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Effect of doses of potassium salt of active phosphorus (PSAP) on productivity and quality of sugarcane (*Saccharum sp.* hybrid)

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ABSTRACT

Potassium salt of active phosphorus (PSAP) is a molecule in which phosphorus is activated by catalytic process and potash is attached with this phosphorus by split technology. PSAP is soluble in water and easily taken up by sugarcane leaves and roots. It does not get fixed in any kind of soil. Active phosphorus also helps in producing additional energy in the form of phosphate bonds of ATP/ADP. About 90-95 per cent PSAP gets absorbed by sugarcane leaves very effectively when applied through spray. PSAP can also be given through drip or drenching. A field experiment was conducted during two consecutive years *i.e.* 2016-17 and 2017-18 at Research Farm of Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Kushinagar, U.P. The experiment consisted of seven treatments (T_1-100 per cent recommended dose of NPK, T_2-100 per cent recommended dose of NPK+10 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP, T_3-100 per cent recommended dose of NPK+10 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP, T_4-100 per cent recommended dose of NPK+12.5 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP, T_5-100 per cent recommended dose of NPK+12.5 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP ,T_6-100 per cent recommended dose of NPK+15 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP and T_7-100 per cent recommended dose of NPK+15 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP) were laid out in randomized block design with three replications. Sugarcane variety 'UP 05125' was planted at 90 cm row spacing. The experimental findings on the basis of pooled data of two years revealed that germination per cent and CCS per cent were not affected significantly with different treatments but maximum value of germination per cent (58.95) was obtained in 100 per cent recommended dose of NPK+12.5 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60,75, 90 and 105 DAP and CCS (12.81 per cent) in (T_7)100 % recommended dose of NPK+15 kg PSAP per hectare through 5 foliar sprays at 45,60,75, 90 and 105 DAP applications. Effect of treatments on shoot population, NMC and cane yield were recorded significantly higher in PSAP treatments as compared to control. Cane yield was significantly lower in control (67.97 t/ha) as compared to remaining treatments and it increased up to 35.89 per cent over control plot. On the basis of yield, it has been concluded that 100 per cent recommended dose of N, P and K along with foliar spraying of PSAP @ 15 kg per hectare at 45, 60,60,75,90 and 105 days after planting (DAP) is helpful for increasing cane yield and CCS yield in calcareous soil having more calcium content. When compared between spraying and drenching performance of PSAP, better performance was found in five spraying at 45,60,75,90 and 105 day after planting in term of yield attributing characters.

Key words: Sugarcane, Yield, CCS, PSAP, Salt, Nutrients, Productivity

INTRODUCTION

Sugarcane assumes an important position in the Indian economy, contributing nearly 1.5 per cent of national gross domestic product. Sugarcane is being cultivated in most of the countries of the world and is an important agro industrial crop of the state. It is one of the most energy rich plants and most efficient converter of solar energy into sugar. The productivity of sugarcane in India is quite low owing to several factors *viz.*, poor management of crop, poor soil condition, abiotic and biotic stresses *etc.* 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). 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. Potash is plenty in our soils but its availability is poor. The potassium

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salt of active phosphorus (PSAP) has been developed by Isha Agro India, Pune for spray application as well as through fertigation. Potassium salt of active phosphorus (PSAP) is a research molecule, first time given in India. Phosphorus is activated by catalytic process and potash is attached with this phosphorus by split technology in PSAP. Active phosphorus of PSAP helps to produce additional energy in the form of phosphorus bonds of ATP/ADP in sugarcane. This additional energy pushes all those pathways near to the completion much early. Advancement of various syntheses in presence of active potash from PSAP will produce more sugar in cane. This active potash from PSAP converts the reducing sugar, finally into the sucrose and reflects as CCS per cent. 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 yields and better sugar recovery per cent for sugar industry. Hence, the present study was conducted to find out the effect of doses of potassium salt of active phosphorus (PSAP) on productivity and quality of sugarcane (*Saccharum sp.* hybrid).

MATERIALS AND METHODS

The field experiments were conducted during 2016-17 and 2017-2018 at the Research Farm of Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Kushinagar, U.P. The Research Farm is located at 27.2^0 N latitude, 84.2^0 E longitude and at altitude of 99.8 meter above the mean sea level. The frost occurs in winter generally from second week of December to end of January. The experiment consisted of seven treatments (T_1)-100 % recommended dose of NPK, T_2-100 % recommended dose of NPK+10 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP, T_3- 100 % recommended dose of NPK+10 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP, T_4-100 % recommended dose of NPK+12.5 kg PSAP per hectarethrough one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP, T_5-100 % recommended dose of NPK+12.5 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP ,T_6-100 % recommended dose of NPK+15 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP and T_7-100 % recommended dose of NPK+15 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 (DAP) were laid out in randomized block design with three replications. Foliar spraying concentration of PSAP was 0.4 per cent i.e. 4 gm PSAP per litre of water. Sugarcane variety 'UP 05125' was planted at 90 cm row spacing, all recommended package of practices were adopted in the experiment conducted. The soil of experimental plot was medium in organic carbon, low in available phosphorus and medium in potash with pH 8.1. Fertilizer was applied as per treatment with proper recommendations. Urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O) were used as sources of nitrogen, phosphorous and potassium, respectively. PSAP chemical was provided by Isha Agro India, Pune. The observations were recorded on number of shoots, millable canes, cane yield and quality parameters. Germination per cent was recorded at 45 days after planting of the crop. Yield of sugarcane was recorded from each plot. The length of all five canes was measured with help of measuring tape and averaged. The canes used for recording length were also used for observation on number of internodes per cane. All the inter nodes of five canes were counted and averaged. The diameter of each cane was measured with the help of a Vernier calliperse and averaged. The weight of all five canes were taken and averaged. Commercial cane sugar per cent in cane juice was analyzed and calculated by using the following formula (Spencer and Meade, 1955)

Commercial cane sugar per cent = [S - {0.4(B - S)} 0.73]

Where, S = Sucrose per cent in juice

B = Corrected Brix of juice

0.4 & 0.73 are constants

The commercial cane sugar per hectare at harvesting stage was computed as follows

$$\text{CCS (t ha}^{-1}) = \frac{\text{Commercial cane sugar percent in cane}}{100} \times \text{cane yield (t ha}^{-1})$$

RESULTS AND DISCUSSION

The pooled data of two years in Table 1 indicated that germination and CCS per cent were not affected significantly by different treatments. Significantly higher number of shoot population (152,790) and number of millable canes (110,800) were produced in T_7 treatment which was 14.48 and 18.48 per cent higher than the control. Cane yield(92.37t/ha) and CCS per cent (12.81) obtained in 100 per cent recommended dose of NPK+15 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP treatment were significantly higher than other remaining treatments, except T_6 treatment. The increased cane productivity under PSAP treatments was 16.71 to 35.89 per cent higher than that of control. CCS t/ha was also significantly increased in 100 per cent recommended dose of NPK+15 kg PSAP per hectare through one drenching at 45 DAP and 4 foliar sprays at 60, 75, 90 and 105 DAP treatment (11.72 t/ha) as compared to other remaining treatments. Table 1 indicated that T_7 treatment obtained more plant cane length (41.27cm) and single cane weight (0.369 kg) than control. Cane length, single cane weight and cane diameter were affected significantly higher in 100 per cent recommended dose of NPK+15 kg PSAP per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 day after planting (265.310 cm, 0.980 kg and 2.70 cm, respectively) over rest treatments however at par with T_6 PSAP treatment while spraying and drenching treatment were statistically non significant but value obtained was higher in five spraying of PSAP. Singh *et al.* (2012) also reported that productivity depends upon the quantity of millable canes. Numerically increase in CCS per cent may be attributed primarily due to increased cane productivity and up to some extent improved juice quality. Effect on CCS per cent between

Table 1 Effect of potassium salt of active phosphorus (PSAP) on sugarcane yield and Juice quality

Treatments	Pooled data of two years								
	Germination (%)	Shoots (000/ha)	NMC (000/ha)	Cane length (cm)	Single cane weight (kg)	Cane thickness (cm)	Cane yield (t/ha)	CCS (%)	CCS (t/ha)
T_1 -100 % Recommended dose of NPK(control)	48.56	133.46	93.47	223.83	0.725	2.05	67.97	12.31	8.37
T_2-100 % Recommended dose of NPK+10 kg PSAP/ha through one drenching at 45 DAP and 4 foliar sprays at 60,75, 90 and 105 DAP	50.22	143.52	101.38	227.50	0.786	2.15	79.33	12.47	9.88
T_3-100 % Recommended dose of NPK+10 kg PSAP/ha through 5 foliar sprays at 45,60,75, 90 and 105 DAP	53.28	149.88	103.95	231.67	0.872	2.32	80.94	12.65	10.08
T_4-100 % Recommended dose of NPK+12.5 kg PSAP/ha through one drenching at 45 DAP and 4 foliar sprays at 60,75, 90 and 105 DAP	53.95	151.32	104.54	232.50	0.886	2.38	85.22	12.58	10.72
T_5-100 % Recommended dose of NPK+12.5 kg PSAP/ha through 5 foliar sprays at 45,60,75, 90 and 105 DAP	49.45	152.53	109.09	234.17	0.891	2.48	85.18	12.51	10.47
T_6-100 % Recommended dose of NPK+15 kg PSAP/ha through one drenching at 45 DAP and 4 foliar sprays at 60,75, 90 and 105 DAP	50.72	152.09	106.69	244.17	0.920	2.58	88.17	12.48	11.02
T_7-100 % Recommended dose of NPK+15 kg PSAP/ha through 5 foliar sprays at 45,60,75, 90 and 105 DAP	47.23	152.79	110.80	265.00	0.980	2.70	92.37	12.81	11.72
SEm±	2.51	2.50	2.39	3.34	0.086	0.11	1.22	0.19	0.27
CD(P=0.05)	NS	7.79	7.47	10.43	0.028	0.33	3.81	NS	0.84

spraying and drenching at same doses of PSAP treatment was observed to be non significant but numerically higher value was obtained in spraying treatment. Effect of PSAP treatments on CCS per cent was found non significant but lowest value was noted in control treatment (12.31). Sarwar *et al.,* (2009) applied different solid and liquid fertilizers in broadcast and foliar forms and found non-significant effect on germination and CCS but this significant affected the tillering, number of millable cane, cane yield and sugar yield. Similar results were also found by Singh *et al.* 2018 that higher dose of PSAP (15 kg per hectare) gave more cane productivity and improved yields attribute characters.

CONCLUSION

On the basis of above investigation, it may be concluded that PSAP is benefited to sugarcane growers. Cane yield was increased up to 36 per cent by using PSAP. Treatment 100 per cent recommended dose of NPK+15 kg PSAP. The treatment per hectare through 5 foliar sprays at 45, 60, 75, 90 and 105 DAP produced significantly higher number of millable cane and cane yield. CCS per cent was not affected significantly due to different PSAP treatments.

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