International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 17-09-2021, Accepted: 01-10-2021, Published: 18-10-2021
Volume 6, Issue 5, 2021, Page No. 1267-1270

Nutrient and microbiological evaluation of indigenous liquid organic manures: Panchagavya, jeevamirtham and amirthakaraisal

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Abstract

Recently Organic farming is gaining importance due to the negative impact of chemical fertilizers and pesticides on the environment and human health. Hence, the present study evaluates the microbial and nutrient content of indigenous liquid organic manure (LOM) preparations like Panchagavya (PG), Jeevamirtham (JM) and Amirthakaraisal (AK) commonly used in organic farming. Twenty-three morphologically distinct isolates were obtained from these preparations. Enumeration of bacterial content from these liquid organic preparations revealed the highest amount of aerobic bacterial load in PG. N_2-Fixers were found to be high in JM and the P-solubilizers and Lactobacillus content were found to equally high in both JM and AK. The plant nutrients such as NPK, organic content and micronutrients Cu, Zn, Mn and Fe was high in PG. Thus PG was found to be superior both in aerobic microbial load and plant nutrients compared to JM and AK. But JM was found to good in the content of soil fertilizing bacteria like N_2 –fixers and P-solubilisers and also the Lactobacillus.

Keywords: organic farming, liquid organic manure (LOM), panchagavya, plant nutrients, soil fertilizing bacteria

Introduction

With the advent of green revolution in the late 1960s the traditional Indian farming methods were replaced with high yielding varieties, modern equipments and chemical fertilizers. Initially there was an increase in food production but in the long run it proved to be unsustainable and harmful to the environment. Over use of chemical fertilizers rendered the soil less productive due to reduction of organic and microflora content, increase in the salinity of soil, change in soil soil pH [1, 2]. Therefore, the current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable and quality food production. Organic farming envisages the comprehensive management approach to improve the soil health, eco-system of the region and the quality of product.

A number of indigenous organic sources of nutrients like organic manures, enriched manures, vermicompost, green manures, and liquid organic manures (LOM) such as Beejamruth, Jeevamruth, Amruthpani and Panchagavya are commonly used by the farmers engaged in organic food production. Of these liquid organic manures, Panchagavya is more widely used as a traditional practice to protect soil microorganisms, crops and to improve plant productivity. Panchagavya has been tested on a variety of crops [3-21] Existing scientific knowledge about Panchagavya suggests that it contains nutrients and growth promoting substances and hence when applied to crops it is known to improve growth and yield of crops.

In this present study, three indigenous liquid organic manures, Panchagavya, Jeevamirtham and Amirthakaraisal were used. Systematic analysis of the nutrients and microbial flora was done for each preparation.

Materials and Methods

Materials

The liquid organic manure such as Panchagavya, Jeevamirtham and Amirthakaraisal used in the study was procured from Pioneer Agro Industries Pvt. Ltd., Coimbatore. The general method for the preparation of these liquid organic manure is mentioned briefly in this article as per standard procedure mentioned in the ancient literature.

Preparation of Panchagavya

2 liters of Panchagavya could be prepared by adding 500grams of fresh cow dung and 100ml of ghee (Clarified butter) into a plastic tub, mixed well and incubated for 3 days. The contents can be mixed once every 24 hours**.** On the fourth day, 300ml fresh cow urine, 200ml of milk (boiled and cooled), 200ml of curd, 300ml of tender coconut water, 100g of Jaggery (unrefined sugar)/300ml of sugarcane juice and 100g of ripened banana with skin (poovan)-mashed well and could be added and mixed thoroughly and incubated for fermentation for 12 days. The mixture could be stirred thoroughly two times a day at morning and evening for 20 minutes each time. The plastic tub was covered with a cotton cloth was kept in shade. After 12 days of fermentation the liquid mixture can be filtered through a cotton cloth and stored in PET bottle with lid loosely closed. The time required for preparation of Panchagavya by this method is 15 days.

Preparation of Jeevamirtham

2 liters of Jeevamirtham could be prepared in a plastic tub by mixing 100g of fresh cow dung, 100ml of fresh cow urine, 5g of jaggery (unrefined sugar), 10 gram of pigeon

pea flour and 5g of garden soil, these ingredients could be added into a plastic tub and mixed thoroughly and the volume can be made up to 2 litres by adding water. The mixture could be stirred well three times a day and the plastic tub kept in shade, covered with cotton cloth. for 24hours for fermentation.

Preparation of Amirthakaraisal

2 liters of Amirthakaraisal could be prepared in a plastic tub by mixing 200g of cow dung and 200ml of fresh cow urine. To this mixture, 5g of jaggery (unrefined sugar) can added and the volume made to 2 1iters by adding water and stirred well until the jaggery was fully dissolved. The mixture could be allowed to ferment for 24 hours and stored in the shade by covering it with a cotton cloth.

Isolation and enumeration of bacteria from LOM

The diversity and density of bacteria in the LOM were enumerated on selective medium and at different growth conditions. Different dilutions of the LOM were plated on ashby' sagar [22], pikovskaya's agar [23], and MRS agar to enumerate nitrogen fixing bacteria, phosphate solubilizing bacteria, and lactobacillus, respectively.

To enumerate total aerobic bacteria, different dilutions of LOM were plated on Nutrient agar medium and incubated under aerobic condition. Three plates per dilution were incubated at 30°C and the bacterial counts were made at 24 h and 48 h and expressed as mean ± SEM of the colony forming unit (cfu/ml).The number and cultural characteristics of distinct bacterial isolates from the LOM were studied.

Determination of nutrients in LOM

The pH and electrical conductivity (EC) was determined using pH and EC meter. Macro and micro elements were estimated using atomic absorption technique and nitrogen content was estimated by Kjeldahl method [24].

Statistical Analysis

Mean of cfu/ml (n=3) were calculated and expressed as mean ± SEM. The statistical significance between different LOM preparations was calculated by t-test.

Results and Discussion

Microbial load and nutrient content liquid organic manure preparations

It could be observed from figure 1, the total aerobic bacterial population on nutrient agar was found to be highest in PG ($2.85x10^8$ cfu/ml) while AK had the lowest bacterial count ($4.3x10^5$ cfu/ml).In contrast the count of N_2- Fixers, P-Solubilisers and Lactobacillus in PG was found to be the lowest as compared with JM and AK.

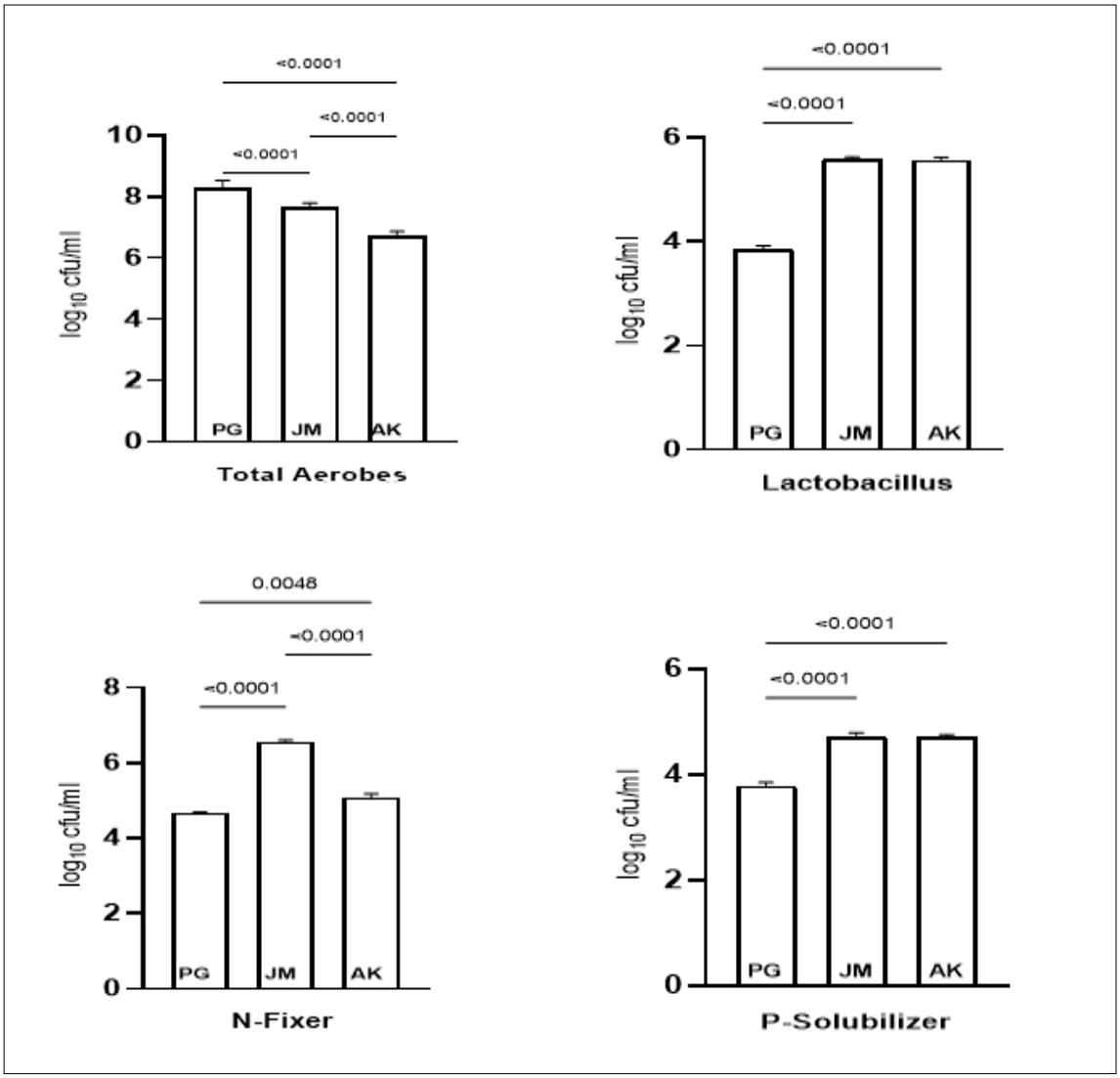

Fig 1: Bacterial count in Liquid Organic Manure

The high aerobic bacterial count in PG may be attributed to its higher nutrient content. The microbial load in JM was found to be intermediate between PG and AK.

The content of N_2-Fixers, P-Solubilisers and Lactobacillus were determined because these bacterial species enhance soil fertility and thus increases the growth of the crops. *Lactobacillus*, even though not a PGPR - Plant Growth Promoting Rhizobacteria was determined since its presence in large numbers in a fermented product is an important criteria in the stability of the product and thus increasing its shelf life. But few results have shown their presence in rhizosphere [25] and has plant-growth promoting activity [26]. JM was found to good in the content of soil fertilizing bacteria like N_2 –fixers and P-solubilisers, this may be attributed to the addition of garden soil in the preparation of JM.

Table 1: Number of bacterial isolates from Liquid organic manures (LOM).

Liquid Organic manure	Number of isolates				Total isolates
	Nutrient agar	Ashby's agar	Pikovskaya's agar	MRS agar	
Panchagavya	1	2	2	2	7
Jeevamirtham	3	2	1	1	7
Amirthakaraisal	4	2	1	2	9
					23

The number of isolates in PG, JM and AK was 7, 7 and 9 respectively table 1. In total, 23 isolates were found to be present in the liquid organic manures and were morphologically characterized and presented in table 2.

Table 2: Cultural characteristics of bacteria isolated from LOM

Liquid organic manure	Isolates	Cultural Characteristics
Panchagavya	PG1 (NA)	Circular, shiny, raised, translucent colonies
	PG2 (AA)	Large, circular, opaque, white colonies
	PG3 (AA)	Small, circular, opaque, coloured colonies
	PG4 (PA)	Circular, opaque, white colonies
	PG5 (PA)	Large, irregular, opaque, pale yellow colonies
	PG6 (MA)	Circular, mucoid, opaque, viscous, white colonies
	PG7 (MA)	Circular, raised, dry, opaque, white colonies
Jeevamirtham	JM1 (NA)	Irregular, wrinkled, flat, creamy white colonies
	JM2 (NA)	Small, circular, smooth, raised, yellow colonies
	JM3 (NA)	Irregular, wrinkled, flat, creamy whitewith clear zone around the colonies
	JM4 (AA)	Small, circular, shiny, yellowish colonies
	JM5 (AA)	Irregular, flat,red colonies
	JM6 (PA)	Variable
	JM6 (MA)	Small, circular, raised pale yellow colonies
Amirthakaraisal	AK1 (NA)	Small, circular, smooth, raised, yellow colonies
	AK2 (NA)	Large, irregular margin, wrinkled, flat, creamy white colonies
	AK3 (NA)	Irregular, wrinkled, raised centered, brownish colonies.
	AK4 (NA)	Small, circular, smooth, raised, white colonies
	AK5 (AM)	Small, irregular, raised, transparent colonies
	AK6 (AM)	Large, irregular, flat, creamy white colonies
	AK7 (PA)	Variable
	AK8 (MA)	Large, circular, mucoid, raised, pink colonies
	AK9 (MA)	Small, circular, mucoid, raised, brown centered, light brown colonies

Table 3: Physico-chemical content of the liquid organic manure

Liquid Organic Manure	Nutrient Contents											
	P^H	EC µS/cm	Moisture %	N %	P %	K %	Organic Content %	C:N Ratio	Cu mg/L	Zn mg/L	Mn mg/L	Fe mg/L
Panchagavya	3.75	2960	93.39	0.33	0.18	0.68	3.43	10:1	1.25	4.71	3.17	29.34
Jeevamirtham	4.30	1240	94.49	0.06	0.04	0.18	2.87	48:1	0.80	2.35	2.72	10.12
Amirthakaraisal	6.20	1682	98.85	0.04	0.02	0.20.	0.51	13:1	0.50	1.78	1.88	8.31

Physiochemical analysis data presented in table 3 shows that PG and JM was acidic, with P^H of 3.75 and 4.30, respectively. This might be due to the production of acid metabolites during the fermentation of PG and JM. Whereas, P^H of AK was slightly acidic (6.20).

The data in the table 3 also reflects higher macro and micronutrient content and C: N ratio in PG compared to JM and AK. Thus, of the liquid organic manure tested, PG was found to be high both in aerobic microbial and nutrient status compared to JM and AK. But JM was found to good in the content of soil fertilizing bacteria like N_2 –fixers and P-solubilisers and also the Lactobacillus. This may be attributed to addition of garden soil for the preparation of JM.

Conclusion

Microbial evaluation of three liquid organic preparations, PG, JM and AK, revealed abundance of aerobic microbes in PG as compared to JM and AK respectively. N_2-Fixers were found to be high in JM and the P-solubilizers and Lactobacillus content were found to equally high in both JM and AK. Nutrient analysis of the LOM preparations also revealed high macro and micronutrient contents in PG compared to JM and AK. However, JM was found to good

in the content of soil fertilizing bacteria like N_2 –fixers and P-solubilisers The results indicated that PG is superior both in aerobic microbial and nutrient contents compared to JM and AK. The presence of the beneficial microorganisms and the plant macro and micronutrients in these preparations would have played an important role in plant growth promotion. However, their effect on plant growth and soil fertility need to be studied to ascertain its efficiency.

Acknowledgement
The authors are grateful to the Department of Microbiology, Faculty of Science, Annamalai University, Annamalainagar, Tamil Nadu and Department of Microbiology, Madras Christian College, Tambaram, Chennai, Tamil Nadu, India, for providing the lab facilities for the research.

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