Studies on Soil fertility, Cow urine and Panchagavya levels on Growth and Yield of Maize

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Abstract

A field experiment on organic farming was conducted to study the influence of different levels of cow urine, panchagavya and fertility on maize. The grain and stover yield of maize varied significantly under different levels of fertility, panchagavya spray and cow urine levels. Maximum grain yield of 18.6 q per ha and 17.6 q per ha were recorded with application of cow urine and panchagavya and minimum was recorded in the plots without application of them. However, no significant difference was observed in stover yield but, higher stover yield of 42.7 q per ha and 39.6 q per ha were recorded in the plots with application of panchagavya and cow urine. Among different fertility levels, maximum grain yield of 20.9 q per ha and stover yield of 47.5 q per ha were recorded in the plots supplied with press mud equivalent to recommended 300 per cent N. Height, number of leaves per plant at harvest in maize crop varied significantly due to application of different cow urine and fertility levels.

Introduction

Traditional Agriculture has been generally considered everywhere as a joint effort of man and cattle. In recent past, a great deal of importance has been given to individual animal product and formulation. Among the formulations, the most widely mentioned and discussed is *Panchagavya*, which literally means a mixture of five products originating from cow. Panchagavya is the formulation mentioned in Ayurveda, prepared using five components derived from cow *viz.* milk, curd, ghee, urine and dung (Mathivanan *et al*., 2006). The liquid organic manures such as panchagavya and cow urine are commonly used in organic farming to provide balanced nutrition to the crop. Devakumar *et al.,* (2008) observed the presence of naturally occurring beneficial microorganisms, predominantly bacteria, yeast, actinomycetes, photosynthetic bacteria and certain fungi in organic liquid manures. Another important product that is being extensively used in traditional agriculture is cow's urine or *go-mutra* (Sanskrit), which has been known to be used by various sectors of people in India from Vedic period for medicinal and agricultural purposes. The traditional knowledge also recognizes the importance of cow urine in agriculture and is being sprayed on plants to control fungal/bacterial diseases. It helps in the management of pests (25%) of sweet corn at tasseling and cob formation stages. Maize is the third most important cereal grown in India after wheat and rice. With this in view, an attempt was made to study the effect of soil fertility and cow urine levels with panchagavya spray to study growth and yield of maize.

Materials and methods

A field study was conducted at Organic Farming Research Centre, (OFRC), University of Agricultural Sciences Bangalore, India. The soils are sandy loam with low organic carbon content of 0.38 per cent. The experiment consisted of cow urine levels (2) with and without panchagavya (2) and three fertility levels (100%, 200% and 300% of recommended N equivalent). Experiment was laid out on Factorial Randomized Block Design with 12 treatment combinations and three replications. The treatment combinations are: $P_1C_1F_1$, $P_1C_1F_2$, $P_1C_1F_3$, $P_1C_2F_1$, P1C2F2, $P_1C_2F_3$, $P_2C_1F_1$, $P_2C_1F_2$, $P_1C_2F_3$, $P_2C_2F_1$, $P_2C_2F_2$ and $P_2C_2F_3$. Panchagavya was prepared by following the standard procedure and filtered. Three litres of filtrate was taken and diluted to 100 litres using water and sprayed to the crop during the 30th and 60th day after sowing when the soil is moist. Cow urine was collected and applied to the crop at the rate of 5000 litres per ha during the 30th and 60th day after sowing when the soil is moist and recorded observations on plant height, number of leaves per plant, grain and stover yield at harvest.

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Results

Grain and stover yield of maize varied significantly due to different soil fertility levels, panchagavya spray and cow urine levels (Table 1). Maximum grain yield of 18.6 q per ha was recorded with plot applied with cow urine and minimum of 14.2 q per ha was recorded in the plot without the application of cow urine. Although, no significant difference was observed in stover yield, higher stover yield of 39.6 q per ha was recorded in cow urine applied plots. Among the different fertility levels, maximum grain yield of 20.9 q per ha and stover yield of 47.5 q per ha were recorded in plots applied with 300 per cent N equivalent supplied through pressmud. Minimum grain yield of 10.8 q per ha and stover yield of 31.4 q per ha was recorded in 100 per cent fertility levels. Plant height and number of leaves per plant in Maize at harvest varied significantly due to different cow urine and fertility levels. Maximum plant height (173.7 cm) and number of leaves (13.0) per plant were recorded in cow urine applied plots and higher plant of 177.7 cm and 13.3 leaves per plant in 300 per cent N equivalent supplied through pressmud. Taller plants and higher leaves per plant were recorded with application panchagavya.

Table 1: Effect of fertility, cow urine levels and Panchagavya spray on grain and stover yield (q / ha) in maize

Panchagavya Spray (P)	Grain yield (q / ha)				Stover yield(q / ha)			
	Cowurine levels (C)				Cowurine levels (C)			
	With (C_1)		Without (C_2)	Mean	With (C_1)		Without(C_2)	Mean
With Panchagavya	19.50		17.60	17.6	44.0		41.3	**42.7**
Without Panchagavya	15.7		12.80	15.2	35.2		37.4	**36.3**
Mean	**18.60**		**14.20**		**39.6**		**39.4**	-
	F-test	S.Ed±	C.D at 5 %		F-test	S.Ed±	C.D at 5 %	
C	**	0.373	0.70		NS	1.493	-	
P	**	0.773	1.45		*	1.737	3.25	
C x P	NS	1.093	-		NS			
Fertility levels (F)								
F_1 – 100 %	13.1		8.5	10.8	32.2		30.6	**31.4**
F_2 – 200 %	19.4		15.7	17.5	37.2		42.1	**39.6**
F3 – 300 %	23.2		18.6	20.9	49.6		45.4	**47.5**
Mean	**18.6**		**14.2**		**39.6**		**39.4**	
	F-test	S.Ed±	C.D at 5 %		F-test	S.Ed±	C.D at 5%	
F	**	0.946	2.307		**	2.128	5.19	
C x F	NS	1.339	-		NS	3.00	-	

Discussions

Higher grain and stover yield recorded might be due to the higher plant height (172.5 cm) and increased number of leaves (13) leading to more photosynthetic area thereby resulting in higher yield levels. These results are in confirmity with the findings of Sathyamoorthi (1997) where higher leaf area index (LAI) and nutrient uptake might have contributed for higher yield attributes in maize by application of bio-digester liquid, panchagavya and cow urine spray. These might be also due to presence of naturally occurring beneficial microorganisms predominantly bacteria, yeast, actinomycetes, photosynthetic bacteria and certain fungi which were detected in organic liquid manures (Swaminathan, 2005 and Devakumar *et al.* 2008). Maximum grain yield of 17.6 q per ha and stover yield of 42.7 q per ha was recorded in panchagavya sprayed plots. This was due to increased in plant height and number of leaves. These results are in corroboration with the findings of Meena and Bheemavat, (2009) that cow urine combined with application of green manures and foliar application of panchagavya twice on the standing crop resulted in better growth and development of plants for increased and maximum grain yield of maize. Cob length and cob girth were significantly higher in the plots applied with bio-digester slurry followed by plots supplied with cow urine and panchagavya liquid manures. Papen *et al.,* (2002) reported that panchagavya contains macro and micro nutrients besides total reducing sugar-glucose. Chemolithotrops and autotropic nitrifiers (ammonifers and nitrifers) present in panchagavya

which colonize in the leaves and increase the ammonia uptake and thereby enhancing the total N supply. The microorganisms present in the rhizosphere environment around the roots, influence the plant growth and crop yield. Because of these reasons crops applied with liquid manures are benefitted in terms of soil fertility, soil health.

Table 2: Effect of fertility, cow urine levels and panchagavya on plant height (cm) and number of leaves per plant at harvest in maize

Panchagavya Sprays (P)	Plant height (cm)				No. of leaves/plant			
	Cowurine levels (C)				Cowurine levels (C)			
	With (C_1)		Without(C_2)	Mean	With (C_1)		Without(C_2)	Mean
With Panchagavya	176.4		168.5	**172.5**	13.2		12.8	**13.0**
Without Panchagavya	170.9		164.3	**167.6**	12.9		12.1	**12.5**
Mean	**173.7**		**166.4**		**13.0**		**12.5**	
	F-test	S.Ed±	C.D at 5 %		F-test	S.Ed±	C.D at 5 %	
C	**	0.880	1.65		*	0.192	0.359	
P	NS	2.42	-		NS	0.293	-	
C x P	NS	3.42	-		NS	0.414	-	
Fertility levels (F)								
F_1 – 100 %	164.8		156.3	**160.5**	12.5		11.7	**12.1**
F_2 – 200 %	175.0		168.6	**171.8**	13.2		12.7	**12.9**
F3 – 300 %	181.1		174.4	**177.7**	13.5		13.1	**13.3**
Mean	**173.7**		**166.4**		**13.0**		**12.5**	
	F-test	S.Ed ±	C.D at 5 %		F-test	S.Ed±	C.D at 5%	
F	**	2.96	7.22		NS	0.359	-	
C x F	NS	4.18	-		NS	0.508	-	

The higher grain yield of 20.9 q per ha and stover yield of 47.5 q per ha were recorded in plots applied with 300 percent N equivalent supplied through pressmud. They are in confirmity with the findings of Khan *et al,.* (2008) who reported that grain yield and stover yield were significantly higher under 10 to 20 t FYM per ha and also had significant and positive effect on green cob yield than control. Pressmud supplies nitrogen, phosphorus and sulphur in available forms to the plants through biological decomposition and improves physical properties of soil such as aggregation, aeration, permeability and water holding capacity. These results are in confirmity with the findings of Masti *et al.,*(2003) where liquid cattle manure applied to soil did not affect the seed germination but resulted in a significant increase in plant height, number of green leaves and dry biomass of maize relative to control and was similar to that fertilizer treatment. Organic manures can improve soil-water-plant relations through modifying bulk density, total porosity, soil water relation and consequently, increasing plant growth and water use efficiency.

Conclusion

The present study revealed that higher grain and stover yield, plant height and number of leaves in maize with panchagavya, cow urine which were comparable to recommended fertilizer treatments at higher level (200% and 300%*)*. It can be concluded that presence of rich plant growth substances, both major and micro nutrients, beneficial microbial population in organic liquid manures have helped to bring rapid changes in phenotypic characteristics of plants and also improvement in the growth ultimately improving in the productivity of the crops. Liquid organic manure like panchagavya could be prepared locally by farmers themselves and obtain increased yield levels. Such practices would pave way to reduce use of external inputs and increase sustainability among organic farmers in the developing countries.

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