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Effect of Potassium on the Yield and Quality of Late Harvested Sugarcane

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ABSTRACT

A field experiment was conducted on clay loam soil of Regional Agricultural Research Station, Anakapalle (A.P) to study the individual and integrated effects of levels of potassium (0,50,100,150 and 200 kg K_2O/ha) and three times of harvest (12, 14 and 16 months) on the yield and quality of a late maturing sugarcane variety Co 7706. The percentage juice recovery and purity improved with 100 kg K_2O/ha whereas the percentage juice sucrose increased upto 200 kg K_2O/ha level. Similarly, stalk population at harvest, cane and sugar yields increased upto 100 kg K_2O/ha. All characters were adversely affected when the harvest was delayed to 16 months compared to 12 months harvest.

INTRODUCTION

Sugarcane is an important commercial crop grown in about 1.47 lakh hectares in Andhra Pradesh. Usually it is harvested during November to April for sugar or jaggery manufacture, depending on the duration of the variety. harvest is sometimes forced to be delayed due to rush in harvesting of cane during limited period of maturity. This period coincides with rising summer temperature, and crop is subjected to stress leading to reduction in yield, and quality. Potassium is known for maintaining moisture in plant tissues by regulating stomatal opening and turgidity of cell, besides playing an important role in the synthesis and translocation of sugars, activation of plant enzymes and many other processes (Anon., 1989). The requirement of potassium by sugarcane is twice that of nitrogen (Pataskar, 1972). The effect of potassium on maintenance of yield and quality of sugarcane, especially under late harvested condition would be of immense use to sugarcane growers.

MATERIALS AND METHODS

A field experiment was conducted during two cropping season 1987-88 and 1988-89 at Regional Agricultural Research Station, Anakapalle, Andhra Pradesh to study the effect of five levels of potassium (0, 50, 100, 150 and 200 kg K_2O/ha), and three times of harvest (at 12, 14 and 16 months) on the yield and quality of sugarcane variety Co 7706. The crop was planted during middle of February in both the seasons and received uniform dose of 112 kg N/ha in the form of urea in two equal halves at 45 and 90d after planting. Potassium was applied basally as per treatments in the form of muriate of potash. These fifteen treatment combinations were studied in a randomised block design and replicated thrice.

The soil of the experimental field was clay loam with neutral reaction (pH 7.2), normal conductivity (E.C. 0.12 mmhos/cm), low in available nitrogen (220 kg N/ha), medium in available phosohorus (15.2 kg P/ha) and high in available potassium (300 kg K/ha). Standard procedures were followed for soil analysis (Jackson, 1973) and juice analysis (Browne and Zerban, 1941).

The mean maximum and minimum temperatures recorded during the months of February, March, April, May and June in 1988 and 1989 are given in the Table 1.

RESULTS AND DISCUSSION

The mean juice recovery percentage increased with increase in level of applied potassium but tended to decrease with delay in harvest time from 12 to 16 months (Table 2); Significant improvement in juice recovery was obtained at 100 kg K_2O/ha over O kg K_2O/ha but was at par with 50, 150 and 200 kg K_2O/ha. On the other hand, juice recovery percentage was noted to decrease as time of harvest was delayed to 14 to 16 months. The juice recovery percentage of 14 months harvested corp with no added potassium decreased by 5.98% compared to crops receiving 100 kg K_2O/ha, and harvested at 12 months age. At 16 months age, juice recovery percentage decreased by 7.89% in plots with no potassium application. The percentage recovery of juice decreased to 5.56% even in the presence of 100 kg K_2O/ha as compared to plots harvestd at 12 months age. The beneficial effect of potassium application in maintaining juice recovery percentage even under delayed harvested conditions brought out from these observations could be due to maintenance of succulance of cane crop by maintaining moisture in plant.

Table 1. Maximum and minimum temperatures during different periods of harvest.

Harvesting month	1988		1989	
	Maximum Temp. °C	Minimum Temp. °C	Maximum Temp. °C	Minimum Temp. °C
February	32.2	18.7	33.3	17.5
March	34.4	23.1	34.0	20.7
April	35.7	24.3	36.3	25.1
May	36.7	26.3	37.2	27.4
June	37.0	24.2	35.1	26.8

Juice Quality

Slight improvement in juice quality was observed with increase in level of potassium from 50 to 200 kg/ha. On the other hand, the juice sucrose percentage values tended to decrease when the harvesting was delayed from 12 to 16 months (Table 2). The differences in juice sucrose values due to 12 and 14 months age of harvests being at par, it was depressed significantly at 16 months age of the crop. This deterioration in juice quality was due to rise in temperatures (Table 1). Irrespective of the time of harvest, better juice sucrose values were recorded with higher levels of K application. Crops that received 200 kg K_2O/ha and harvested at 12 months age had richest juice sucrose value (18.55%). When the crops were harvested at 14 and 16 months age improvement of 0.79 and 1.53 percentage units of sucrose was recorded with 200 kg K_2O/ha respectively over O kg K_2O level, indicating that the crops can be retained in the field upto 14 to 16 months with higher level of potassium. Adequate potassium

helps in utilization of assimilated nitrogen in cane and conversion of reducing sugars to recoverable sugars. Beringer (1978) reported that optimal K nutrition improves quality of sugarcane by increasing protein and by reducing soluble nitrogen.

Table 2. Effect of levels of potassium and time of harvest on juice recovery, sucrose and purity percentages.

Level of potassium (kg K_2O/ha)	Juice recovery percentage				Juice sucrose percentage				Juice purity percentage			
	12 month harvest	14 month harvest	16 month harvest	Mean for level of potassium	12 month harvest	14 month harvest	16 month harvest	Mean for level of potassium	12 month harvest	14 month harvest	16 month harvest	Mean for level of potassium
0	60.4	57.7	56.5	58.2	17.4	17.2	13.9	16.3	87.6	89.3	81.7	86.4
50	60.7	58.4	56.9	58.7	17.9	17.8	14.5	16.7	88.8	89.5	83.0	87.1
100	61.3	58.8	57.9	59.3	18.1	18.0	14.9	17.0	88.9	91.6	84.0	88.2
150	61.8	59.4	59.2	60.1	18.2	17.9	15.5	17.2	90.6	90.7	85.1	88.8
200	62.2	60.2	59.1	60.5	18.6	18.0	15.5	17.4	90.9	91.4	85.3	80.2
Mean for time of harvest	61.3	58.9	57.9	—	18.0	17.8	14.9	—	89.2	90.6	83.8	—
C.D. at P= 0.05 for												
Potassium (K)		1.10				—				1.15		
Time of harvest (T)		0.85				0.75				0.89		
K X T		—				—				—		

The purity percentage values increased with increasing level of potassium from 50 to 200 kg K_2O/ha. Significant imporvement in percentage juice purity was observed upto 100 kg K_2O/ha. Further increase in the level of K to 200 kg K_2O/ha did not significantly improve percentage purity (Table 2). On the other hand, the purity percentage in juice tended to depress when the harvest was delayed from 12 to 16 months, irrespective of the level of K. Significantly less pure juices were obtained when the crop was harvested at 16 months age. Better juice purity was observed at 14 moths age supplied with 100 kg K_2O/ha. Even under delayed harvest at 16 months age, higher levels of potassium tended to maintain higher purity percentage to tune of 3.5 percentage units juices as a result of K application could be due to reduction in glucose, nitrogen and non-sugars in juices and higher sucrose in juices.

Application of potassium from 50 to 100 kg/ha significantly increased the number of millable canes at harvest, but further increase in the level of K to 150 or 200 kg K_2O/ha did not show any beneficial increase in the number of millable canes. When potassium was applied at 100 kg/ha, the number of millable canes increased by 11.7 and 6.48 percentage over control when compared to zero level of potassium and 50 kg K_2O/ha level respectively. Beneficial effect of potassium application in maintaining optimum tiller population and millable cane number was reported by Srivastava and Hunsigi (1978).

Table 3. Effect of levels of potassium and time of harvest on number of millable canes, cane and sugar yields at harvest.

Level of potassium (Kg K_2O/ha)	Number of millables canes/ha				Cane yield t/ha				Sugar yield t/ha			
	12 month harvest	14 month harvest	16 month harvest	Mean for level of potassium	12 month harvest	14 month harvest	16 month harvest	Mean for level of potassium	12 month harvest	14 month harvest	16 month harvest	Mean for level of potassium
0	66910	57630	45981	56873	94.9	89.9	67.8	84.2	12.2	11.2	6.8	10.0
50	69705	61485	49514	60234	103.0	89.5	69.4	87.2	13.0	11.5	7.1	10.5
100	72665	65608	54974	64416	107.9	98.5	73.1	93.1	13.8	12.7	7.5	11.3
150	75859	66988	53412	65420	108.5	98.2	73.5	93.4	14.0	12.9	7.9	11.6
200	76299	67936	54650	66295	108.7	99.9	73.7	94.1	14.0	13.1	8.0	11.7
Mean for time of harvest	72288	63929	51706	—	104.6	95.2	71.6	—	13.4	12.3	7.5	—
CD at P= 0.05 for												
K Level's		3506				6.02				0.84		
Time of hatvest		2715				4.67				0.65		
K level's time of harvest.		—				—				—		

The cane yield increased significantly with increase in the level of potassium upto 100 kg/ha. Further additions of potassium to 150 or 200 kg K_2O/ha did not show any significant improvemnet in cane yield ; thus indicating 100kg K_2O/ha was optimum for sugarcane variety Co 7706. Significant response of sugarcane to potash application was reported by Srinivasan and Morachan (1980) and Narasimham (1990). The mean cane yield tended to fall significantly and continuously as harvest was delayed from 12 months to 16 months. As a result of delayed harvest at 14 and 16 months age, cane yield decreased to tune of 7.68 and 30.56 percentage respectively over 12 months harvest. However, none of the interaction effects were significant.

The sugar yield increased significantly upto 100 kg K_2O/ha with no further significant improvement at higher levels of potash application. Significant reduction in sugar yield was observed as harvest was delayed beyond 12 months. The improvement in sugar yield as a result of potash application might be due to the fact that potassium aided both in cane yield and juice sucrose improvement. The reduction in sugar yield was noted to extent of 8.30 and 44.28 percentage for 14 and 16 month harvests respectively over 12 month harvest.

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