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ORGANIC BABY CORN (*ZEA MAYS* L.) PRODUCTION AS INFLUENCED BY NUTRIENT MANAGEMENT AND MOISTURE CONSERVATION PRACTICES IN SANDY LOAM SOILS OF ASSAM

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Abstract

A field experiment was conducted at the Assam Agricultural University, Jorhat during the *rabi* season of 2016-17 to study the effect of nutrient management and moisture conservation practices on yield performance and nutrient uptake of organic baby corn grown in a sandy loam soil under rainfed condition. The experiment was laid out in factorial RBD with three replications. PAC 321 was used as the test variety of baby corn. Among various organic manures, highest amount of N (2.30 %), P (2.10 %) and K (2.20 %) content was recorded in enriched compost used in this study. Application of enriched compost 2.5 t ha^{-1} has recorded the significantly better result with respect to cob yield, corn yield, green fodder yield, N, P, K content and uptake of grain and stover. On the other hand, paddy straw mulch 2 t ha^{-1} when applied to the soil surface recorded significantly higher results with respect to cob yield, green fodder yield, nutrient content and uptake.

Key words: Baby corn, organic, mulch, enriched compost, nutrient uptake, nutrient content

Introduction

Maize (*Zea mays* L.) is the third most important cereal crop in India as well as in the world next to rice and wheat (Murdia *et al.,* 2016). For diversification and value addition of maize, a recent development is of growing maize for the vegetable purpose, which is commonly known as baby corn. Baby corn is the small (6-7 cm long), young, unfertilized corn ear harvested at the stage of silk emergence (*i.e.* within 2-3 days of silk emergence). It is a profitable crop that allows a diversification of production, aggregation of value and increased income (Pandey *et al*., 2000). Maize, being an exhaustive crop, much attention is required in its nutrient management especially while growing under organic cultivation. The literature available on nutrient management under organic mode in baby corn cultivation is quite limited and technology generation in this line has started recently in this state. This is very true in the North Eastern region, because cultivation of the crop is relatively new. Development of organic production technology for baby corn is necessary for realizing higher yield and economic returns (Saha *et al.*, 2007). Assam has tremendous potential to grow crop organically and emerge as a main supplier of organic products in the world's organic market.

The need was felt to standardize organic production technology for baby corn through supplementation of the nutrient requirement through organic manures and biofertilizers. Moisture conservation in agriculture is also very essential in this dynamic climate change. Due to very scanty rainfall during *rabi* season in Assam, the need of soil moisture conservation was felt.

Materials and Methods

A field experiment was conducted at Assam Agricultural University, Jorhat during the year 2016-17. The experiment was laid out in factorial RBD with 3 replications. Baby corn variety PAC 321 was used as the test crop. The soil of experimental field was loamy sand, acidic in soil reaction (5.5), medium in organic carbon (0.52 %), low in available N (190.24 kg ha^{-1}), low

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in available P (20.03 kg ha^{-1}) and medium in available K (160.30 kg ha^{-1}). The experiment consisted of two different factors *i.e.* nutrient management *viz.*, control, enriched compost 2.5 t ha^{-1}, vermicompost 2 t ha^{-1} incubated with bio-fertilizers, poultry manure 2 t ha^{-1} incubated with bio-fertilizers, FYM 2.5 t ha^{-1} incubated with bio-fertilizers and FYM 2.5 t ha^{-1} + lime + ash (1000 : 10 : 1); and moisture conservation *i.e.* no mulch and mulch with paddy straw @ 2 t ha^{-1}. The manures were incubated for 15 days with *Azotobacter* and phosphorous solubilizing bacteria (PSB) 0.2% (w/w) each and moisture was maintained at about 25 ± (w/w) (Borah *et al.,* 2014). Incubated manures were applied as per the treatments mentioned above. Cob yield, corn yield and green fodder yield were recorded from the net plot area and expressed in t ha^{-1}. The NPK contents in different manures before application are presented.

Results and Discussion

In the present study, the highest cob and corn yield was obtained when enriched compost was applied 2.5 t ha^{-1}, which might be due to the presence of higher N content of enriched compost used in the study. This is in consonance with the findings of Raja (2001) and Kar *et al.*, (2006) who reported an increase in baby corn yield due to nitrogen application. Green fodder yield also reflected the superiority of enriched compost was applied 2.5 t ha^{-1}. Kar *et al.*, (2006) and Dadarwal *et al.,* (2009) also reported an increase in fodder yield with a successive increase in nitrogen application. There was a significant influence of straw mulch on yield of cob, corn and green fodder. The treatment with straw mulch 2 t ha^{-1} recorded the highest yield. (cob, corn and green fodder yield), which can be attributed to higher soil moisture content and consequently to better water balance in the plant system at reproductive stage in mulched plots, which might have resulted in higher growth and yield attributes of the crop (Kumar *et al.*, 2015). The values regarding the yield (cob, corn and green fodder) and NPK content of baby corn and stover were furnished in table 2 and table 3 respectively.

Application of enriched compost 2.5 t ha^{-1} recorded significantly highest N content and uptake in corn and stover. The presence of higher amount of N content of enriched compost might have helped in better N uptake by the crop. This treatment also could have helped in the availability of more N and subsequent uptake by the crop plants which ultimately resulted in high yield as well as

Table 1: Nutrient composition of different manures before application.

Treatments	N (%)	P (%)	K (%)
Enriched compost	2.30	2.10	2.20
Vermicompost*	1.61	1.05	1.89
Poultry manure*	1.60	1.00	0.60
FYM *	0.48	0.26	0.68

* incubated with *Azotobacter* and PSB

Table 2: Effect of nutrient management and moisture conservation on cob yield (t ha^{-1}), corn yield (t ha^{-1}) and green fodder yield (t ha^{-1}).

Treatments	Cob yield with husk (t ha^{-1})	Corn yield (t ha^{-1})	Green fodder yield(t ha^{-1})
A. Nutrient management			
Control	3.690	0.521	18.69
Enrichedcompost 2.5 t ha^{-1}	8.165	1.398	36.47
Vermicompost 2 t ha^{-1*}	6.479	1.076	33.57
Poultry manure 2 t ha^{-1*}	5.617	0.912	32.03
FYM 2.5 t ha^{-1*}	4.364	0.721	26.96
FYM 2.5 t ha^{-1}+lime+ash (1000:10:1)	6.495	1.10	34.34
S.Em (±)	0.207	0.050	0.50
CD (p=0.05)	0.607	0.147	1.46
B. Moisture conservation			
No Mulch	5.431	0.908	29.34
Mulching (Paddy straw 2t ha^{-1})	6.172	1.001	31.35
S.Em (±)	0.119	0.029	0.29
CD (p=0.05)	0.350	0.085	0.84

Table 3: Effect of nutrient management and moisture conservation on N, P and K (%) content of baby corn and stover.

Treatments	N %		P %		K %	
	Corn	Stover	Corn	Stover	Corn	Stover
A. Nutrient management						
Control	0.62	0.34	0.25	0.10	0.31	0.73
Enriched compost 2.5 t ha^{-1}	0.86	0.48	0.40	0.20	0.50	1.11
Vermicompost 2 t ha^{-1*}	0.83	0.45	0.36	0.17	0.47	1.05
Poultry manure 2 t ha^{-1*}	0.82	0.44	0.35	0.15	0.35	0.81
FYM 2.5 t ha^{-1*}	0.71	0.36	0.28	0.12	0.36	0.83
FYM 2.5 t ha^{-1}+lime+ash (1000:10:1)	0.79	0.41	0.38	0.19	0.46	1.02
S.Em (±)	0.007	0.006	0.003	0.003	0.004	0.005
CD (p=0.05)	0.02	0.02	0.009	0.009	0.01	0.01
B. Moisture conservation						
No Mulch	0.76	0.40	0.33	0.15	0.40	0.92
Mulching (Paddy straw 2 t ha^{-1})	0.78	0.43	0.34	0.16	0.41	0.93
S.Em (±)	0.004	0.003	0.002	0.002	0.002	0.003
CD (p=0.05)	0.01	0.009	0.005	0.005	0.006	0.009

more N content in grain and stover. Similar results were reported by Misra *et al.*, (1994) and Killer and Zourarakis (1992). In the present investigation, higher N content in cobs and fodder and subsequently more uptake were recorded with the aforesaid treatments. This could also be explained on the basis of better availability of desired and required nutrients in crop root zone resulting from its solubilization caused by the organic acid production from the decaying organic matter and also the increased uptake by baby corn roots due to their mycorrhizal filaments increasing the ascribing area of roots. The results of the present investigation are in close agreements with the findings of Kalibhavi *et al.*, (2001). The values regarding the N uptake of baby corn furnished in table 4.

Table 4: Effect of nutrient management and moisture conservation on N uptake (kg ha^{-1}) of baby corn.

Treatments	N uptake (kg ha^{-1})		
	Corn	Stover	Total
A. Nutrient management			
Control	0.55	9.95	10.50
Enrichedcompost 2.5 t ha^{-1}	1.98	23.20	25.18
Vermicompost 2 t ha^{-1*}	1.49	20.25	21.74
Poultry manure 2 t ha^{-1*}	1.25	19.28	20.54
FYM 2.5 t ha^{-1*}	0.86	12.42	13.28
FYM 2.5 t ha^{-1}+lime+ash (1000:10:1)	1.44	19.03	20.46
S.Em (±)	0.064	0.25	0.26
CD (p=0.05)	0.19	0.74	0.76
B. Moisture conservation			
No Mulch	1.19	16.75	17.93
Mulching (Paddy straw 2t ha^{-1})	1.34	17.96	19.30
S.Em (±)	0.037	0.15	0.15
CD (p=0.05)	0.109	0.43	0.44

Enriched compost 2.5 t ha^{-1} recorded significantly highest P content in corn and stover. Similarly, P uptake by corn, stover and total P uptake were significantly highest in enriched compost 2.5 t ha^{-1}. Since, rock phosphate is used in preparation of enriched compost in addition to PSB, hence enriched manures maintain higher levels of P in soil solution for a longer period than the fertilizer alone (Ali *et al.*, 2014). PSB could help to increase the availability of accumulated phosphate (by solubilization), the efficiency of biological nitrogen fixation and increase the availability of Fe, Zn, etc., through the production of plant growth promoting substances. So the highest P content and uptake by both corn and stover could be due to the combined action of rock phosphate and PSB. Similar reports were given by Afzal *et al.*, (2005) and Ozuturk *et al*., (2003). The values regarding the P uptake of baby corn were presented in table 5.

Table 5: Effect of nutrient management and moisture conservation on P uptake (kg ha^{-1}) of baby corn.

Treatments	P uptake (kg ha^{-1})		
	Corn	Stover	Total
A.Nutrient management			
Control	0.22	2.81	3.04
Enrichedcompost 2.5 t ha^{-1}	0.92	9.67	10.59
Vermicompost 2 t ha^{-1*}	0.64	7.71	8.35
Poultry manure 2 t ha^{-1*}	0.53	6.63	7.15
FYM 2.5 t ha^{-1*}	0.34	4.14	4.48
FYM 2.5 t ha^{-1}+lime+ash (1000:10:1)	0.68	8.73	9.41
S.Em (±)	0.003	0.16	0.15
CD (p=0.05)	0.09	0.46	0.44
B. Moisture conservation			
No Mulch	0.52	6.20	6.72
Mulching (Paddy straw 2t ha^{-1})	0.59	7.02	7.61
S.Em (±)	0.02	0.09	0.09
CD (p=0.05)	0.05	0.26	0.25

Application of enriched compost 2.5 t ha^{-1} recorded significantly highest K content in corn and stover. Similarly, K uptake by corn, stover and total K uptake were significantly highest in enriched compost application 2.5 t ha^{-1}. The nutrient uptake is a function of yield and nutrient concentration in the plant Table 6. Thus, significant improvement in uptake of K might be attributed to their concentration in cobs and fodder and associated with higher green cob and fodder yields.

The treatment with mulch recorded significantly highest NPK content in corn, stover and green fodder.

Table 6: Effect of nutrient management and moisture conservationon K uptake (kg ha^{-1}) of baby corn.

Treatments	K uptake (kg ha^{-1})		
	Corn	Stover	Total
A. Nutrient management			
Control	0.27	21.21	21.49
Enrichedcompost 2.5 t ha^{-1}	1.13	53.76	54.89
Vermicompost 2 t ha^{-1*}	0.84	47.45	48.28
Poultry manure 2 t ha^{-1*}	0.53	35.69	36.22
FYM 2.5 t ha^{-1*}	0.44	28.78	29.22
FYM 2.5 t ha^{-1}+lime+ash (1000:10:1)	0.83	47.05	47.88
S.Em (±)	0.004	0.30	0.31
CD (p=0.05)	0.11	0.88	0.91
B. Moisture conservation			
No Mulch	0.63	38.41	39.04
Mulching (Paddy straw 2t ha^{-1})	0.71	39.57	40.28
S.Em (±)	0.02	0.17	0.18
CD (p=0.05)	0.07	0.51	0.52

Similarly, NPK uptake by corn, stover and total NPK uptake were significantly highest in mulch treatment with application of paddy straw 2 t ha^{-1}. Soil moisture acts as a medium for the supply of nutrients to growing plants and as the mulches conserves soil moisture and it is clear that mulches improve the nutrient uptake also (Rajput *et al.*, 1970).

Conclusion

Application of enriched compost 2.5 t ha^{-1} in baby corn produced highest cob yield with husk (8.165 t ha^{-1}) followed by FYM 2.5 t ha^{-1} + lime + ash (6.495 t ha^{-1}). Mulching with paddy straw 2 t ha^{-1} recorded the higher cob yield (6.172 t ha^{-1}) over no mulch condition (5.431 t ha^{-1}). Among the treatments, application of enriched compost 2.5 t ha^{-1} has shown the significantly better results with respect to nutrient content and uptake of corn and stover which can be applied as a source of N supplementation in organic baby corn production.

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