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Kasi Viswanath R

Department of Agronomy,
Hemvati Nandan Bahuguna
Garhwal University, Doon
Valley College of Education,
Dehradun, Uttarakhand, India

Roop Kishore Sharma

Department of Agronomy,
Hemvati Nandan Bahuguna
Garhwal University, Doon
Valley College of Education,
Dehradun, Uttarakhand, India

Mallikarjuna G

Department of Agronomy,
Hemvati Nandan Bahuguna
Garhwal University, Doon
Valley College of Education,
Dehradun, Uttarakhand, India

Effect of organic and inorganic manures on n, p and k content in grain and straw at harvest of maize

Kasi Viswanath R, Roop Kishore Sharma and Mallikarjuna G

Abstract

Field experiment was conducted during *Rabi* season of 2017-18 at College Farm of Doon Valley College of education, Dehradun, to study the effect of organic and inorganic manures on N, P and K content in grain and straw at harvest of maize under doon valley conditions. The experiment comprising of seven treatment combinations viz., T₁= 100% RDF, T₂= 100% RDF + FYM @05 t/ha, T₃= 100% RDF + FYM @ 10 t/ha, T₄= 100% RDF + vermicompost @3 t/ha, T₅= 100% RDF + Vermicompost @05 t/ha T₆= 100% RDF+Neem cake @ 05 t/ha T₇= Control were tested in a randomized block design with three replications. Recommended dose of fertilizer (RDF) was 120-60-00 kg N-P-K/ha. The results revealed that organic and inorganic manure source treatments influenced on N, P and K content in grain and straw. However, N, P and K content in grain and straw were recorded significantly higher in 100% RDF + Vermicompost @ 05 t/ha as compared to control. Maximum net returns of 57333 ₹ /ha and benefit: cost ratio value 2.68 was obtained in treatment of 100% RDF + Vermicompost @ 05 t/ha.

Keywords: Maize, RDF, vermicompost, N, P, K content, grain and straw

Introduction

Maize (*Zea mays* L.) ranks third with regards to total world production among the cereals followed by wheat and rice and it is principal staple food in many countries, particularly in the tropics and subtropics (Anonymous, 1999). Maize is considered as the "Queen of Cereals" and it is one of the most versatile crops which can be grown diverse environment and geographical range. The major maize producing countries in the world are USA, China, South and Central Africa, Argentina, Brazil and Mexico.

Globally, maize is cultivated on an area of 146 million ha with production of 680 million tonnes with a productivity of 4658 kg/ha. In India, maize is cultivated on 8.71 million ha with a production of 21.76 million tonnes and productivity 2498 kg/ha. India stands sixth in world with respect to maize production. Cultivation of maize in India is mostly confined to the states of Rajasthan, Maharashtra, Gujarat, Uttar Pradesh, Karnataka, Madhya Pradesh, Andhra Pradesh and Jammu - Kashmir. Gujarat occupies an area of 0.50 million ha with a production of 0.82 million tonnes and productivity of 1640 kg/ha (Anonymous, 2012).

Maize, because of high nutrient demand responds well to fertilizer but under field conditions due to over reliance on nitrogenous fertilizers and no or negligible used of organic manure its yield potential is difficult to exploit. Organic manures not only help to provide balanced nutrient but also support sustainable production due to their pivotal role in soil health enhancement. Proper application of organic and inorganic fertilizers increases the soil available nutrient contents (He and Li, 2004; Saha *et al.*, 2008) ^[1, 4]. Application of organic manure mixed with chemical fertilizers improve the soil fertility and fertilizer use efficiency. Application of organic manure improve the soil quality and more profitable in environment protection when compared with application of chemical fertilizers alone (Reganold, 1997) ^[3]. Considering these facts and view, the present experiment has been planned to study the effect of organic and inorganic manures on N, P and K content in grain and straw at harvest of maize.

Materials and Methods

The present study was conducted at Agriculture farm. Doon Valley College of education, Dehradun during *Rabi*, 2017-18. The farm is geographically situated of 542.m above the mean sea level at 30^o. 15 N latitude 79^o 15 E longitude and falls under the northern Dehradun Agr-climic zone of Uttarakhand. The experiment was laid out in a Randomized Block Design (RBD) with seven treatments and three replication.

Correspondence**Kasi Viswanath R**

Department of Agronomy,
Hemvati Nandan Bahuguna
Garhwal University, Doon
Valley College of Education,
Dehradun, Uttarakhand, India

Treatment details

a) The details of experiment are given as under

T₁: 100%RDF

T₂: 100%RDF+FYM (05 t ha⁻¹)

T₃: 100%RDF+ FYM (10 t ha⁻¹)

T₄: 100%RDF+ Vermicompost (03 t ha⁻¹)

T₅: 100%RDF+ Vermicompost (05 t ha⁻¹)

T₆: 100%RDF+ Neem cake (05 t ha⁻¹)

T₇: Control

b) Experimental design: Randomized Block Design

c) Number of replications: 3 (Three)

d) Number of Treatments: 7 (Seven)

e) Crop and variety: Hybrid Maize KANCHEN 25

f) Seed rate: 20 kg/ha

g) Spacing: 60 cm X 20 cm

Chemical composition of FYM, vermicompost and Neemcake

For the estimation of nitrogen, phosphorus and potassium in FYM, vermicompost and neem cake, representative samples were taken from these materials and analyzed for N, P and K content. The values of N, P and K content along with procedure followed for estimation are given below.

Nutrient composition (N, P, K) of FYM was 0.70%, 0.43%, 0.72% respectively, vermicompost was 1.6%, 0.9%, 1.0% respectively and Neem cake 2.1%, 1.0%, 0.8% respectively by standard procedure. Information of nutrient content in grain and straw and economic evaluation interms of net profit earned and benefit cost ratio were recorded.

Results and Discussion

The results pertaining to nitrogen, phosphorus and potassium content in grain and straw by maize are furnished in table 2 and 3.

Nutrient content (N, P and K) in grain at harvest

The results regarding to nutrient content in maize grain as influenced by organic and inorganic manures treatments are furnished in Table 1.

Nitrogen content: Data mentioned in Table 1 indicated that various levels of fertilizer and organic source treatments failed to express any significant result for nitrogen content in maize grain.

Phosphorous content: The mean data furnished in Table 1 concluded that effect of various levels of fertilizer and organic source treatments failed to reach the level of significance with regard to phosphorus content in grain at harvest.

Potassium content: A perusal of data presented in Table 1 revealed that effect of various levels of fertilizer and organic source treatments on potassium content in maize grain at harvest was indicating higher potassium content (0.50) was recorded in treatment 100%RDF+Vermicompost @05 t/ha (T₅). Relatively the lowest potassium content recorded in control treatment (T₇).

Table 1: Effect of organic and inorganic manures on N, P and K content in grain at harvest

Treatment	Nutrient content in grain(%) at harvest		
	N	P	K
T ₁	1.50	0.29	0.44
T ₂	1.53	0.29	0.45
T ₃	1.58	0.30	0.50
T ₄	1.56	0.29	0.47
T ₅	1.61	0.30	0.50
T ₆	1.57	0.30	0.48
T ₇	1.43	0.26	0.44
S. Em±	0.00	0.00	0.00
C.D.(P=0.05)	0.00	0.00	0.001

Nutrient content in straw at harvest

The results pertaining to nutrient content in maize straw as affected by various levels of fertilizer and organic sources are furnished in Table 2.

Nitrogen content: The data depicted in Table 2 showed that various levels of fertilizer and organic source treatments given significant influenced on nitrogen content in straw at harvest. however the higher nitrogen content in stover (0.61) at harvest under the treatment 100%RDF+Vremicompost @05 t/ha (T₅).

Phosphorous content: An examination of data (Table 2) mentioned that different levels of fertilizer and organic source treatments resulted in non-significant influence on phosphorus content in straw at harvest.

Potassium content: The mean data presented in Table 2 concluded that different treatments failed to express any significant effect on potassium content in straw at harvest.

Table 2: Effect of organic and inorganic manures on N, P and K content in straw at harvest

Treatment	Nutrient content in Stover (%) at harvest		
	N	P	K
T ₁	0.53	0.16	0.88
T ₂	0.56	0.17	0.88
T ₃	0.60	0.18	0.89
T ₄	0.56	0.18	0.88
T ₅	0.61	0.18	0.93
T ₆	0.59	0.18	0.88
T ₇	0.39	0.15	0.85
S.Em±	0.05	0.00	0.00
C.D.(P=0.05)	0.14	0.00	0.00

The results obtained were in conformation with Singh and Nepalia (2009) ^[5] who reported that application of 125% RDF (100% RDF 90-40 kg N-P 2O 5/ha) favorably improved organic carbon content, N and P status of soil over control. Further, Singh *et al.* 2011 a field experiment was laid out at Varanasi (Uttar Pradesh) during *kharif* season 2004-05 on effect of organic and inorganic source of nutrient on growth, yield, quality and nutrient uptake by baby corn recorded maximum NPK uptake at 180-38.7-74.7 kg N-P-K/ha.

Table 3: Economics as influenced by organic and inorganic manure sources treatments in maize.

Treatment	Yield		Cost of cultivation/ha	GMR	NMR	Benefit Cost Ratio
	Grain yield(t/ha)	Stover yield(t/ha)				
T ₁	3.24	7.82	19117	72080	52963	3.77
T ₂	3.64	8.24	24617	81040	56423	3.79
T ₃	3.94	8.53	30117	87330	57213	2.89
T ₄	3.75	8.32	28117	82720	54603	2.94
T ₅	4.13	8.85	34117	91450	57333	2.68
T ₆	3.81	8.44	34117	85040	50923	2.49
T ₇	2.04	5.70	12890	46500	33610	3.60

Application of 150% RDF fetched significantly higher net return (19251 /ha) and benefit: cost ratio (1.90) as compared to 100% RDF (40 -15-00 kg N-P-K/ha) of earlier studies (Tetarwal *et al.*, 2011) ^[7]. Similarly, Joshi *et al.* (2013) ^[2] revealed that application of 100% RDF (120-60-30 kg N-P-K/ha) recorded significantly higher net return (26600 /ha) and benefit: cost ratio (1.84) than control.

Raskar *et al.* (2013) revealed that highest benefit: cost ratio (2.21) was found under application of nitrogen (160 kg N/ha) and phosphorus (80 kg P/ha) in maize over other treatments.

Conclusion

The experiment entitled “Effect of organic and inorganic manures on n, p and k content in grain and straw at harvest of maize” under doon valley conditions. Conducted on experimental farm of Doon valley college of Education, Dehradun during the season of 2017-18.

The experiment comprising seven treatment combinations viz., T₁= 100% RDF, T₂= 100% RDF + FYM @ 05 t/ha, T₃= 100% RDF + FYM @ 10 t/ha, T₄= 100% RDF + vermicompost @ 3 t/ha, T₅= 100% RDF + Vermicompost 10 @ t/ha, T₆= 100% RDF+ Neemcake @ 05 t/ha, T₇= Control were tested in a randomized block design with three replications. The soil of the experimental field was sandy loam in texture, medium in available nitrogen (245.54 kg/ha), low in available phosphorus (8.96 kg/ha), fairly medium in available potassium (148.45 kg/ha), slightly alkaline in reaction (pH 6.8) with normal electrical conductivity (0.10 dS/m) and having well drainage with fair moisture retention capacity.

Organic and inorganic manure source treatments influenced on N, P and K content in grain and straw. However, N, P and K content in grain and straw were recorded significantly higher in 100% RDF + Vermicompost @ 05 t/ha as compared to control. The maximum net realization of 57333 ₹ /ha and benefit: cost ratio value 2.68 was obtained in treatment of 100% RDF + Vermicompost @ 05 t/ha.

From the present study, can be concluded that to obtain higher economical production from *rabi* maize and maintaining soil fertility, the crop should be applied 100% RDF along with Vermicompost @05 t/ha under doon valley condition. Nitrogen content and phosphorus was found non-significant by grain. Where as in Stover nitrogen content value

Economics

The gross as well as net returns, cost benefit ratio and cost of cultivation per hectare for individual treatment were worked out on the basis of grain and straw yields and prevailing local market prices (Table 3).

Among various treatments 100%RDF+ Vermicompost (05 t ha-1) (T₅) recorded maximum net realization (57333 /ha) with BCR (2.68) followed by treatment 100%RDF+ FYM (10 t ha-1) (T₃) (57213 /ha) with BCR (2.89) the lowest net realization of 33610 /ha was noted in treatment control (T₇).

significant. However, nitrogen in grain and straw was recorded significantly highest with application of 100% RDF + Vermicompost @ 05 t/ha (T₅). Various levels of fertilizer and organic source treatments failed to express its non-significant effect on phosphorus content in grain and stover. While phosphorus content in grain and stover were non-significantly higher in treatment 100% RDF + Vermicompost @ 05 t/ha (T₅). Potassium content was observed significant by grain and non-significant in stover. However, potassium in grain was recorded significantly higher with 100% RDF + Vermicompost @ 05 t/ha (T₅). Among various treatments 100%RDF+ Vermicompost (05 t ha-1) (T₅) recorded maximum net realization (57333 /ha) with BCR (2.68) followed by treatment 100%RDF+ FYM (10 t ha-1) (T₃) (57213 /ha) with BCR (2.89) the lowest net realization of 33610 /ha was noted in treatment control (T₇).

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