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Effect of trash mulching and nitrogen application on growth and yield of sugarcane ratoon

N.S. RANA, A.K. SINGH, SANJAY KUMAR AND SANDEEP KUMAR

Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttaranchal 263 145

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ABSTRACT

A field experiment was conducted at Crop Research Centre of the Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, during 1995–98, to study the effect of mulching (no mulch and trash mulch @ 6 tonnes/ha) and nitrogen doses (0, 75, 112.5, 150 and 187.5 kg N/ha) on growth and yield of sugarcane ratoon under foot-hill conditions of Uttaranchal. Trash mulching @ 6 tonnes/ha led to marginal improvement in shoot population, shoot height, shoot dry matter, cane length, cane girth and cane yield over no mulching. Individual cane weight exhibited significant increase with trash mulching (767 g) compared with no mulch (740 g) during 1996–97. Respective increase during 1997–98 was from 724 to 751 g. Improvement in yield attributes resulted in 3.2 and 5.8% increase in cane yield during the 2 seasons. All the growth parameters and yield attributes exhibited an increasing trend with increasing N level up to 187.5 kg/ha. Crop fertilized with 187.5 kg N/ha gave 4.5, 13.4, 21.0 and 43.1% more cane yield than that of 150, 112.5, 75 and 0 kg N/ha respectively.

Key words : Sugarcane ratoon, Mulching, N management, Growth, Yield

Sugarcane occupies a prominent position as cash crop in India. Ratooning plays a key role in economizing its cultivation through savings in investments on seed input, field preparation, planting etc. Attributed to continued decline in organic carbon status, the cane yields and the productivity of sugarcane-based cropping systems are on decline or constant despite increasing use of fertilizers. After harvest, a cane crop leaves 10–15% of cane yield as trash, which is either burnt *in situ* or used as fuel leading to multifarious problems. Trash contains nearly 0.5% of N besides other nutrients (Rasal *et al.*, 1988). The fate of added crop residues depends largely on their C : N ratio, subsequently alter nutrient availability to crops. Keeping this view, the present investigation was undertaken to study the effect of mulching (no mulch and trash mulch @ 6 tonnes/ha) and N doses (0, 75, 112.5, 150 and 187.5 kg N/ha) on growth and yield of sugarcane ratoon under foot-hill conditions of Uttaranchal.

MATERIALS AND METHODS

A field experiment was conducted at Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, during 1995–97 and 1996–98. The soil was silty clay-loam, rich in organic carbon and available K and medium in available P with pH 7.4. The experiment was laid out in randomized block design with 4 replications. Sugarcane cv. 'Co S 767' was planted in furrows 75 cm apart on 24 February 1995 and 5 March 1996, and harvested on 27 February 1996 and 5 March 1997 as to execute the treatments. Trash was applied as mulch uniformly in the inter-row space as per treatment. Half of N (60 kg) and full dose of 60 kg P_2O_5 and 40 kg K_2O were applied, as basal, and remaining N was top-dressed at 80 days after planting. Other practices were followed as per recommendation for the crop. Ratoon was supplied with N only as per treatments and harvested on 20 January 1997 and 25 January 1998 respectively. Clumps and shoot population were recorded at 40 and 90 days after ratooning respectively. All the observations were recorded using standard techniques. Since a similar trend was noticed during both the years and data qualified the homogeneity test, pooling was done over the years.

RESULTS AND DISCUSSION

Effect of mulching

Mulching did not have significant effect on shoot population and growth (Table 1). However, there was an improvement in clump population and shoot dry-matter accumulation. Such improvement might have been owing to moisture conservation with improved N supply and suppression of weeds. Shinde *et al.* (1993) and Yadav *et al.* (1994) were also of the similar opinion. Among yield attributes, weight/cane registered significant improvement under trash mulching attributed to increase in cane length

and girth. Cane yield exhibited an increase of 4.4% under trash mulching over no mulch. Such marginal improvement in yield was mainly owing to cumulative effect of improved cane weight and number of millable canes. Higher nutrient uptake with trash mulching might have led to larger canopy size and better accumulation of photosynthates and synthesis of sucrose. Ballcoelho *et al.* (1993), also observed similar effects in Brazil. Commercial cane sugar, a function of cane yield and juice sucrose was significantly higher in crop raised with trash mulch, being higher by 2.2 tonnes/ha attributed to cumulative effect of higher cane yield and juice sucrose. Crop grown with trash mulching removed 15.1, 15.2 and 14.9% more N, P and K, respectively, than that raised with mulching. Conservation of moisture might have led to better uptake and utilization of nutrients, as also evident by higher order order of yield attributes under trash mulching and soil-fertility status at crop harvest (Table 2). Trash mulching helped in maintaining the soil-fertility status when compared with initial fertility status, whereas without mulch organic carbon as well as available phosphorus and potassium registered significant decline. Yadav *et al.* (1994) also reported benefits in soil-fertility status with crop-residue incorporation.

Effect of nitrogen

Nitrogen fertilization had significant effect on shoot population and growth (Table 1). Shoot count and dry matter both increased with the increasing levels of N up to 187.5k g N/ha though the mean increase beyond 150 kg/ha was just 2.1 and 1.9% respectively. Increased N supply and consequently the enhanced cytokinin activity might have induced tillering and growth of shoots. Prasad *et al.* (1990) also opined favourable effect of N on tillering. Yield attributes, viz. cane length, girth and weight and millable canes, exhibited significant effect of N applica-

Table 1. Effect of trash mulching and nitrogen application on yield attributes and cane yield of sugarcane ratoon

Treatment	Clump population ('000/ha)	Shoot population ('000/ha)	Shoot dry matter (g/shoot)	Cane length (cm)	Cane girth (cm) (cm)	Cane weight (g)	No. of millable canes ('000/ha)	Cane yield (tonnes/ha)	Commercial cane sugar yield (tonnes/ha)
Mulching									
No mulch	17.6	197.7	285.9	193.6	6.5	732	86.4	61.6	5.83
Trash mulch	18.0	201.4	301.6	199.1	6.7	759	87.3	64.3	6.27
CD (P=0.05)	NS	NS	NS	NS	NS	19	NS	NS	0.44
Nitrogen (kg/ha)									
0	16.4	168.8	268.6	184.7	6.1	685	73.4	50.3	5.52
75	17.2	185.7	284.0	194.5	6.4	713	81.6	59.6	5.76
112.5	17.9	196.6	292.8	198.2	6.6	747	89.2	63.6	5.95
150	18.5	219.5	308.5	201.0	6.8	777	93.4	69.0	6.42
187.5	18.9	227.7	314.5	203.4	7.1	803	96.5	72.1	6.60
CD (P=0.05)	NS	21.2	25.8	13.1	0.6	75	7.8	6.6	0.68

Table 2. Effect of trash mulching and nitrogen application on nutrient uptake by the crop and fertility status of soil

Treatment	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potassium uptake (kg/ha)	Soil organic carbon (%)	Available phosphorus (kg/ha)	Available potassium (kg/ha)
Mulching						
No mulching	113.9	7.72	181.2	1.15	12.7	274
Trash mulch	131.1	8.89	208.2	1.19	13.9	300
CD (P=0.05)	6.8	0.16	8.3	0.03	0.8	7.0
Nitrogen (kg/ha)						
0	73.4	4.84	118.1	1.15	12.2	263
75	95.4	6.46	132.4	1.16	12.7	273
112.5	116.7	8.00	185.0	1.17	13.2	285
150	146.2	10.0	232.6	1.18	13.9	299
187.5	180.3	12.3	285.5	1.19	14.6	316
CD (P=0.05)	10.7	0.26	114.1	NS	NS	12

tion (Table 1). Crop fertilized with 187.5 kg N/ha gave 43.1, 21.0, 13.4 and 4.5% more mean cane yield than those fertilized with 0, 75, 112.5 and 150 kg N/ha. Kapoor *et al.* (1993) also recorded increase in cane yield with N application. Improvement in yield attributes, particularly in canes and cane weight, might have attributed towards increase in cane yield. Corresponding mean increase in number of millable canes was 31.5, 17.8, 8.2 and 3.3%. Better tillering and growth (Table 1) with improved N provided the base for higher number of millable canes with more weight. Nutrient uptake exhibited an increasing trend with increasing levels of N irrespective of the nutrients (Table 2). Higher biomass with increasing levels of N was primarily responsible for increasing trend in uptake. Sharma and Gupta (1991) also noted increase in uptake with increasing N applications.

Soil organic carbon and vailable P status remained statistically unaffected by N fertilization, though an increasing trends was observed (Table 2). The increasing trend might have been attributed to better decomposition of trash by soil microbes under improved N nutrition. Available K content of soil increased significantly with increased N applications, possibly due to release of trash K. Results are in conformity with those of Yadav *et al.* (1994).

Thus trash mulching at 6.0 tonnes/ha led to significantly higher commercial cane yield attributed to cumulative effect of improvement in yield and quality attributes, when compared with no mulch. Besides, it sustained the soil fertility. Application of 150 kg N/ha remaining at par with 187.5 kg N/ha proved superior to lower doses.

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