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Integrated nitrogen management on green fodder yield and quality of sweet corn hybrid

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Abstract
A field experiment was conducted during *rabi* 2014-2015 on clay loam soil at irrigated upland farms of Eastern block, Tamil Nadu Agricultural University, Coimbatore to study the effect of integrated nitrogen management on green fodder yield and quality of sweet corn hybrid. The experiment was replicated thrice, with 12 treatments comprising integration of organic manures *viz.*, FYM, vermicompost, poultry manure, goat manure and biogas slurry at 2 levels (25 and 50 percent) with inorganic N at 75 and 50 per cent. The remaining two treatments were 100 per cent N as inorganic fertilizer and 100 per cent N as inorganic fertilizers with 12.5 t ha^{-1} of FYM. Higher green fodder (27.1 t ha^{-1}) was recorded with plots treated with 25 per cent N as poultry manure + 75 per cent N as inorganic fertilizer due to superior growth and higher nitrogen uptake. Application of 25 per cent N as poultry manure in combination with 75 per cent N as inorganic fertilizer recorded maximum crude protein content, crude fibre content and their yield which was comparable with 25 per cent N as goat manure and 75 per cent N as inorganic fertilizers application.

Keywords: Sweet corn, Green fodder yield, Fodder quality

Introduction
In recent past, India has made an impressive progress in achieving self sufficiency in food grain production by elevating productivity of several crops. Maize is a versatile product with uses ranging from industrial products to food preparations, as well as direct human consumption at vegetative stage. Off the different variety, sweet corn is a hybridized variety of maize specifically bred to increase the sugar content. Its consumption at immature stage as roasted and boiled ears is a popular practice as the kernels are sweet, creamy, tender, and crispy and tests almost shell-less. The crop is highly remunerative as it possesses high total biomass and green cobs (Singh et al. 2017a; Singh et al. 2017b; Singh et al. 2017c; Singh et al. 2018; Tiwari et al. 2018; Tiwari et al. 2019a; Tiwari et al. 2019b; Kour et al. 2019; Singh et al. 2019) [8, 9, 10, 11, 12, 13, 14, 15, 16]. Due to its extra sweet taste and tenderness, cultivation of sweet corn is the first choice of the farmers especially in periurban agriculture, so it may solve fodder crisis near cities. It is an established fact that green cobs and fodder yield potentials of the sweet corn genotypes are realized to the fullest extent when they are grown under adequate nitrogen mineral fertilization, which has influential effect on fodder quality. Therefore, there is need to evaluate green fodder production performance and quality of sweet corn hybrid under varying combination of organic and inorganic sources of nitrogen in the prevailing agro climatic conditions.

Materials and Methods
The field experiment was carried out during ***rabi*** 2014-15 at irrigated upland farm of Eastern block, Tamil Nadu Agriculture University, Coimbatore which is situated at11º N latitude and 77º E longitude with an altitude of 426.74 meters above mean sea level. The soil of the experimental field was clay loam, alkaline in reaction (pH: 8.6), non saline (EC: 0.28 dSm^{-1}), medium in organic carbon (0.46%) and low available nitrogen (208 kg ha^{-1}), medium available phosphorus (18 kg ha^{-1}) and high available potassium (415 kg ha^{-1}) in the plough layer.

Field experiment was laid out in randomized block design with 12 treatments and replicated thrice. The treatments include, T_1 (25% N as FYM + 75% N as inorganics), T_2 (25% N as vermicompost + 75% N as inorganics), T_3 (25% N as poultry manure + 75% N as inorganics), T_4 (25% N as goat manure + 75% N as inorganics), T_5 (25% N as biogas slurry + 75% N as inorganics), T_6 (50% N as FYM + 50% N as inorganics), T_7 (50% N as vermicompost + 50% N as inorganics), T_8 (50% N as poultry manure + 50% N as inorganics), T_9 (50% N as goat manure + 50% N as inorganics), T_{10} (50% N as biogas slurry + 50% N as inorganics), T_{11} (100% N as inorganic) and T_{12} (100% N as inorganic + FYM @ 12.5 t ha^{-1}) which is the recommended practice and fixed as bench mark.

The recommended dose of fertilizer was applied as N: P_2O_5: K_2O @ 120:60:45 kg ha^{-1}. Based on N equal basis required quantities of organic manures were incorporated in the soil one week before sowing. P and K requirements of the crop were applied separately as fertilizer. All the package of practices was carried out as per recommendation of CPG (2012) [3]. All the relevant observations on growth parameters *viz*., plant height, stem girth, number of leaves, leaf area, LAI, CGR, dry matter production were recorded at periodic interval of the crop growth stages. The green fodder yield and their quality was estimated using standard procedure. Data of each character collected were statistically analyzed using standard procedure of variance analysis.

Results and Discussion

Growth parameters

At harvest, taller plants with more leaves and thick stems was recorded from plots treated with 25 per cent N as poultry manure + 75 per cent N as inorganic fertilizers (Table-1). It is due to increased uptake of N which being the chief constituent of protein and protoplasm, which vigorously induced the vegetative development of the plants. The higher availability of nitrogen seems to have promoted development of morphological structure by virtue of multiplication of cell division which is well reflected through increased leaf area index, crop growth rate and relative growth rate (Kumar, 2008) [4].

Taller plants usually provide a better ventilated canopy and improvement in CO_2 exchange (Noova and Loomis, 1981) [7]. In this study, better N utilization resulted in more leaves and large leaf surface area and thereby by higher LAI and CGR. This is in accordance with earlier findings of Agyenim *et al*. (2006) [2].

Leaf area index and dry matter were significantly correlated demonstrating that LAI is an indicator of its photosynthetic capacity and translocation. As consequence, higher amount of radiation associated with higher LAI contributed to enhance dry matter production (Kumar, 2009) [5].

Table 1: Effect of integrated nitrogen management on growth and yield of sweet corn green fodder

Treatment	At harvest				LAI	CGR 60 DAS – harvest (g $m^{-2}day^{-1}$)	Dry Matter Production (kg ha^{-1})	Green fodder yield (t ha^{-1})
	Plant height (cm)	Stem girth (cm)	No. of leaves $plant^{-1}$	Leaf area (cm^2 $plant^{-1}$)				
T_1–25%N FYM + 75% inorganic	185.2	7.01	14.0	5069	4.01	14.41	10557	23.9
T_2 –25%N VC+ 75%N inorganic	187.8	7.05	14.1	5193	4.06	14.82	11359	24.0
T_3–25%N PM + 75%N inorganic	202.6	7.24	14.4	5602	4.86	17.25	12636	27.1
T_4 –25%N GM + 75% N inorganic	191.5	7.18	14.4	5305	4.09	15.76	12547	24.5
T_5 –25%N BS + 75%N inorganic	183.2	6.94	13.9	4964	4.00	13.91	10189	23.8
T_6 –50%N FYM + 50%N inorganic	170.4	6.79	13.6	4642	3.66	11.24	8332	22.3
T_7 – 50%N VC + 50%N inorganic	172.6	6.83	13.7	4725	3.70	11.65	8539	22.6
T_8 – 50%N PM + 50%N inorganic	176.9	6.92	13.9	4837	3.77	12.29	9404	22.9
T_9 – 50%N GM + 50%N inorganic	173.8	6.87	13.7	4774	3.72	12.04	8821	22.7
T_{10} – 50%N BS + 50%N inorganic	167.2	6.74	13.4	4309	3.62	10.65	7982	22.0
T_{11} – 100% N inorganic	188.6	7.16	14.2	5271	4.32	15.05	12026	25.2
T_{12}–100%N inorganic +12.5 t ha^{-1} FYM	224.4	7.48	14.6	5828	5.38	18.86	13816	29.4
Mean	185.4	7.02	14.0	5043	4.10	13.99	10517	24.2
SEd	7.8	0.11	0.2	209	0.26	1.24	955	1.1
CD (P=0.05)	16.2	0.22	0.4	433	0.54	2.57	1981	2.2

Green Fodder Yield

Application of 25 per cent N as poultry manure with 75 per cent N as inorganic fertilizer produced higher green fodder yield, which is comparable with application of 25 per cent N as goat manure with 75 per cent N as inorganic fertilizer. This might be on account of overall improvement in growth as evinced from higher dry matter, leaf area index, CGR, and N uptake (Kumar, 2009) [5].

Quality of Green Fodder

Application of recommended 25 per cent N as poultry/goat manure + 75 per cent N as inorganic fertilizer produced higher levels of crude protein, crude fibre and their yield, which was found comparable with application of 100 per cent N as inorganic treatment (Table-2).

Higher dose of nitrogen along with poultry/goat manure might have led to faster decomposition of manures leading to perfused growth, higher dry matter production as N accumulation thereby increased crude protein and fibre yield of green fodder. This follows in line with Nath *et al.* (2009) [6] and Suthar *et al*. (2014) [17].

Table 2: Effect of integrated nitrogen management on quality of sweet corn green fodder

Treatments	Crude protein (%)	Crude protein yield (kg ha^{-1})	Crude fibre (%)	Crude fibre yield (kg ha^{-1})
T_1–25%N FYM + 75% inorganic	6.7	258.3	36.3	3832.3
T_2 –25%N VC+ 75%N inorganic	6.9	296.2	37.9	4305.2
T_3–25%N PM + 75%N inorganic	7.3	364.7	39.7	5016.5

T_4 –25%N GM + 75% N inorganic	7.2	351.3	39.1	4906.0
T_5 –25%N BS + 75%N inorganic	6.7	242.7	35.6	3627.1
T_6 –50%N FYM + 50%N inorganic	5.7	162.9	34.6	2882.9
T_7 – 50%N VC + 50%N inorganic	5.7	170.3	34.8	2971.5
T_8 – 50%N PM + 50%N inorganic	6.6	219.3	35.5	3338.3
T_9 – 50%N GM + 50%N inorganic	6.5	204.2	35.5	3131.5
T_{10} – 50%N BS + 50%N inorganic	5.6	149.6	33.6	2681.8
T_{11} – 100% N inorganic	7.0	322.7	38.5	4629.8
T_{12}–100%N inorganic +12.5 t ha^{-1} FYM	7.4	408.0	39.8	5498.6
Mean	6.6	262.5	36.7	3901.8
SEd	0.3	42.1	1.1	464.2
CD (P=0.05)	0.6	87.2	2.2	962.7

Conclusion

On the basis of results emanated from the present experiment conducted during *rabi* 2014-15, it was concluded that under prevailing agro-climatic conditions, sweet corn variety 'Sugar 75' when applied with 25 per cent N as poultry manure + 75 per cent N as inorganic fertilizer produced huge biomass and quality fodder.

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