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RESEARCH ARTICLE

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Evaluating the effect of coated DAP (Diammonium phosphate) in sugarcane (*Saccharum officinarum* L.)

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ABSTRACT : A field experiment was conducted to study the efficiency of coated DAP in sugarcane crop at M/s Sakthi Sugars Ltd., experimental farm, Appakudal, Erode district with 12 treatments comprising coated and uncoated DAP applications at three levels of P (100, 80 and 60 % of recommended P for sugarcane) with three replications.The design adopted was Randomized Block Design The results indicated that the treatment receiving coated DAP at 80 per cent of recommended P registered higher cane yield when compared with treatment receiving uncoated DAP at 100 per cent of recommended P. Among the sources of P, the treatments receiving coated DAP with nimin coated urea maintained their superiority in recording higher available N, P and K at post harvest stage followed by the treatments receiving coated DAP and uncoated DAP. However, with respect to available phosphorus at post- harvest stage, a marked increase in the available P status of the soil with the increasing levels of P as coated DAP was noticed.

KEY WORDS : Coated DAP, P availability, Sugarcane yield

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INTRODUCTION

Sugarcane is one of the important cash crops next to cotton. The sugar industry occupies a prime place in Indian economy being one of the five largest industries comprising about 400 units spread all over the country (Yadav, 2000). In India, the population has been increasing unabatedly and the sugar consumption level also increases steadily. By the end of this century, for an estimated population of 1032 million, 15.26 million tonnes of sugar is needed as against the present production of 9.55 million tones. So, there is a dire need to increase the sugarcane production (Shahi, 1999). With regard to mineral nutrition of sugarcane, at the desired time and proportions, is one of the potential factors in improving cane yield and quality.

Next to nitrogen, phosphorus is an important element to sugarcane crop. Phosphorus content is indispensable for bud sprouting, tillering and sugar transformation in cane and also in purification process of cane juice in the mill. The application of P, at low levels to soil would cause imbalance of nutrients, which is turn affect the sucrose accumulation and thereafter yield adversely. But the problem with phosphorus is that about more than 80 per cent of the applied P is being converted into unavailable forms of P which is being fixed by the soil (Mahapatra *et*

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al., 1985).

In India, the most commonly used water soluble P fertilizer for sugarcane crop is diammonium phosphate. Whatever may be the forms of P fertilizer, its efficiency may depend upon the degree and duration to which its reaction products can serve as a source of plant available phosphorus. One of the approaches may be to match more nearly the rate of release of water-soluble phosphorus from the fertilizer granules to the rate of uptake by the plant roots by coating the granules. It is believed that coated granules would maintain P in soluble form for a longer period by not allowing the entire soluble P to come in contact with soil constituents, thereby, lessening the fairly rapid fixation reactions. And once, when it is released in small increments from the coated granules into the soil solution, the plant root could compete very well with the fixation reactions and absorb more phosphorus.

Keeping all the above facts in mind, a field experiment was conducted to elicit information on the efficiency of DAP, coated with "DAP-COAT" developed by M/s. Godrej Agrovet Ltd., in sugarcane crop with the following objectives (i) to study the effect of coated DAP on the available nutrient status of the soils especially available P and (ii) to study the effect of coated DAP on growth and yield characteristics of sugarcane and P use efficiency.

EXPERIMENTAL METHODS

A field experiment conducted at M/s Sakthi Sugars Ltd., experimental farm, Appakudal, Erode district to study the efficiency of DAP coated with the coating agent "DAP-COAT" developed by M/s. Godrej Agrovet Ltd., on the soil available nutrients, cane yield and available N, P and K at post- harvest stage of sugarcane cv Co.86032.

The treatment details are as follows:

T_1 – Control
T_2 – Recommended N and K
T_3 – Recommended N and K + 62.5 kg of P_2O_5 ha^{-1} as SSP (100 % of recommended P)
T_4 – Recommended N and K + 62.5 kg of P_2O_5 ha^{-1} as uncoated DAP
T_5 – Recommended N and K + 62.5 kg of P_2O_5 ha^{-1} as coated DAP
T_6 – Recommended N and K + 50.0 kg of P_2O_5 ha^{-1} as uncoated DAP (80 % recommended P)
T_7 – Recommended N and K + 50.0 kg of P_2O_5 ha^{-1} as coated DAP
T_8 – Recommended N and K + 37.5 kg of P_2O_5 ha^{-1} as uncoated DAP(60 % recommended p)
T_9 – Recommended N and K + 37.5 kg of P_2O_5 ha^{-1} as coated DAP
T_{10} – T_5 + N as nimin coated urea
T_{11} – T_7 + N as nimin coated urea
T_{12} – T_9 + N as nimin coated urea

The experiment was conducted in RBD with three replications. The soil type of the experimental was typic haplaustalf belongs to kuppandapalayam series. The methods employed for soil analysis are furnished in the Table A.

The initial soil analysis of the experimental site (Table B) showed that coarse sand (16.48%), fine sand (28.37%), clay (24.10%) and clay (32.05 %) with clay

Table A : Methods employed for the analysis of soil samples

Sr. No.	Determinations	Methods	References
1.	Soil reaction (pH)	Potentiometry (1 : 2.5 Soil : Water)	Jackson (1973)
2.	Electrical conductivity	Conductometry (1 : 2.5 Soil : Water)	Jackson (1973)
3.	Organic carbon	1: 1 HCl chromic acid wet digestion method	Walkley and Black (1934)
4.	Available nitrogen	Alkaline $KmnO_4$ method	Subbiah and Asija (1956)
5.	Available phosphorus	0.5 M $NaHCO_3$ ph (8.5)	Olsen *et al.* (1954)
6.	Available potassium	Neutral normal ammonium acetate	Hanway and Heidal (1952)
7.	Available micronutrients	Atomic absorption spectrophotometer	Jackson (1973)

Table B : Initial soil test values of the experimental farm, M/s. Sakthi Sugars Ltd., Appakudal, Erode district

Parameters	pH	EC (dsm^{-1})	Organic carbon (%)	Available macro nutrients (kg ha^{-1})			Available micronutrients (ppm)			
				N	P	K	Fe	Mn	Cu	Zn
Soil test values	8.2	0.32	0.52	219	14.50	345	3.11	2,46	1.20	0.98

loam texture and pH (8.2), EC (0.32 dSm^{-1}), organic carbon (0.52 %) and available N, P and K (219 kg ha^{-1}, 14.50 kg ha^{-1} and 345 kg ha^{-1}).Thirteen grams of DAP-COAT was thoroughly mixed with one kg of DAP (650g of DAP-COAT per bag of 50 kg of DAP) for the coated DAP treatments.

The entire dose of phosphorus was applied through SSP or DAP (coated / uncoated as basal by placement method in between the beds. Moreover, nimin coated urea was prepared by mixing 10g of nimin with one kg of urea and applied basally. The cane yield was recorded at harvest. The soil samples were collected at post-harvest stage and analyzed for available N, P and K.

The P use efficiency in sugarcane crop was calculated by the formula (Roy and Jha, 1987) :

$$\mathbf{PUE} = \frac{\mathbf{Ydt} - \mathbf{Ydc}}{\mathbf{Pa}}$$

where,

PUE = Phosphorus use efficiency,

Ydt = Yield in treated plot (kg / ha)

Ydc = Yield in P control plot (kg / ha)

Pa = Phosphorus applied (kg P_2O_5 / ha).

EXPERIMENTAL RESULTS AND ANALYSIS

The results showed that with respect to yield (Table 1) of sugarcane variety Co.86032, the treatment T_{10} which received 100 per cent P as coated DAP and N as nimin coated urea significantly recorded the highest cane yield (147.67 kg ha^{-1}). The reason attributed may be due to improved tillering and a positive relationship with the number of millable canes due to the slow release of P applied through coated DAP. This findings are in agreement with the results obtained by Asokan (1981) and Rao *et al*. (1987).

Among the treatments, significantly the highest values of available N, P and K (Table 1) at post- harvest stage (262 kg ha^{-1}, 30.93 kg ha^{-1} and 533 kg ha^{-1}, respectively) was recorded in the treatment T_{11} receiving 80 per cent P as coated DAP and N as nimin coated urea, followed by the treatment T_{10} receiving 100 per cent P as coated DAP and N as nimin coated urea. The highest available N, P and K might be due to the superiority of coated fertilizers in maintaining the nutrient status at the highest level even at harvest stages indicating the slow and steady release of N and P from coated fertilizers (Kamaraj, 1999). Similar results were also reported by Viswanathan and Bennette (1979) and Sunilkumar (1997).

Phosphorus use efficiency, expressed as kg cane kg^{-1} P_2O_5 (Table 1) was the highest in T_{11} (233) receiving N and K, 80 per cent recommended P as coated DAP + N as nimin coated urea, followed by T_{10} (224) receiving 100 per cent recommended P as coated DAP. The findings are in accordance with that of Rao *et al*. (1991) and Kamaraj (1999).

Table 1 : Effect of sources and levels of P (kg/ha) on cane yield, available N, P and K status in soil at post harvest stage and P use efficiency of sugarcane cv. Co.86032

Treatments	Cane yield (kg ha^{-1})	At post-harvest stage N(kg ha^{-1})	P(kg ha^{-1})	K (kg ha^{-1})	P use efficiency (kg cane kg^{-1} P_2O_5)
T_1	132.67	218	4.89	162	-
T_2	133.67	223	4.92	174	-
T_3	134.67	233	10.51	209	16
T_4	138.67	237	15.54	441	80
T_5	142.33	242	30.54	527	139
T_6	135.67	238	14.77	357	40
T_7	139.67	242	24.91	471	120
T_8	134.00	235	11.02	340	9
T_9	138.33	240	21.23	444	124
T_{10}	147.67*	262*	30.93*	533*	224
T_{11}	145.33	277	25.82	474	233*
T_{12}	141.67	255	21.53	456	213

* indicate significance of value at P=0.05

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