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Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Sweet Corn

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ABSTRACT

A field experiment entitled "Sustaining soil health and productivity of sweet corn through nutrient management"was carried out during *kharif*, 2017 having ten treatments in randomized block design with replicated thrice at Agricultural College Farm, Bapatla. The results on plant height ,yield attributes *viz.,* length and girth of the cob, no of kernels per cob, 100 kernel weight and drymatter yield at tasseling and at harvest, green cob and stoveryields were significantly influenced by the treatments and the treatment which received 100 per cent RDF recorded highest values and it was on par with treatments received 50 per cent recommended dose of fertilizers along with organic manures. Significant positive correlation was observed between soil properties and performance of sweet corn.

Key words:*Plant height, dry matter production, yield, sweet corn*

Maize (*Zea mays* L.) is a miracle crop emerging as the third most important cereal crop in the world after wheat and rice, both as food for human consumption and feed for livestock. Of late, specialty corns such as baby corn and sweet corn have emerged as an alternative food sources, especially for the affluent section of the society. Out of various specialty corns, sweet corn(*Zea mays* L., *SaccharataSturt*) is also known as sugar corn, hybridized variety of maize (*Zea mays* L.) specifically bred to increase the sugar content.Sweet corn is marketed as fresh, roasted or boiled and can also be canned for future use.Due to its extra sweetness, it is gaining potential in domestic and international market and remunerative crop for the farmers because of its short duration nature .

Sweet corn is an exhaustive crop and it requires more nutrients for optimum production. So integrated nutrient management involving particularly FYM, liquid N,P and K biofertlizers and cow based liquid formulations *viz.,*beejamrutham and jeevamrutham not only acts as a source of multiple nutrients and have ability to improve soil characteristics. In this context, it is worthy to study the nutrient management options in conjunction with inorganic fertilizers play an important role in sustaining productivity of sweet corn.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College Farm, Bapatla using sweet corn hybrid maize Mahy-301as a test crop. The experiment comprising of 10 treatments involving inorganic fertilizers, FYM, cow based liquid organic sources of nutrients *viz.,* Beejamrutham, Jeevamrutham and liquid N, P & K biofertilizers.The treatmental details are T_1 : Absolute Control, T_2 : 100% RDF, T_3 : FYM @ 5 t ha^{-1} + LBF @ 1.5 L ha^{-1}, T_4 : Beejamrutham + Jeevamrutham, T_5: 50% RDF + FYM @ 5 t ha^{-1}, T_6 : 50% RDF + LBF @ 1.5 L ha^{-1}, T_7 : 50 % RDF + T_4, T_8 : 25% RDF + T_4, T_9 : 25% RDF + FYM @ 5 t ha^{-1} + T_4, T_{10} : 25% RDF +LBF @ 1.5 L ha^{-1} + $T_4$and were laid out in completely randomized block design with three replications.Initial soil sample was analysed for soil properties by adopting standard procedures.

The recommended dose of N, P_2O_5 and K_2O fertilizers for the crop was 150-60-50 $kgha^{-1}$. Fertilizer nitrogen and potassium were applied in the form of urea and muriate of potash in three equal splits (Basal, knee high and at tasseling stage of crop growth) as per the treatments. Entire dose of phosphorus was applied in the form of single super phosphate as basal in the last plough.Well decomposed FYM was broadcasted and incorporated in soil one week before sowing. Required quantities of liquid N,P and K biofertilizers were incubated overnight with well decomposed FYM and then applied to soil as per the treatments at the time of sowing. Liquid jeevamrutham was applied to soil nearer to the plant at every fortnight interval @ 500 L ha^{-1}upto cob formation. The data on plant height at both the stages of crop growth, drymatter yield at tasseling and yield attributes and yield of sweet corn was recorded .

RESULTS AND DISCUSSION

Plant height

The treatment T_2 which received 100 per cent RDF was recorded highest plant height 160 and 171 cm at tasseling and at harvest, respectively and it was on par with the treatments T_5 and T_6which received 50 per cent RDF with organic sources of nutrients at both the stages of crop growth. This might be due to better utilization of easily available nutrients from inorganic sources and their profound influence on

vegetative crop growth resulting in maximum plant height.

Nitrogen was associated with increase in chlorophyll which inturn increases the photosynthesis, cell division and cell elongation resulting in taller plants.(Vasanti and Kumar swamy, 2000). Minimum plant height was observed in absolute control (T_1) with 117 and 129 cm at tasseling and at harvest, respectively. Among the integrated treatments (T_5 to T_{10}) integration of 50 per cent RDF was superior than the integration of 25 per cent RDF with organic sources of nutrients at both the stages of crop growth. The treatment T_5 which received 50 per cent RDF and FYM @ 5 t ha^{-1} showed superiority with a value of 147 and 163 cm at tasseling and at harvest, respectively and it was at par with T_6 (50 % RDF + LBF @ 1.5 L ha^{-1}) and T_7 (50 % RDF + beejamrutham + jeevamrutham), respectively. This might be due to balanced use of organic and inorganic fertilizers supplies the nutrients slowly and liquid biofertilizers when applied to soil, colonize the rhizosphere and promote growth by converting nutritionally important elements (nitrogen, phosphorus and potassium) from unavailable to available form through biological process such as nitrogen fixation. Palekar (2007) reported that jeevamrutham contains enormous amount of microbial load when applied to soil, multiply in the soil and plants under such management putforth better plant growth.

Length and girth of the cob

The highest length and girth of the cob (20.21 and 14.65 cm, respectively) were observed in the treatment supplied with 100 per cent RDF (T_2). The highest length and girth might be due to application of RDF resulted in higher dry matter production and effective partitioning of the assimilates to the sink as a result, availability of nutrients in sufficient quantity matching the physiological needs of the crop. Whereas, the lowest values were recorded in absolute control (T_1) with 12.71 and 10.84 cm, respectively.(Table 1)

The treatments which received integration of inorganic fertilizers @ 50 and 25 per cent RDF with organic sources of nutrients were on par with each other in respect of length and girth of the cob and were superior when compared to the sole application of organic sources of nutrients. This might be due to greater availability of photosynthates, metabolites and nutrients to develop reproductive structures resulted increased length and girth of the cob under INM. Similar results were reported by Jinjala *et al*. (2016) and Majid *et al.* (2017) in baby corn and maize, respectively.

Among the organic sources of nutrients, FYM applied treatments were superior than LBF and beejamrutham and jeevamrutham. This might be due to nutrients are slowly released from added FYM and enhanced biological activity in soil and play an important role producing higher length and girth of the cob.

Number of kernels per cob

Among the treatments significantly highest number of kernels per cob (308) was observed in the treatment supplied with 100 per cent RDF (T_2). This might be due to application of inorganic fertilizers releases the nutrients immediately in to soil solution which will be utilized by the crop, whereas the lowest number of kernels per cob (196) was observed in absolute control plot. Similar results were also reported by Raisi and Nejad (2012).

The treatments which received integration of inorganic fertilizers @ 50 per cent RDF with organic sources of nutrients were recorded higher number of kernels and were significantly superior than integration with 25 per cent RDF. However, the treatment T_5 which received 50 per cent RDF + FYM @ 5 t ha^{-1} recorded higher number of kernels per cob than the integration with LBF and beejamrutham and jeevamrutham. Among the treatments receiving only organic sources of nutrients (T_3 and T_4) the treatment which received FYM @ 5 t ha^{-1} + LBF @ 1.5 L ha^{-1} recorded higher number of kernels than the treatment which received cow based liquid organic sources of nutrients *viz.,* beejamrutham and jeevamrutham.

100 kernel weight

The treatment supplied with 100 per cent RDF (T_2) recorded highest 100 kernel weight (32.47g) and it was on par with T_5 (50 per cent RDF + FYM @ 5 t ha^{-1}). The highest 100 kernel weight might be due to supplementation of N, P and K in optimum dose resulted in better kernel filling due to increased photosynthetic activity of larger leaf area and higher drymatter production.

The treatments which received integration of inorganic fertilizers @ 50 per cent RDF with organic sources of nutrients were on par with each other and superior over integration of 25 per cent RDF with organic sources of nutrients in respect of test weight. However, among the integrated treatments T_5 (50 % RDF + FYM @ 5 t ha^{-1}) recorded highest value (28.92g) which was followed by T_6 and T_7 and lowest 100 kernel weight was observed in T_8. This might be due to timely supply of nutrients to sweet corn through inorganics and slow release of nutrients from organics might have resulted higher test weight in sweet corn.

The higher values in yield attributes might be ascribed to the balanced supply of N, P and K nutrients which increase photosynthetic activities and translocation of photosynthates, might have promoted the growth, better partitioning of photosynthates into yield attributes and eventually produced large size cobs,

Table 1. Influence of integrated nutrient management ongrowth and yield attributes of sweet corn

Treatments	Plant height (cm)		Length of the cob (cm)	Girth of the cob (cm)	100 kernel weight (g)	No. of kernels cob^{-1}
	Tasseling	Harvest				
T_1 : Absolute Control	117	129	12.71	10.84	18.48	196
T_2 : 100 % RDF	160	171	20.21	14.65	32.47	308
T_3: FYM @ 5t ha^{-1} + LBF @ 1.5L ha^{-1}	126	145	14.42	12.26	22.87	230
T_4 : Beejamrutham+ Jeevamrutham	119	136	12.91	12.20	22.44	228
T_5 : 50% RDF + FYM @ 5t ha^{-1}	147	163	18.02	13.85	28.92	272
T_6 : 50% RDF + LBF @ 1.5L ha^{-1}	147	158	17.47	13.58	27.71	263
T_7 : 50 % RDF+ T_4	141	159	17.39	13.71	27.30	261
T_8 : 25% RDF + T_4	136	148	14.89	12.24	22.31	230
T_9 :25% RDF + FYM @ 5t ha^{-1} + T_4	137	156	15.82	12.46	23.49	239
T_{10} : 25% RDF+LBF @ 1.5L ha^{-1}+ T_4	139	156	15.48	12.32	23.09	233
SEm±	4.77	4.47	0.83	0.34	1.31	10.74
CD @ 0.05	14.16	13.28	2.48	1	3.88	31.92
CV (%)	6.01	5.08	9.07	4.53	9.08	7.55

Table 2. Influence of integrated nutrient management on yield of sweet corn

Treatments	Drymatter yield	Green cob yield	Stover yield
	(kg ha^{-1})		
T_1 : Absolute Control	1338	6520	1624
T_2 : 100 % RDF	2987	12144	3560
T_3: FYM @ 5t ha^{-1} + LBF @ 1.5L ha^{-1}	1710	7548	1912
T_4 : Beejamrutham + Jeevamrutham	1606	7346	1896
T_5 : 50% RDF + FYM @ 5t ha^{-1}	2745	10197	3411
T_6 : 50% RDF + LBF @ 1.5L ha^{-1}	2748	10034	3310
T_7 : 50 % RDF +T_4	2738	10031	3241
T_8 : T_6 + 25% RDF +T_4	1941	7912	2010
T_9 : 25% RDF + FYM @ 5t ha^{-1} +T_4	2271	8550	2433
T_{10} : 25% RDF +LBF @ 1.5L ha^{-1}+ T_4	2021	8526	2215
SEm±	87.4	456.52	110.4
CD @ 0.05	259.63	1356.18	327.97
CV (%)	6.85	8.9	7.47

as well as more grain of higher weight that ultimately increased the yield. Similar results on yield attributes were also reported by Shivakumar and Mishra (2001), Singh *et al*. (2003) and Mishra (2012).

Drymatter production

The highest drymatter production (2987 kg ha^{-1}) was recorded in recommended dose of fertilizers (T_2) whereas the lowest (kg ha^{-1})was recorded in absolute control (T_1).

The highest dry matter production in 100 per cent RDF was due to direct supply of inorganic sources of nutrients and it was on a par with treatment which received integration of 50 per cent RDF with FYM @ 5 t ha^{-1}, integration of 50 per cent RDF with liquid, P and K biofertilizers and seed treatment with beejamrutham and jeevamrutham. This might be due to the production of organic acids and growth promoting substances during decomposition of organic manures might have facilitated easy availability of macro as well as micronutrients. Adequate and timely supply of nutrients to the crop helps in the synthesis of carbohydrates, which are required for the formation of protoplasm, resulting in higher cell division and cell elongation. Thus, an increase in growth due to the application of organic manures in combination with inorganic fertilizers might have been an account of overall improvement in the vegetative growth of the plant. Similarly, improvement in growth and yield of sweet corn due to combined application of organic and inorganic fertilizers was earlier reported by Makinde and Ayoola (2010).

Green cob and stoveryield

Among the treatments, significantly highest green coband stover yields (12144 and 3560 kg ha^{-1}, respectively) were recorded in the treatment which received 100 per cent RDF (T_2) and the lowest (6520 and 1624 kg ha^{-1}) was observed in absolute control (T_1). This might be attributed to greater development of plant stature and yield attributes might be possible consequences for higher yields by the application of recommended dose of fertilizers(table 2).

Integration of 50 per cent RDF with FYM / LBF / beejamrutham and jeevamrutham exhibited significantly superior cob and stoveryields over the treatments which received integration of organic sources of nutrients with 25 per cent RDF and application of organic sources of nutrients only. The marked increase in stover yield of sweet corn might be due to mineralization of nutrients and the enrichment of soil fertility through the incorporation of FYM and RDF resulted in increasing the availability and uptake of nutrients and their cumulative effect by LBF resulted in improvement of growth and yield attributes, such as plant height, length of cob and 100 kernel weight (Brar*et al*., 2000 and Jyothibasu *et al*., 2017).

The increase in green cob yield in integrated plots might be due to better and continuous availability of nutrients for plants which ultimately increase the yield. These results were similar to that of Farhad *et al*. (2009) in maize. Similar results were obtained by Makinde and Ayoola (2010) who reported that conjunctive application of organic and inorganic fertilizers is effective for the growth of sweet corn and in improving the yields. This might be due to addition of organic material which can markedly increase soil productivity by providing essential plant nutrients and by improving physical properties (Shah *et al*., 2010).

Among the organic sources, FYM applied treatments exhibited superiority when compared to cow based liquid organic manures beejamrutham and jeevamrutham. This might be due to balanced and slow release of nutrients frrom FYM which are readily available due to well decomposition.Among the treatments receiving only organic sources of nutrients, treatments received combination of FYM @ 5 t ha^{-1} + LBF @ 1.5 L ha^{-1} produced higher yields than beejamrutham + jeevamrutham. The lower yield with cow based liquid organic sources might be due to reduced availability of nitrogen to the crop and hence the trend of yield formation followed the trend of growth (Ashalatha*et al.*, 2013).

CONCLUSION

The present study indicates that the treatment supplied with 100 per cent recommended fertilizer N,P and K exhibited significant highest plant growth, yield attributes and yield in sweet corn and it was on a par with integration of 50 per centrecommended fertilizer N,P and K with FYM / LBF / beejamrutham and jeevamrutham.

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