Indian Journal of Sugarcane Technology **27(02)**: 62-64, December 2012

Improving productivity of winter initiated ratoon of sugarcane in sub tropical India

KULDEEP SINGH, HARMANDEEP SINGH[1], RAMANDEEP SINGH SANDHU[1] and M S BHULLAR

Punjab Agricultural University, Regional Station, Faridkot, Punjab 151203

ABSTRACT

A field experiment was conducted during 2007–2009, 2008–2010 and 2009-2011 at Punjab Agricultural University, Regional Research Station, Faridkot for addressing the problem of poor sprouting in winter initiated ratoon. Results revealed that application of 60 kg K /ha to standing plant crop 30 days before ratoon initiation (DBR) increased ratoon cane yield (20.8%) and ratoon sugar yield (21.6%) over control. Application of 60 kg K/ha + 25 kg $ZnSO_4$/ha 30 DBR with irrigation and 25 kg $ZnSO_4$/ha + 10 t SPMC (fresh) /ha at time of ratoon initiation increased 15.8 and 14.3% ratoon yield and 17.3 and 15.0% sugar yield over control, respectively. Thus, K, Zinc and press mud application holds great promise for improving productivity of ratoon cane initiated in the winter season.

Key words: sugarcane ratoon, press mud, potassium, zinc

Ratooning is sprouting of underground sugarcane stubbles left in the field after harvest of the plant crop. It is beneficial due to its low cost of production as compared to plant crop owing to saving in the seed material and planting operations. Regular supply of sugarcane for extended period is required for running of sugar mills for long time. In Indo-Gangetic Plain of South Asia, sugarcane (plant) – ratoon cane, crop rotation is practiced on 2.5 million hectares (Yadav *et al.* 2009). However, ratoon yields are lower than the plant crop due to soil compaction (Verma 2002), decreased rate of soil fertility under continuous sugarcane cropping and inefficient use of applied fertilizers (Sundara and Tripathi 1999). Stubble decline, characterized by progressive reduction of yield in successive crops, is a major constraint to productivity and profitability of the sugarcane industry (Shukla *et al.* 2008). Factors associated with stubble decline include genotype, low winter temperatures including freezing, poor soil aeration and drainage, weed competition and physiological maturity and health of the cane plant. These factors are influenced by growing conditions (Dissanayake and Hoy 1999). In subtropical India, after harvest of plant crop, most often fewer buds sprout due to low temperature. Unsprouted stubbles cause gaps in stubble rows resulting in low initial shoot population and cane yield (Shukla *et al.* 2008). Several agro-techniques viz., trash mulching, polyethylene mulching, intercropping of wheat and potato have been used (Verma and Yadav 1988) to enhance stubble bud sprouting in the ratoon cane but without success. Due to decline in sugarcane area in Punjab, the sugar mills are running only for a short period and cane is being harvested in winter months. Moreover, 'CoJ 85' is sugarcane variety with high sugar and its area is increasing with time. However, it has been found to be a poor ratooner, may be due to winter harvesting of this variety. The present investigation was therefore carried out to get better ratoon yield with application of various treatments in standing plant cane before harvest that can ensure adequate sprouting of buds.

[1]Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India

MATERIALS AND METHODS

A field experiment was conducted for three crop cycles of plant and ratoon crops of sugarcane during 2007–2009, 2008–2010 and 2009-2011 at Punjab Agricultural University, Regional Research Station, Faridkot located at 30° 40' N, 74° 44' E and 200 m above mean sea level with semi-arid sub-tropical climate having dry hot summer and cold winter. During 2008-09, the highest rainfall (161.8 mm) was recorded in August whereas in March and November there was no rain. July was the hottest month with maximum temperature of 35.4 ^{0}C followed by April (34.1 ^{0}C), however the lowest value of 18.3 ^{0}C was recorded in December. Relative humidity was the highest in August (90.2%) and the lowest was in May (63.4%). During 2009-10, the maximum rainfall of 188.7 mm was recorded in the month of July whereas the least rainfall was observed in December. The values of maximum temperature was the highest in June (40.7 ^{0}C) followed by May (39.8 ^{0}C) and the lowest values (16.2 ^{0}C) were in January, 2010. The highest values of minimum temperature were recorded in July (28.3 ^{0}C) followed by August (27.8 ^{0}C) and the lowest values (7.6 ^{0}C) were in January, 2010. Relative humidity was the highest in January, 2010 (96.0%) and the lowest was in May 2009. During 2010-11, the highest rainfall was in July (255.1 mm) and there was no rain in April, October

and November 2010. The maximum temperature of 39.0 ^{0}C was recorded in May followed by April (37.8 ^{0}C) and the lowest values (13.6 ^{0}C) were in January, 2011. The values of minimum temperature were the highest in June (29.3 ^{0}C) followed by July (28.6 ^{0}C) and the lowest values (6.0 ^{0}C) were in December. Relative humidity was the highest (93.6%) in August and the lowest was in April. The soil of the experimental field was sandy loam of Indo-Gangetic alluvial origin and well drained.

An early maturing sugarcane variety, 'CoJ 85' was planted in 15 cm deep furrows by placing cane setts horizontally, end to end at 75 cm apart with tractor drawn furrow opener. Twelve buds per meter row length were planted by taking three budded seed setts. All recommended production and protection practices were uniformly applied.

Eight treatments (**T_1:** Recommended practices i.e. 90 kg N/ha in three equal splits 1/3rd each in February, April and June, stubble shaving and interculture for weed control); **T_2**: One irrigation to plant crop 30 DBR (Days before ratooning) and then irrigation at 15 days interval upto 1st week of Feb; **T_3**: Fresh sulphitation press mud cake SPMC @ 20t/ha at ratooning; **T_4**: Application of 60 kg K_2O /ha 30 DBR; **T_5**: Intercropping of legume, Senji (*Melilotus alba*) in ratoon crop for green manuring; **T_6**: Soil application of $ZnSO_4$ @ 25 kg/ha before 30 DBR along with irrigation; **T_7**: Application of K_2O /ha @ 60 kg + $ZnSO_4$ @ 25 kg/ha 30 DBR with irrigation; **T_8**: Application of $ZnSO_4$ @ 25 kg/ha + SPMC (fresh) @ 10 t/ha at ratooning) were applied to standing plant crop to observe their effect on following ratoon crop. For raising ratoon crop, in addition to these treatments, 225 kg N /ha was also applied in three equal splits in February, April and May. The crop was harvested in first week of January close to the ground level by specially designed steel chopper.

A 5-cane sample was taken at random from each plot for determining cane height and cane thickness. To carry out juice quality analysis, the 5-cane sample was weighed and crushed through three roller miller. A sub sample of crushed cane juice was analyzed for brix (total solids) by a brix hygrometer. Sucrose concentration was determined by polarimeter after clarifying the juice with lead acetate. Commercial cane sugar percent (CCS) was calculated by using the formula of Sastry and Chari (1960). Variances were subjected to Bartlett's test for homogeneity of variances. As variances were found to be homogeneous, pooled data are presented.

RESULTS AND DISCUSSION

Averaged over three years**,** application of 60 kg K_2O/ ha 30 days before ratoon initiation significantly increased the number of shoots/ha as compared to other treatments (Table 1). Potassium is known for maintaining water balance in the stubble thereby enhancing metabolic activities. It regulates water uptake, transport and utilization. Its application may have improved shoot population density due to higher availability of nutrients to crop (Aide and Picker 1996). Improved shoot population density in ratoon with application of K with irrigation water in standing plant cane is also reported by Shukla *et al.* 2009. The lowest number of shoots was recorded with soil application of $ZnSO_4$ @ 25 kg/ha 30 DBR along with irrigation. The number of millable canes was significantly higher under application of 60 kg K_2O /ha 30 DBR (T_4) as compared to recommended practices i.e. 90 kg N/ha in three equal splits 1/3rd each in February, April and June, stubble shaving and interculture for weed control (T_1), one irrigation to plant crop 30 DBR (Days before ratooning) & then irrigation at 15 days interval upto 1st week of Feb (T_2) and soil application of $ZnSO_4$ @ 25 kg/ha before 30 DBR along with irrigation (T_6). The vigorous shoots formed in ratoon cane in T4 contributed towards larger share in millable cane formation. Beneficial effects of K application in

Table 1 Effect of different treatments on growth parameters of sugarcane ratoon (Pooled for three years)

Treatments	No. of shoots (000/ha)	NMC (000/ha)	Stalk length (cm)	Stalk girth (cm)	Single cane wt. (g)	CCS (%)
T_1	85.3	58.0	116.9	3.19	903	13.50
T_2	92.4	63.7	111.3	3.21	868	13.57
T_3	92.8	67.3	111.9	3.17	863	13.52
T_4	106.8	70.7	118.8	3.18	922	13.60
T_5	91.2	60.6	111.5	3.08	835	13.49
T_6	83.0	53.1	112.2	3.25	899	13.42
T_7	96.6	69.2	117.4	3.19	892	13.68
T_8	95.9	68.1	120.5	3.15	915	13.59
CD (5%)	**9.2**	**5.1**	**7.1**	**NS**	**NS**	**NS**

T_1: Recommended practices, **T_2**: One irrigation to plant 30 DBR and then irrigation 15 days interval upto 1st week of Feb.,**T_3**: Fresh sulphitation press mud cake (SPMC) @ 20t/ha at ratooning , **T_4**: Application of 60 kg K_2O /ha 30 DBR (Days before ratooning), **T_5**: Intercropping of legume, Senji (*Melilotus alba*) in ratoon crop for green manuring, **T_6**: Soil application of $ZnSO_4$ @ 25 kg/ha before 30 DBR along with irrigation, **T_7**: Application of K_2O /ha @ 60 kg + $ZnSO_4$ @ 25 kg/ha 30 DBR with irrigation, **T_8**: Application of $ZnSO_4$ @ 25 kg/ha + SPMC (fresh) @ 10 t/ha at ratooning

Table 2 Effect of different treatments on cane and sugar yield of sugarcane ratoon

Treatments	Cane Yield (t/ha)				Sugar Yield (t/ha)			
	2008-09	2009-10	2010-11	Pooled	2008-09	2009-10	2010-11	Pooled
T_1	46.1	48.3	41.6	45.3	6.05	6.67	5.64	6.12
T_2	47.6	50.8	41.3	46.6	6.15	7.12	5.71	6.33
T_3	44.8	47.5	52.5	48.3	5.77	6.61	7.22	6.53
T_4	53.7	55.9	54.6	54.7	7.02	7.80	7.50	7.44
T_5	45.8	43.7	45.2	44.9	5.83	6.10	6.24	6.06
T_6	42.6	44.1	40.0	42.2	5.50	6.17	5.35	5.67
T_7	53.0	50.6	53.8	52.5	6.97	7.13	7.43	7.18
T_8	52.2	49.7	53.5	51.8	6.78	7.00	7.34	7.04
CD (5%)	**5.1**	**6.5**	**7.6**	**3.6**	**0.74**	**0.99**	**1.11**	**0.53**

T_1: Recommended practices, **T_2**: One irrigation to plant 30 DBR and then irrigation 15 days interval upto 1st week of Feb.,**T_3**: Fresh sulphitation press mud cake (SPMC) @ 20t/ha at ratooning, **T_4**: Application of 60 kg K_2O /ha 30 DBR (Days before ratooning), **T_5**: Intercropping of legume, Senji (*Melilotus alba*) in ratoon crop for green manuring, **T_6**: Soil application of $ZnSO_4$ @ 25 kg/ha before 30 DBR along with irrigation, **T_7**: Application of K_2O /ha @ 60 kg + $ZnSO_4$ @ 25 kg/ha 30 DBR with irrigation, **T_8**: Application of $ZnSO_4$ @ 25 kg/ha + SPMC (fresh) @ 10 t/ha at ratooning

increasing the millable canes numbers in ratoon cane has been reported earlier (Shukla *et al.* 2009). The K application also resulted in production of taller canes in ratoon crop as compared to canes in other treatments. The production of higher number of millable canes having higher cane weight and height in T4 reflected in production of the highest ratoon cane yield which was significantly more as compared to T_1, T_2, T_3, T_5 and T_6 treatments (Table 2). K application to plant cane significantly improved the following ratoon cane yield (Shukla *et al.* 2009). They also reported that incorporation of press mud along with potash and $ZnSO_4$ improved sprouting of buds and availability as well as absorption of nutrients which increased the ratoon cane yield. Singh and Chauhan (2012) also found that application of sulphitation press mud cake @ 20t/ha + 25 kg ZnSO4 increased the productivity of rations. K application recorded higher sugar productivity as compared to control treatment (Table 2). Krauss (1991) had reported higher sucrose content in stalks with increasing K content. Combined application of 60 kg K /ha + 25 kg $ZnSO_4$ /ha 30 DBR with irrigation and 25 kg $ZnSO_4$ /ha + 10t SPMC (fresh)/ ha at time of ratoon initiation increased 15.8 and 14.3 percent ratoon yield and 17.3 and 15.0% sugar yield than control, respectively. Thus K, Zinc and press mud application holds great promise for improving productivity of ratoon cane initiated in the winter season.

REFERENCES

Aide M and Picker J. 1996. Potassium and phosphorus nutrition in rice. Missouri Rice Research Reports. Online Information from Missouri Rice Research Update.

Dissanayake N and Hoy J W. 1999. Organic material soil amendment effects on root rot and sugarcane growth and characterization of the materials. *Plant Disease* **83**: 1039–46.

Krauss A. 1991. Chloride and sucrose content in sugarcane. In: *IFA-FADINAP Regional fertilizer conference for Asia and The Pacific*, New Delhi, December 8–11.

Singh S N and Chauhan R S. 2012. Improving productivity of winter initiated ratoon in sub tropical climate conditions of India. In: *Proc. International Symposium on New Paradigms in Sugarcane Research*. Organized by Society for Sugarcane Research and Development, Coimbatore and Sugarcane Breeding Institute (ICAR), Coimbatore during 15-18 October, 2012. pp 75-76.

Sastry S K and Chari A V. 1960. In: *Proceedings of 4th Biennial Conference of Sugarcane Research and Development Workers*, India. Pp 145-59.

Shukla S K, Yadav R L, Suman A and Singh P N. 2008. Improving rhizospheric environment and sugarcane ratoon yield through bioagents amended farm yard manures in udic Ustochrept soil. *Soil Tillage Research* **99**:158–68.

Shukla S K, Yadav R L, Singh P N and Singh Ishwar. 2009. Potassium nutrition for improving stubble bud sprouting, dry matter partitioning, nutrient uptake and winter initiated sugarcane (*Saccharum* spp. hybrid complex) ratoon yield. *European Journal of Agronomy* **30**: 27–33.

Sundara B and Tripathi B K 1999. Available N changes and N balance under multi ratooning of sugarcane varieties in a tropical vertisol. In: *Proceedings of International Society of Sugar Cane Technologists* XXIII, pp 80–8.

Yadav R L, Shukla S K, Suman A and Singh P N. 2009. Trichoderma inoculation and trash management

effects on soil microbial biomass, soil respiration, nutrient uptake and yield of ratoon sugarcane under subtropical conditions. *Biology and Fertility of Soils.* **45**: 461–8.

Verma R S and Yadav R L. 1988. Intercropping in sugarcane for improving stubble sprouting under low temperature conditions in subtropical India. *Bhartiya Sugar*. **13**: 45–8.

Verma R S. 2002. Sugarcane ratoon management. *International Book Distributing Co. Pvt. Ltd.*, Lucknow, p 202.