



Effect of farmyard manure and vermicompost on the maize-based intercropping system at Doon Valley of Uttarakhand

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Abstract

The Field experiment was conducted at Uttaranchal University Experimental Farm in Dehradun, to evaluate the effects of farmyard manure and vermicompost on maize-based intercropping system during *Kharif*, 2017. The experiment was laid out in split plot design replicated three times with three main and five sub plots -treatments viz., M₁- Control, M₂ - FYM + RDF and M₃ - Vermicompost + RDF, S₁ - Sole Maize, S₂ - Maize + Cowpea, S₃ - Maize + Black gram, S₄ - Maize + Green gram and S₅ - Maize + Amaranthus. With regard to the effect of organic manures, vermicompost @ 5 t ha⁻¹ + RDF recorded the highest growth and yield components in maize based intercropping system. It was followed by FYM @ 12.5 t ha⁻¹ + RDF. Among the cropping system, maize + cowpea intercropping system satisfyingly influenced the growth and yield components of maize such as plant height, LAI, DMP, cob length, cob diameter, number of grain cob⁻¹ and grain yield. The lowest values of all growth and yield components were recorded under maize + amaranthus /green gram intercropping systems. The maize + cowpea (S₂) intercropping system with the addition of vermicompost @ 5 t ha⁻¹ + RDF (M₃) recorded the highest grain yield of 6141 kg ha⁻¹ in *Kharif*, 2017. The uptake of nutrients was found to be significantly higher in vermicompost application with maize + cowpea intercropping system. From the present investigation, it was concluded that maize intercropped with cowpea along with the addition of vermicompost @ 5 t ha⁻¹ + RDF, is an economically feasible and eco-friendly approach to realize better return in maize.

Keywords: vermicompost, intercropping system, Doon Valley

Introduction

Maize (*Zea mays*), belongs to the grass family of *Poaceae* (Gordon, 1993) it is originated from Central America. It's otherwise known as corn. Maize is one of the most important cereal crop in the world agriculture economy both as food for humans and feed for animals. The crop has high yield potential, wider adaptability, grown throughout the world and therefore it is called "Queen of cereals". Maize grain contains about 11.1 per cent protein, 4.0 per cent oil, 66.2 per cent carbohydrate and 2.7 per cent crude fiber. Besides being a potential source of food for human being, it is used for the production of starch, syrup, alcohol, acetic acid and lactic acid etc. In Worldwide, maize is grown over an area of 181.03 million hectares with a production of 1073.93 million tones and with productivity of 5.73 t ha⁻¹. In India, maize occupies an area of 9.50 million hectares with a production of 24.50 million tones and productivity of 2.58 t ha⁻¹ (USDA, 2017). In Tamil Nadu, it is cultivated in an area of 0.22 million hectares with production of 0.81 million tonnes and a productivity of 4.5 t ha⁻¹ and also it occupies fourth position in India (Gangaiya, 2013). Excessive use of chemical fertilizers, decline in soil and food quality due to loss of soil organic matter is the main characteristics of the conventional farming systems which are more pronounced in arid and semi-arid areas (Singh *et al.*, 2007; Melero *et al.*, 2008 and Liu *et al.*, 2009) [8, 5, 4]. Increasing public awareness of the negative environmental impacts, growing consumer demand for healthier products and criticism of high input

production systems lead to more emphasis on organic crop production under integrated management systems (Guarda *et al.*, 2004) [3]. The intercropping of a cereal with a legume is a preferred system for achieving increased food supply and reduced environmental feedback. Efficient cereal/legume intercropping often facilitates N use through complementarily and/or N transfer (Rao *et al.*, 1987 and Li *et al.*, 2009) [9, 10]. Efficient and most economical production system is intercropping because it not only increases the production per unit area per unit time but also enhances resources use efficiency and improved economic status of the farmers. Intercropping is one of the potential cropping systems to exploit the natural and the artificial resources more efficiently than a sole crop (Srilatha *et al.*, 2001). Adoption of intercropping is one of the ways to produce more per unit area per unit time in maize (Kumar *et al.*, 2004).

Materials and Methods

A. Location of the experimental field

The field experiment was carried out during, 2017 at Experimental field of Uttaranchal University, Prem nagar, Dehradun.

It is a district of Uttarakhand state in northern India. It is located in the western Himalayan region 1, the location of experimental farm is situated at 30°33' North latitude and 77°94' East longitude at an altitude of 597 m above mean sea level (MSL).

B. Weather and climate

The climate of Dehradun also depends upon the altitude, and the temperature sometimes falls below the freezing point. During the summer ranges between 36° C - 16.7° C in winter. The temperature ranges from 23.4° C to 75.2° C. Dehradun gets the annual rainfall is 2115.4 mm/year. The hottest, coldest, wettest and windiest month respectively is June (29°C), January (14°C), August (673.6mm avg) and April (3km/hr). The maximum temperature is (32°C) and the minimum temperature is (24°C). The relative humidity is 85 percent and the pressure is 999 m bar.

C. Field experiment

The field experiment was laid out in split plot design with three replications.

D. Treatment details

The details of the treatment schedule was given below,

Main treatments: M₁ – Control, M₂ – FYM @ 12.5t ha⁻¹ + RDF and M₃ – Vermicompost @ 5t ha⁻¹ + RDF

Sub treatments: S₁ – Sole Maize (*Zea mays*), S₂ – Maize + Cowpea (*Vigna unguiculata*), S₃ – Maize + Black gram (*Vigna mungo*), S₄ – Maize + Green gram (*Vigna radiate*) and S₅– Maize + Amaranthus (*Amaranthus sp.*)

E. Crop and Varieties

The maize hybrid (Kanchan 26) and intercrops viz., Black gram (ADT 3), Cowpea (Gomati), Green gram (SML-668) and *Amaranthus katuwa* (multi cut) were chosen for study.

Results and Discussion

Maize grain yield recorded the highest in the organic manures applied plots (Table 1). Intercropping system and

utilizations of organic manures practices significantly influenced the grain yield. The grain yield of maize exhibited significant variation due to organic material applications. Application of vermicompost @ 2.5 t ha⁻¹ + RDF was recorded highest grain yield of 4574 kg ha⁻¹. M₁ recorded the lowest grain yield of 3463 kg ha⁻¹. Maize + cowpea intercropping situation produced the highest grain yield 5173 kg ha⁻¹ and stover yield 9801 Kg ha⁻¹ (Table 2), which was 57 per cent increased over the farmers practice. It was followed by maize + black gram (4554 kg ha⁻¹). Sole maize crop recorded the lowest grain yield of 2460 kg ha⁻¹. With records to interaction effect, Maize + cowpea with vermicompost @ 2.5 t ha⁻¹ + RDF (M₃S₂) recorded the highest maize grain of (5831 kg ha⁻¹). This yield components as well as grain yield of maize were comparatively more in intercropping system than sole maize. The increased grain yield under intercropping system was due to weed suppression by intercrop by the way of covering the land surface. Generally all growth and yield parameters were higher in maize intercropped with legumes than in maize raised in pure stand and intercropped with oilseeds. This may be attributed to the beneficial effects of legumes as associated crops (Pantra *et al.*, (1999). Similar result was found by Banik *et al.*, (2000) [1]. Maize yield was increased due to intercropped with cowpea compared to other intercrops. Muoneke *et al.*, (2012) [6] reported maize intercropped with vegetable cowpea, the grain yield of maize was increased. Choudhary, (2014) [2] reported highest stover yield of maize was obtained in maize intercropped with cowpea. Increase in grain yield of maize was also reported by Ndakidemi and Dakora, (2005) due to intercropping with cowpea.

Table 1: Effect of different treatments on the yield (Kg ha⁻¹)

Sub plot treatments	Main plot treatments			
	M ₁ Control	M ₂ FYM+RDF	M ₃ VC+RDF	Mean
S ₁ -Maize (Sole crop)	2460	2850	3118	2809
S ₂ -Maize+Cowpea	4419	5270	5831	5173
S ₃ -Maize+Blackgram	3971	4761	5030	4587
S ₄ -Maize+Greengram	3543	4100	4460	4024
S ₅ -Maize+Amaranthus	2922	3870	4429	3740
Mean	3463	4168	4574	
Treatments	Main treatments	Sub treatments	Interactions	
			S x M	M x S
SEd	75.2	101.2	110.1	115.2
CD (P=0.05)	150.4	202.4	220.2	230.4

Table 2: Effect of different treatments on the stover yield (Kg ha⁻¹)

Sub plot treatments	Main treatments			
	M ₁ Control	M ₂ FYM+RDF	M ₃ VC+RDF	Mean
S ₁ -Maize alone	4072.0	4481.49	4876.7	4476.73
S ₂ -Maize+Cowpea	7618.0	8948.12	9801.7	8689.27
S ₃ -Maize+Blackgram	6831.35	6436.72	7765.6	7011.22
S ₄ -Maize+Greengram	5045.76	5867.36	6853.9	5922.34
S ₅ -Maize+Amaranthus	4606.36	5790.86	6186.0	5527.74
Mean	5634.67	6304.91	7097.38	
Treatments	Main treatments	Sub treatments	Interactions	
			S x M	M x S
SEd	82.1	109.4	162.7	189.53
CD(P=0.05)	164.2	218.8	325.4	379.1

Conclusion

Maize intercropped with cowpea was superior to other treatments, by recording highest growth components in maize and it was followed by the intercrop blackgram. The

interaction effect between the organic manures and cropping systems was found to be significant in influencing the growth components in maize. In general maize + cowpea

with vermicompost @ 5 t ha⁻¹ + RDF registered highest values in growth components of maize.

From the above results, it is concluded that maize intercropped with cowpea along with the addition of vermicompost @ 5 t ha⁻¹ + RDF, is an economically feasible and eco-friendly approach to realize better returns in maize.

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