Effect of Seed treatment, Panchagavya application and Organic Farming Systems on Soil microbial population, Growth and Yield of Maize

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Key words: Panchagavya, Beejamrutha, Rhizosphere, Bacteria and organic farming system, palekar's method

Abstract

An experiment was conducted to study the effect of seed treatment, panchagavya application and organic farming systems on soil microbial population, growth and yield of maize. Grain yield of maize varied significantly due to different organic farming systems, seed treatment and panchagavya spray. Maximum grain yield of 19.3 q per ha was recorded in organic farming system II and minimum maize grain yield was recorded in systems I (17.1 q / ha). The grain yield of 19.6 q per ha and 16.90 q per ha was recorded with panchagavya (3 %) and without panchagavya application. Maximum yield of 19.90 q per ha was recorded in seed treatment with panchagavya followed by beejamrutha (17.99 q / ha) and minimum grain yield of 16.90 q per ha was recorded in control. Higher microbial population was observed in organic farming system II compared to organic farming system I. Panchagavya spray and panchagavya seed treatment showed higher rhizosphere microbial population followed by with panchagavya and beejamrutha seed treatment. Lower microbial population was observed in without panchagavya spray and without seed treatment.

Introduction

With increased awareness on organic farming among the farming community they are use of many organic formulations in crop production is increasing. During the last few years there has been increasing interest in the use of panchagavya, beejamrutha, jeevamrutha and other liquid organic formulations. Panchagavya and beejamrutha are two organic products which have received wide spread attention and acceptability among organic farming practitioners. They proved to be efficient plant growth stimulants enhances the biological efficiency of crops and the nutritional quality of the fruits and vegetables. Swaminathan (2007) and Devakumar *et al*., (2008) reported the presence of naturally occurring beneficial microorganism's predominantly lactic acid bacteria, yeast, actinomycets, photosynthetic bacteria, nitrogen fixers, phosphorus solublisers and fungi in panchagavya and beejamrutha. An attempt was made to study the effect of seed treatment, panchagavya application and organic farming systems on soil microbial population, growth and yield of maize. The objectives are to study the effect of beejamrutha and panchagavya on growth and yield of maize, and to study the effect of these on soil microbial population.

Material and Method

A field study was conducted at Organic Farming Research Center, Shivamogga, University of Agricultural Sciences, Bangalore, India. The soil type of experimental field was red sandy loam. Beejamrutha was prepared by following standard procedure given by Palekar, (2006). Panchagavya was prepared by following standard procedure given by Natrajan (2007).Panchagavya was filtered through a clean cloth and 3 liters of Panchagavya filtrate was diluted in 100 liters of water and sprayed at seedling, vegetative and tassling stages of maize crop. Grain and stover yields were recorded and studied microbial population viz; bacteria, fungi, actinomycets, N-fixers, P-solubilizers present in rhizosphere. Serial dilution and standard plate count methods were used for isolation of rhizosphere bacteria, fungi and actinomycets using nutrient agar, Martin's rose bengal agar and Kuster's agar respectively. The free living nitrogen fixers and P-solubilizers using Norri's N-free media and Pikovskaya's media respectively. Inoculated plates were incubated at 32 ± 2^0C for 5 days and the colony counts were recorded. Field experiment consists of three main factors viz; Organic Farming Systems-F_1- Organic farming system I (Palekar's method) and F_2- Organic farming system II (Non Palekar's method), Panchagavya (3%) spray-P_1-With Panchagavya and P_2–Without Panchagavya, Seed treatments-S_1- Control, S_2 – Beejamrutha and S_3 – Panchagavya (3%) and experiment was laid out on Factorial Randomized Block design with 12 treatment combinations with three replications. The treatment

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combinations were T_1: $F_1P_oS_1$, T_2: $F_1P_oS_2$, T_3: $F_1P_oS_3$, T_4: $F_1P_1S_1$, T_5: $F_1P_1S_2$, T_6: $F_1P_1S_3$, T_7: $F_2P_oS_1$, T_8: $F_2P_oS_2$, T_9: $F_2P_oS_3$, T_{10}:$F_2P_1S_1$, T_{11}: $F_2P_1S_2$ and T_{12}: $F_2P_1S_3$

Results

The results indicate that grain yield of maize varied significantly due to different organic farming systems, seed treatment and panchagavya spray (Table 1). Maximum maize grain of 19.3 q per ha and stover (30.0 q / ha) yield were recorded in organic farming system II and minimum yield of 17.1 q per ha and stover yield of 25.7 q per ha were recorded in systems I i.e., Palekar's method of cultivation.

Table 1: Effect of seed treatment, panchagavya application and organic farming systems of cultivation on grain and stover yield (q / ha) of maize

Panchagavya Sprays (P)	Grain yield (q / ha)				Stover yield(q / ha)			
	Organic Farming systems (F)				Organic Farming systems (F)			
	System I (F_1)		SystemII (F_2)	Mean	System I (F_1)		System II(F_2)	Mean
With Panchagavya spray (P_1)	17.5		21.7	**19.6**	28.1		31.4	**29.7**
Without Panchagavya spray (P_2)	16.7		17.0	**16.9**	23.3		28.0	**26.0**
Mean	**17.1**		**19.3**		**25.7**		**30.0**	
	F-test	**S.Ed±**	**C.D at 5 %**		**F-test**	**S.Ed±**	**C.D at 5 %**	
F	**	0.252	1.154		*	1.326	8.07	
P	**	0.636	11.423		*	1.197	21.50	
F x P	*	0.899	16.155		NS	1.692	-	
Seed treatments (S)								
S_1 – Control	16.3		17.6	**16.9**	24.8		30.5	**27.6**
S_2 – Beejamrutha	17.1		18.6	**17.9**	25.6		28.1	**26.8**
S3 – Panchagavya	18.0		21.8	**19.9**	26.7		31.4	**29.0**
Mean	**17.1**		**19.3**		**25.7**		**30.0**	
	F-test	**S.Ed±**	**C.D at 5 %**		**F-test**	**S.Ed±**	**C.D at 5 %**	
S	*	0.778	6.70		NS	1.466	-	
F x S	NS	1.101	-		NS	2.073	-	

The rhizosphere microbial population varied due to the levels of panchagavya, seed treatment and organic farming systems are presented in table 2. Higher microbial population was observed in organic farming system II (Non Palekar) as compared to organic farming system I(Palekar's method). Treatment T_9 with panchagavya spray and panchagavya seed treatment showed higher microbial population followed by with panchagavya and beejamrutha seed treatment. Lower microbial population was observed in T_4 without panchagavya spray and without seed treatment.

Table 2. Soil microbial populations as influenced by seed treatment, panchagavya application and organic farming systems in maize

Treatments	Bacteria (10^5)	Fungi (10^4)	Actinomycetes (10^3)	N-fixers (10^3)	P-solubilizers (10^3)
Initial	124	8	16	25	36
T_1	208	06	20	58	53
T_2	112	07	22	62	50
T_3	224	04	19	59	49
T_4	103	03	11	40	30
T_5	208	06	19	57	47
T_6	211	08	16	46	54
T_7	298	07	14	68	76
T_8	313	12	23	72	85
T_9	348	18	29	85	108
T_{10}	221	08	18	44	49
T_{11}	256	07	21	58	54
T_{12}	176	09	18	63	57

Discussion

Higher grain and stover yield of maize in non palekar method of cultivation was may be due to the better nutrients, soil-water-plant relations in these treatments due to application of pressmud. These are in confirmity with Muthuvelu (2002) and Devakumar et al., (2008) have also reported increase yields in ladies finger, field bean and finger millet. Grain yield of 19.6 q per ha and 16.90 q per ha were recorded with panchagavya (3 %) and without panchagavya spray. Maximum yield of 19.90 q per ha was recorded in seed treatment with panchagavya followed by beejamrutha (17.99 q per ha) and minimum grain yield of 16.90 q per ha was recorded in control. The interaction effects between were found to be non significant.

The organic liquid manures are eco-friendly organic preparations made from cow products and contain macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting substances like IAA, GA and beneficial microorganisms. In the present study, higher growth, yield and quality of crops are due to these factors which are in confirmation with findings of Palekar (2006) and Natarajan (2007). Application of beejamrutha resulted in significantly higher root length than jeevamrutha at vegetative and tassling the stages of crop growth. Panchagavya contains naturally occurring beneficial, effective microorganisms, lactic acid bacteria, yeast, actinomycets, photosynthetic bacteria and certain fungi have improved quality, growth and yield of crops. These results are in confirmity with the findings of Devakumar et al., (2008) reported, application of liquid manure promotes biological activity in soil and enhance nutrients availability to crops.

Application of panchagavya at regular intervals has resulted in higher microbial population over different treatments. This may be attributed to the fact that panchagavya is a rich source of beneficial micro-organisms like N-fixers and P-solubilizers. Similar observations were made by Nagaraj and Sreenivasa (2009) and Sreenivasa *et al*., (2010). Beneficial microorganisms present in beejamrutha produced IAA and GA and resulted in improvement in seed germination, seedling length and seed vigour in soybean. Sreenivasa et al., (2009) reported that beejamrutha contains not general microflora, certain beneficial biochemical groups such as free living N_2-fixers, P- solubilizers and bacteria and Jeevamrutha promotes higher microbial population in soil (Paleker 2006) and Devakumar *et al*., (2008).

Conclusion

Grain and stover yield of maize varied significantly due to different organic farming systems, seed treatment and panchagavya application. Significantly higher grain and stover yields were recorded in organic farming system II and lower was recorded in system I. Panchagavya spray and panchagavya seed treatment recorded higher rhizosphere microbial population followed by with panchagavya and beejamrutha seed treatment. Use of these formulations in organic farming would help framers to get higher yield and returns besides improvement in soil physical, chemical and biological properties. These formulations can be prepared locally by resource poor farmers and improve soil health, besides obtaining higher returns to the farmers in rural areas.

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