NATIONAL SUGAR INSTITUTE AND ISHA AGRO SCIENCES PVT. LIMITED COLLABORATIVE RESEARCH PROJECT REPORT

on

"TESTING OF PSAP – POTASSIUM SALT OF ACTIVE PHOSPHORUS" A RESEARCH MOLECULE ON SUGARCANE FOR 2019-20"

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Name of the Project : **Testing of PSAP – Potassium salt of active phosphorus" a research molecule on sugarcane for 2019-20**

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INTRODUCTION

Sugarcane is one of the most energy rich plants, cultivated in most of the countries of the world and grown over 2.57 per cent of its gross cropped area. It has engaged around 7.5 per cent of the country rural population in sugarcane farming and contributed 10 per cent of the agricultural GDP in 2010-11 (Solomon 2016). Sugarcane crop requires much higher amount of inputs because of its long duration nature and the cost of sugarcane production has shown an increasing trend over the years (Murthy, 2010). India is the major sugarcane growing country with production about 330-360 million tonnes from a production area of approximately 5.0 million hectares. The productivity of the crop is low mainly due to its late planting after wheat harvest i.e. from April to May. A short growing period coupled with inadequate and imbalanced fertilizer use make the crop more susceptible to shoot borer infestation and other pest problems.

Adoption of balanced and judicious use of all needed nutrients can help in improving cane productivity and enhancement in sugar recovery by rendering resistance against biotic and abiotic stresses, and better synthesis and storage of sugar (Yadav *et.al.,* 1993).

A Recent farmer participatory survey revealed that growers generally apply more than 200 Kg Nitrogen ha^{-1} and 45to60kg P_2O_5 ha^{-1} however use of potassium K, secondary nutrients and micronutrients is all together missing. Farmers are experiencing declining responses to N and P due to omission of other essential nutrients in their fertilizer schedule. Adaption of balanced and judicious use of all needed nutrients can help to improve cane productivity and enhance sugar recovery by rendering resistance against biotic and abiotic stresses, and better synthesis and storage of sugar (Yadav *et.al.* 1993). Nutrients play an important role in crop production. Phosphorus plays a major role in metablolic processes and potash is important to induce ability to tolerate various stresses. Conventionally these major crop nutrients are supplied through chemical fertilizers through soil. 90 % of phosphate gets fixed in soil and only 10 % is absorbed by crop plants. Potash is given in ionic form, whereas its associate's cation has a role which is not synergetic to given Potash.

Availability of applied P and K to the crops is uncertain due to immobilization fixation and leaching of these nutrients in soil and hence, its uptake through roots varies from 15-60 days based on soil, water and climate conditions. Absorption of P and K fertilizer through foliage is hardly 5 to 8 per cent. Crop susceptibility to pest and disease decreases due to P and K fertilizer sprays. Nitrogen, phosphorus and potash are very important essential major nutrients required by

sugarcane crop for good growth. Nitrogen plays major role in building protoplasm and nucleus. Phosphorus is very important for sugar synthesis, energy storage and sugar translocation in plant body and potash plays very important role in providing protection against various stresses. Nitrogen is easily available through various sources like chemical fertilizer, microbial activities etc but phosphorus applied through chemical fertilizers get fixed in soil and hardly 10-13 percent is available to crop plants with help of PSB the P availability is improved slightly. Higher sugar gets translocated in stalk and in turn improves the cane girth and cane weight. PSAP is beneficial to both cane grower to get the higher net return and better sugar recovery per cent for sugar industry. Keeping in view above factors, the present study was conducted to find out the economic dose of potassium salt of active phosphorus for growth, juice purity and overall economics of sugarcane (*Saccharum sp.*) in central plane zone of U.P.

To overcome the constrains of Phosphorus and Potash, in place of conventional fertizers that are traditionally used in agriculture, PSAP – A Noval testing molecule – Potassium salt of active phosphorus is proposed for the study. 1.8 Kg powder form of PSAP in 1 liter water is quickly gets absorbed by green leaves. PSAP can be sprayed at any given stage of crop plants and higher doses do not have any phytotoxicity, PSAP can be applied through foliar, sprinkle, drip, soil drench and root tip. Foliar application of PSAP is extremely effective amongst all.

Therefore the present research project entitled “Testing of PSAP – “Potassium salt of active phosphorus” a research molecule on sugarcane for 2019-20” was proposed to be under taken at the National Sugar Institute.

I) Objectives:

1. To study the effect of PSAP on Sugarcane Quality and Yield.
2. To Estimate the cost/benefit ratio of PSAP for farmer.
3. To find best recommendations of cost effective treatments based on study.
4. To study the Soil Nutrients status as well as other soil parameters before and after experiments.

II) Treatments:

Appropriate formulations of fertilizer application with PSAP applied based on Potassium salt of active phosphorus.

T_1 – 100 % R.D.F. (180:80:80)-Control

T_2- 100 % R.D.F. (180:80:80) + 12.5 kg PSAP /ha , (4 Foliar spray -60, 75, 90 & 120 D.A.P.)

T_3- 100 % R.D.F. (180:80:80) + 12.5 kg PSAP /ha (3 Foliar spray -60, 90 & 120 D.A.P.)

T_4- 50 % R.D.F. of P & K (180:40:40)-Control

T_5- 50 % R.D.F. of P & K (180:40:40) + 12.5 kg PSAP /ha (4 Foliar spray -60, 75, 90 & 120 D.A.P.)

T_6- 50 % R.D.F. of P & K (180:40:40) + 12.5 kg PSAP /ha (3 Foliar spray-60, 90 & 120 D.A.P.)

** R.D.F. (Recommended dose of fertilizer)

**PSAP (Potassium salt of active Phosphorus)

** D.A.P. (Days after Planting)

III) Field Trials:

No. of treatments: 6, No. of replications: 3

Total No. of Plots: 6x3=18 **Plot size:** 5X5m =25 m^2 **Net area:** 450m^2

Variety: Co-0238

Design: Randomized Block Design (RBD)
Recommended dose of Fertilizer (RDF) for Nitrogen, Phosphorus and Potash will be 180:80:80 Kg/ha respectively.
Sources: N: Urea and DAP, P: DAP and K: MOP

** DAP - Diammonium Phosphate

**MOP - Muriate of Potash

IV) Observation to be recorded:

(A) Yield Parameters:

1. Germination
2. Number of millable cane
3. Average Cane Weight
4. Cane and CCS yields

(B) Quality Parameters:

1. Juice Purity
2. Pol %

3. CCS %

4. BRIX %

(C) Soil nutrients:

1. Soil Parameters before and after trials

RESULTS AND DISCUSSION

Table 1: Effect of PSAP on sugarcane yield and yield attributing parameters

Treatments	Plant Height (cm)	Inter node length (cm)	Number of inter nodes per cane	No. of Shoot per meter	Height of cane (cm)	Girth of cane (cm)	No of Millable canes 000 (ha^{-1})	Cane weight (gm)	Cane yield (t/ha)	Germination %
T_1- 100 % R.D.F. (180:80:80)- Control	272.0	9.90	20.10	9.33	184	7.40	7600	980	75.2	52.85
T_2- 100 % R.D.F. (180:80:80) + 12.5kg/ha of PSAP (4 Foliar spray- 60, 75, 90 & 120 D.A.P.)	373.30	10.12	20.90	11.66	244	9.0	103.94	1120	112.8	53.10
T_3- 100 % R.D.F. (180:80:80) + 12.5kg/ha of PSAP (3 Foliar spray- 60, 90 & 120 D.A.P.)	351.66	9.98	20.60	10.66	240	8.6	95.96	1088	102.10	53.00
T_4- 50 % R.D.F. of P & K (180:40:40)- Control	270.66	9.88	20.04	9.30	180	7.20	75.60	970.2	72.20	52.80
T_5- 50 % R.D.F. of P & K (180:40:40) + 12.5kg/ha of PSAP (4 Foliar spray - 60, 75, 90 & 120 D.A.P.)	304.00	10.00	20.12	10.56	198	8.20	92.80	1050.7	99.88	55.00
T_6- 50 % R.D.F. of P & K (180:40:40) + 12.5kg/ha of PSAP (3 Foliar spray- 60, 90 & 120 D.A.P.)	285.00	9.94	20.10	9.45	190	8.00	85.05	1040.8	96.80	52.50
S.E.	15.2	1.0	1.18	1.21	8.70	1.10	4.68	36.2	4.10	2.70
C.D. %	31.31	2.47	2.43	2.49	17.92	2.26	9.64	74.57	8.44	NS

The data of table 1 revealed that more plant height (373.30cm), Girth of cane (9 cm) in T_2 treatment and Cane yield (112.8 t/ha) in T_2 than control (without PSAP application treatment).

Effect of PSAP on number of internodes per cane plant and single inter node length were non-significant but maximum value was recorded (20.09 per cane plant and 10.12 cm) in T_2 treatment.

Table 2: Effect of PSAP on quality, nutrient uptake and economics of sugarcane

Treatments	Brix	Pol %	Purity	Sucrose	CCS (t/ha)	Uptake (Kg/ha)			Cost of cultivation (Rs. ha^{-1})	Gross Income (Rs. ha^{-1})	B:C ration
						N	P	K			
T_1- 100 % R.D.F. (180:80:80)- Control	21.50	14.77	85.16	17.15	8.76	195.52	31.58	363.20	127316	243750	1.91
T_2- 100 % R.D.F. (180:80:80) + 12.5kg/ha of PSAP (4 Foliar spray - 60, 75, 90 & 120 D.A.P.)	22.80	14.81	86.31	17.81	13.73	282.28	47.37	394.80	150428	366600	2.44
T_3- 100 % R.D.F. (180:80:80) + 12.5kg/ha of PSAP (3 Foliar spray - 60, 90 & 120 D.A.P.)	22.72	14.50	85.87	17.76	12.36	265.46	42.88	357.35	149728	331825	2.21
T_4- 50 % R.D.F. of P & K (180:40:40)- Control	21.30	14.63	85.07	17.71	8.68	187.72	28.15	209.38	124776	234650	1.88
T_5- 50 % R.D.F. of P & K (180:40:40) + 12.5kg/ha of PSAP (4 Foliar spray - 60, 75, 90 & 120 D.A.P.)	22.50	14.70	85.82	17.75	12.08	259.69	38.95	289.65	147878	324610	2.19
T_6- 50 % R.D.F. of P & K (180:40:40) + 12.5kg/ha of PSAP (3 Foliar spray - 60, 90 & 120 D.A.P.)	22.48	14.60	86.87	17.72	11.76	251.68	37.35	280.72	147178	314600	2.14
S.E.	1.21	-	-	-	-	15.82	2.80	16.20	-	6250	0.05
C.D. %	NS	-	-	-	-	32.58	5.77	33.37	-	12875	0.10

A difference in sucrose per cent due to PSAP treatment was not significant. Application of PSAP resulted into increase in sucrose per cent in all PSAP treatments against non PSAP application

treatment and recorded highest value (17.81 per cent) in T_2 treatment. Differences in data of purity per cent due to different PSAP treatment were non-significant and recorded highest value (86.31 per cent) in T_2 treatment compared with all PSAP treatments.

Better performance of CCS (t/ha) was noted in 100 per cent recommended dose of NPK (180:80:80) and 12.5 kg/ha PSAP at 60, 75, 90 and 120 DAP was possible due to over all good plant growth enabling plants to accumulate more photosynthates for synthesis of sucrose.

Cost of cultivation depends on variable input and their availability and price in local market. Data from above table 2 showed that maximum cost of cultivation (Rs. 150428 ha^{-1}) was noted in T_2 due to additional cost of PSAP and minimum value of cost of cultivation value was having in control (Rs. 127316 ha^{-1}). Differences between maximum and minimum value of cost of cultivation was obtained only Rs. 23112 ha^{-1}. Gross income and benefit cost ratio value were obtained significantly higher in T_2 treatment (Rs. 36,600 ha^{-1} and 2.44), respectively compared with all other treatments. Higher numbers of foliar spray of 12.5kg/ha PSAP gave higher Gross income and benefit cost ratio due to better response of foliar spray of PSAP on cane productivity.

Table 3: Effect of PSAP on mean observation Data or summary

S. No.	**Parameters**	Control	Treated	Difference
1.	Number of Shoot per Meter	9.31	10.58	1.27
2.	Height of Sugarcane Plant (cm)	274.83	328.49	53.66
3.	Height of cane (cm)	182.00	218.00	36.00
4.	Girth of cane (cm)	7.3	8.45	1.15
5.	Cane weight (gm)	975.1	1074.87	99.77
6.	Cane yield (t/ha)	73.7	102.89	29.19
7.	No of Millable canes (ha^{-1})	75.8	94.43	18.63

The data of table 3 revealed that better cane weight (1074.87 cm), Height of cane plant (328.49 cm) and number of Millable canes (102.89 ha^{-1}) in treated plant than control (without PSAP application treatment). Effect of PSAP on number of shoot per cane was found non-significant with maximum value recorded as (328.49cm) in PSAP treatments.

Table 4: Effects of treatments on available N, P and K (Kg/ha) before and after harvest of sugarcane crop:

Treatments	Available Nutrient (Kg/ha)		
	N	P	K
T_1- 100 % R.D.F. (180:80:80)-Control	280.5	26.2	135.0
T_2- 100 % R.D.F. (180:80:80) + 12.5kg/ha of PSAP (4 Foliar spray- 60, 75, 90 & 120 D.A.P.)	283.2	26.4	138.2
T_3- 100 % R.D.F. (180:80:80) + 12.5kg/ha of PSAP (3 Foliar spray- 60, 90 & 120 D.A.P.)	283.2	26.2	138.0
T_4- 50 % R.D.F. of P & K (180:40:40)-Control	279.8	25.5	132.5
T_5- 50 % R.D.F. of P & K (180:40:40) + 12.5kg/ha of PSAP (4 Foliar spray-60, 75, 90 & 120 D.A.P.)	282.5	25.8	135.5
T_6- 50 % R.D.F. of P & K (180:40:40) + 12.5kg/ha of PSAP (3 Foliar spray-60, 90 & 120 D.A.P.)	282.6	25.8	135.2
S.E.	1.98	1.18	2.10
C.D. %	NS	NS	NS
Initial values	270.4	25.2	129.8

The data of table 4 showed that values of Available N, P and K after harvest of sugar cane crop are non-significant compare to initial values of available N,P and K in soil of experimental site.

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CONCLUSION

On the basis of above study, it is concluded that application of PSAP only through foliar sprays (four prays at 60, 75, 90 and 120 DAP) gave significantly better results with all doses of PSAP than control (without PSAP application treatment). Foliar application of PSAP @ 12.5 kg per hectare at different periods after planting along with 100 per cent recommended dose of NPK (180:80:80) applied in sugarcane cultivation is helpful in improved growth, juice purity and higher net return with improved benefit cost ratio. **One ratoon crop and one more plant cane crop is recommended for validation of above results.**

Recommended by:

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