ammonium sulphate versus chilean nitrate (Sodium nitrate)*

(a) Place of experiment : Palur. Year : 1932—34.

Manures tried : Ammonium sulphate *versus* sodium nitrate at 200 lb. N over 100 lb. P_2O_5 + 50 lb. K_2O with and without groundnut cake (at 2 : 1 ratio).

Result : Sodium nitrate was found to be better both from the point of cane yield and juice quality.

(b) Place of experiment : Palur. Year : 1930—40.

Manures tried : 2,000 lb. N in the form of ammonium sulphate *versus* 200 lb. N in the form of sodium nitrate with 100 lb. P_2O_5 + 50 lb. K_2O

Result : Sodium nitrate depressed the yield.

(c) Places of experiment : Nellikuppam, Kulithalai and Gudiatham. Year : 1952—55.

Manures tried : At two levels of 100 lb. N & 150 lb. N in the form of ammonium sulphate *versus* 100 lb. N & 150 lb. N in the form of Sodium nitrate over 60 lb. P_2O_5 + 60 lb. K_2O + 1000 lb. lime + 5 tons of farm yard manure.

Result : Ammonium sulphate was found to be better than sodium nitrate at both levels².

Conclusion : Except for the first trial in 1932—34, in the rest of the experiments ammonium sulphate was better than sodium nitrate.

2. *Ammonium sulphate compared with urea, ammonium sulphate nitrate and calcium ammonium nitrate :*

Place of experiment : Cuddalore. Year : 1958—59.

Manures tried : 250 lb. N in the 4 different forms for the variety Co. 419.

Result : Calcium ammonium nitrate recorded slightly more yield than others, though it was not significant³.

3. *Ammonium sulphate compared with potassium nitrate, calcium nitrate, calcium cyanamide, milled fish guano, black castor and poudrette.*
- (a) Place of experiment : Coimbatore Central Farm. Year : 1910—13.
Manures tried : 100 lb. N in the above 7 forms.
Result : Calcium cyanamide, calcium nitrate and fish guano were found to be better than ammonium sulphate ¹².
- (b) Place of experiment : Coimbatore Central Farm. Year : 1928—29.
Manures tried : Ammonium sulphate, groundnut cake, sodium nitrate, cattle manure and poudrette compared on 100 lb. N. basis.
Result : Ammonium sulphate gave the highest yield followed by groundnut cake and sodium nitrate. Poudrette was found to be equal to cattle manure ¹².
4. *Ammonium sulphate compared with groundnut cake either alone or in combination.*
- (a) Place of experiment : Palur. Year : 1928—31.
Manures tried : Ammonium sulphate compared to groundnut cake either alone or in combination at 50, 100, 150 and 200 lb. N.
Result : Maximum yield of 68,480 lb. of cane was obtained at 200 lb. N with the combination of cake and sulphate. The higher the dose of N the higher was the yield ¹³.
- (b) Place of experiment : Palur. Year : 1928—31.
Manures tried : Ammonium sulphate and groundnut cake compared both separately and in the form of mixtures at 4:1, 3:2, 2:3, 1:3 and 1:4 proportions.
Result : Groundnut cake and ammonium sulphate at 3:2 gave maximum yield of 58,730 lb. of cane ¹³.
- (c) Place of experiment : Palur. Year : 1930—40.
Manures tried : Ammonium sulphate compared to groundnut cake either alone or in combination at 0, 75 and 150 lb. N per acre.
Result : The ratio of 1:1 was found to be better than individual application ¹¹.
Conclusion : The experiments show that a mixture of ammonium sulphate and groundnut cake is better than ammonium sulphate alone.

B. Levels of Nitrogen:*(i) Responses to graded dose of nitrogen:*

(a) Place of experiment: Palur. Year: 1928—31.

Manures tried: Ammonium sulphate and groundnut cake either alone or in a mixture at graded doses of 50: 75: 87½: 100; 150 and 200 lb. N.

Result : 200 lb. N either alone or in combination with groundnut cake was the best ¹².

(b) Place of experiment: Palur. Year: 1930—40.

Manures tried: Graded doses of N upto 100 lb. with groundnut cake and ammonium sulphate at 4:1 or 3:2 ratio.

Result : 100 lb. N either in the ratio of 4:1 or 3:2 was efficient and economical ¹².

(c) Place of experiment: Palur. Year: 1943—47.

Manures tried: Groundnut cake applied at graded doses of 0, 50, 100, 150, 200 and 250 lb. alone or over a basal dressing of 10 tons of farm yard manure.

Result : Optimum dose of N was found to be 250 lb. but without farm yard manure the quality of juice was depressed ¹¹.

(d) Place of experiment: Gudiatham. Year: 1945—48.

Manures tried: Graded doses of N in the form of ammonium sulphate and groundnut cake either alone or in combination over a basal dressing of 10 tons of cattle manure for the variety Co. 419.

Result : Good response upto 200 lb. N was obtained. The dose of 250 lb. N. delayed maturity and depressed the sucrose content ¹¹.

(e) Place of experiment: Kulithalai. Year: 1954—57.

Manures tried: Graded doses of 50 to 300 lb. N with groundnut cake and ammonium sulphate at 1:2 ratio on the variety Co. 419.

Result : Optimum dose was found to be 250 lb. N ⁶.

(f) Place of experiment: Pandiyarajapuram. Year: 1957—58.

Manures tried: Graded dose upto 250 lb. N with ammonium sulphate and groundnut cake at 1:1 ratio on the variety Co. 419.

Result : There was response upto 250 lb. N ⁷.

(g) Place of experiment: Vadapathimangalam. Year: 1957—58.

Manures tried: Same as in Pandiyarajapuram.

Result : There was response upto 250 lb. N ⁷.

(b) Place of experiment: Palur. Year: 1958—59.

Manures tried: Graded dose from 0 to 500 lb. N in gradations of 50 lb. with ammonium sulphate and groundnut cake at 2:1 ratio for varieties Co. 419 and 449.

Result : In the variety Co. 449 response was seen upto 200 lb. N while in the variety Co. 419 the response was seen upto 300 lb. N^e.

Conclusions : The application of nitrogenous manure increases considerably the yield of sugarcane but the optimum dose varies from place to place ranging from 200 to 250 lb. N.

(ii) *Response to split doses of nitrogen:*

(a) Place of experiment: Palur. Year: 1928—33.

Manures tried: 100 lb. N. (75 lb. groundnut cake + 25 lb. ammonium sulphate) applied in a single dose, 40–45 days after planting and in 2 doses (one at 40–45 days after planting and another at earthing up) for Fiji B. variety.

Result : Application in 2 doses was found to be advantageous¹².

(b) Place of experiment: Palur. Year: 1930—40.

Manures tried: Groundnut cake + ammonium sulphate at 3:2 ratio applied in single and double doses (at planting and tillering).

Result : Double doses was to be more advantageous than single dose with an additional yield of 9.7 per cent¹¹.

(c) Place of experiment: Kulithalai. Year: 1954—56.

Manures tried: 200 lb. N in a single dose and at 2 half dose applied half as basal dose and half at 45 or 90 or 120 or 150 days after planting.

Result : There was no significance in yield; but juice quality was improved by early application.

(d) Place of experiment: Cuddalore. Year: 1956—58.

Manures tried: N in the form of ammonium sulphate and groundnut cake at 1:2 ratio at 250 lb. and 350 lb. level, applied in 3 timings of 45, 90 and 210 days after planting for *adsali* (ratoon) crop of Co. 527.

Result : 250 lb. N applied in 3 doses was found to be adequate^{7 and 8}.

Conclusions : In general, it may be concluded from the above experiments that split doses are better than single dose application of N, when given as a mixture of ammonium sulphate and groundnut cake.

(iii) *Response to foliar application of fertilisers:*

(a) Place of experiment: Cuddalore. Year: 1951—59.

Manures tried: 20 lb. N as urea and ammonium sulphate with soil application of 150 lb. N was compared to soil application of 250 lb. N.

Result : There was no significant difference between the two treatments ⁸.

In one observational trial conducted in 1959—60 with variety Co. 419 at Cuddalore, foliar application was again tried at 0, 10, 20, 30, 40 and 50 lb. N per acre as compared to soil application at 0, 25, 50 and 75 lb. N. Spraying was commenced at 90th day and completed on 150th day, at interval of 8 days with 10 lb. N per acre each time.

The result indicated marked increase in yield due to smaller doses of N as foliar spray with or without soil application ^{5 and 6}.

(iv) *Effect of manuring on germination of canes:*

Place of experiment: Cuddalore. Year: 1957—59.

Manures tried: Over a basal dressing of 5 tons of farm yard manure, 50 lb. of N as ammonium sulphate was compared with 50 lb. N as castor cake, and as a mixture of both at 1:2 ratio.

Result : There was no adverse effect due to the above manures on germination of cane ⁶.

B. Phosphatic Manures:1. *Levels of phosphate:*

(a) Place of experiment: Cuddalore. Year: 1958—60.

Manures tried: Along with a basal dose of 250 lb. N, super phosphate was applied at 75 lb. and 150 lb. P_2O_5 per acre in split doses (half at planting and half at earthing up), and in different methods (surface application and 6" below).

Result : No beneficial effect was seen either on yield and quality of juice on the time, mode and doses ^{5 and 6}.

(b) Place of experiment: Gudiyatham. Year: 1958—59.

Manures tried: Same as in Cuddalore.

Result : There was no response due to time, dose and mode of phosphate application ⁸.

(c) Place of experiment: Pandiyarajapuram. Year: 1957—58.

Manures tried: Over a basal dose of 150 lb. N, 50 lb. of P_2O_5 as super phosphate was added.

Result : There was no response due to phosphate application ⁸.

- (d) Place of experiment: Vadapathimangalam. Year: 1958—60.
Manures tried: Same as in Pandiyarajapuram.
Result : There was no response due to phosphate application⁸.
- (e) Place of experiment: Rajathanikottai. Year: 1958—60.
Manures tried: Same as in Pandiyarajapuram.
Result : There was no response due to phosphates⁸.
Conclusion : The available data shows that sugarcane does not respond to phosphate application in the places where experiments were conducted.

ii) *Placement and time of application of phosphates:*

- Place of experiment: Palur. Year: 1958—'60.
Manures tried: Three doses at 0, 75 and 150 lb. P_2O_5 in the form of super phosphate at 3 placements (surface; 6" below ground level and at earthing up) and at 3 timings (planting; earthing up; half at planting and half at earthing up).
Result : No significant difference was seen⁸.

iii) *Effect of phosphate on juice quality:*

- Place of experiment: Gudiyatham. Year: 1938—'41.
Manures tried: 1 cwt. of super phosphate per acre over a basal dressing of 5 tons of farm yard manure and 100 lb. N was applied in two equal doses at time of planting and earthing up.
Result : There was no beneficial effect either in quality of juice or in the yield⁹.
Conclusion : Phosphates are not effective either in increasing crop yield or in influencing the quality of juice.

Potash Manures:

(a) *Response to potassic manures:*

- Place of experiment: Pandiyarajapuram. Year: 1958—'60.
Manures tried: 50 lb. K_2O in the form potassium sulphate was applied over a dose of 200 lb. N and 150 lb. P_2O_5 .
Result : There was no response due to potash⁸.

(b) *Potash experiments:*

- Place of experiments: Farmer's holdings in 45 centers in South Arcot and Tiruchi districts. Year: 1955—'58.
Manures tried: 100 lb. K_2O in the form of potassium chloride was applied along with N and P.

- Result : Response over N + P treatments was reported to be 8 per cent in South Arcot and 6 per cent in Tiruchi districts.
- Conclusion : It was generally seen that there is no response to potassic fertilisers in sugarcane in Government sponsored experiments, though experiments done by the firm 'Potascheme' have shown up to 8 per cent increase in yield due to potash application.

D. Combination of Manures:

Response to different combinations of manures:

(a) Place of experiment: Palur. Year: 1932—'37.

Manures tried: Different combinations of N, P, K in permanent manurial experiment.

- Result : (1) Ammonium sulphate to supply 200 lb. N was the best for yield and higher doses of N was found to depress the quality of juice.
- (2) 200 lb. N + 100 lb. P_2O_5 + 50 lb. K_2O had not shown any increased yield over 200 lb. N alone.

(b) Place of experiment: Coimbatore Central Farm. Year: 1930—'40.

Manures tried: Permanent manurial plot experiment with Co. 213 variety with 1 cwt. ammonium sulphate + 1 cwt. potassium sulphate + 3 cwt. super phosphate + 5 tons of farm yard manure tried in the usual combinations of N, NK, NP, NPK, PK, K, P, CM, CMR.

Result : N + P + K plots gave maximum yield of 149.7 per cent followed by K + P plots¹².

(c) Place of experiment: Palur. Year: 1939—'40.

Manures tried: Combined varietal and manurial trials with varieties Co. 419, Co. 349 and Co. 2878 with N at 0, 75 and 150 lb, P_2O_5 at 0, 35 and 70 lb. and K_2O at 0, 50, and 100 lb. compared.

Result : Co. 419 was found capable of growing well with smaller doses of N as compared to others. Neither yield nor quality of juice was influenced by P_2O_5 or K_2O ⁸.

(d) Place of experiment: Palur. Year: 1958—'60.

Manures tried: Along with 100 lb. P_2O_5 ; 125 lb. K_2O , N at 150, 250 and 350 lb. were compared.

Result : No response was seen either to P_2O_5 or K_2O . Response to N alone was seen upto 250 lb.⁸.

(e) Place of experiment: Pandiyarajapuram. Year: 1958—'59.

Manures tried: Different combinations of N, P and K compared. N at 100 and 200 lb. P_2O_5 at 100 lb. and K_2O at 50 lb.

Result : There was no significant response to P_2O_5 and K_2O .

(f) Place of experiment: Vadapathimangalam. Year: 1958—'59.

Manures tried: Same as in Pandiyarajapuram.

Result : There was no significant response to P_2O_5 and K_2O .

Conclusion : Sugarcane does not respond to phosphoric acid or potash under Madras conditions.

E. Bulky Organic Manures:

(i) *Response to press mud:*

(Press mud is the solid matter obtained in the clarification of cane juice in sugar factories, containing on an average 1 per cent N, 2 per cent P_2O_5 , 0.5 per cent K_2O and 10 per cent lime).

(a) Place of experiment: Pandiyarajapuram. Year: 1954—'56.

Manures tried: Press mud applied at 0, 5, 10, 15 and 20 tons per acre.

Result : Response to press mud was seen. But between the different levels tried there was no significance ⁸.

(b) Place of experiment: Rajathanikottai. Year: 1954—'56.

Manures tried: Same as in Pandiyarajapuram.

Result : The higher the dose of press mud the better was the yield ⁸.

(ii) *Press mud compared to Compost:*

Place of experiment: Nellikuppam. Year: 1954—'56.

Manures tried: 10 tons compared to compost along with 200 lb. N as ammonium sulphate top-dressed.

Result : Press mud gave 12.80% additional yield over control which received 200 lb. N only ⁶.

(iii) *Press mud compared to others:*

Place of experiment: Pandiyarajapuram. Year: 1956—'58.

Manures tried: Press mud at 10 and 20 tons compared to (i) molasses at 3 tons; (ii) molasses + begasse at 3 tons and (iii) river sand at 20 tons.

Result : Press mud at 20 tons gave the highest yield ⁷.

Conclusion : Press mud can be profitably utilised in the place of compost or farm yard manure.

F. Green Manures :*(i) Response to green Manure :*

(a) Place of experiment: Nellikuppam. Year: 1954—'55.

Manures tried: 5000 lb. sunnhemp as green manure raised inter-sown and incorporated after 45 days of planting and 200 lb. N as ammonium sulphate top dressed.

Result : The green manure treated plot gave 53.92 tons canes as against the yield of 52.24 tons of canes in the control plot supplied only with 200 lb. N in the form of ammonium sulphate.

b) Place of experiment: Kulithalai. Year: 1954—'55.

Manures tried: Same as in Nellikuppam but both sunnhemp and daincha were tried.

Result : Green manure applied plots gave better yield.

(ii) Effect of green manure on setting of jaggery :

Place of experiment: Palur. Year: 1941—'42.

Manures tried: Sunnhemp leaves were applied in the third month along with 200 lb. N (groundnut cake + ammonium sulphate at 3:1 ratio) for the variety Co. 349.

Result : No difference in setting quality and colour of jaggery was found.

G. Placement of Manure :

Place of experiment: Palur. Year: 1933—'34.

Manures tried: Manuring canes in pits compared to local methods of applying in furrows with variety 247. B.

Result : Manuring in pits gave an increased yield of 18.7% over local method.

Summary and conclusions: Manurial experiments on sugarcane have been conducted during the past fifty years in Madras State, primarily in the Research Stations at Palur in South Arcot, Gudiatham in North Arcot and at Central Farm, Coimbatore. But during the past ten years, experiments have also been conducted at Cuddalore, Nellikuppam, Kulithalai, Pandiarajapuram, Vadapathimangalam and Rajathanikottai. The tract represented by Palur is typical of a strip of sandy loamy soil whereas Gudiatham represents a little heavier soil. The Central Farm, Coimbatore representing the Central districts has two different soils viz., black and red soils.

Experiments were conducted with the following manures and fertilisers :

(a) Nitrogenous : ammonium sulphate, sodium nitrate, urea, ammonium sulphate nitrate, calcium ammonium nitrate, potassium nitrate, calcium nitrate, calcium cyanamide and milled fish guano.

- (b) Phosphatic : super phosphate and fish guano.
- (c) Potash : potassium sulphate and potassium chloride.
- (d) Oilcakes : groundnut cake and castor cake.
- (e) Bulky organic manures : farm yard manure, compost, press mud, poudrette, molasses and begasse.
- (f) Green manures : sunnhemp and daincha.

From the factual presentation made in this paper of the manurial experiments it is clear that it is not possible to give a general recommendation but the following conclusions can be drawn.

1. Heavy manuring of seed nursery does not benefit the main crop and so the main crop has to be properly manured.

2. The application of nitrogenous manure increases considerably the tonnage of the popular varieties of canes tested.

3. The optimum dose of nitrogen vary from place to place. This was found to be upto 200 lb. in Gudiyatham, (North Arcot) and upto 250 lb. in other places like Cuddalore, Kulithalai, Nellikuppam, Vadapathimangalam, Pandiarajapuram and Rajathanikottai.

4. The experiments show that a mixture of ammonium sulphate and groundnut cake is better than either groundnut cake or ammonium sulphate alone.

5. Split dose of nitrogen application was found better than single dose.

6. Foliar application of nitrogenous manures was found to be not beneficial.

7. The germination of canes is not affected by concentrated manures.

8. Phosphates though not effective in increasing crop yield and juice quality have been however found to influence the quality of jaggery obtained.

9. In regard to potassic manure, there was no apparent need in all the Research Stations tried.

10. Press mud having the average composition of 1 per cent N, 2 per cent P and 0.5 per cent K_2O available as a bye-product in sugarcane factories can be profitably utilised as a bulky organic manure in the place of compost or farm yard manure.

11. By the proper application of green manures, the dose of fertiliser N can be reduced.

12. Manuring in pits is found to be better than furrow application.

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WELCOME TO NEW PATRON

The Madras Agricultural Students' Union welcomes Sri G. S. Thangamuthu, B. Sc., B. Sc. (Ag.), Post-graduate Scholar in the Faculty of Agronomy, Agricultural College & Research Institute, Coimbatore as a Patron of the Union.