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Quality Analysis and Characterization of Panchagavya, Jeevumrutha and Sasyamrutha

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A B S T R A C T

A study on quality analysis and characterization of Panchagavya, Jeevumrutha and Sasyamrutha was carried out in the departments of soil science, plant pathology and biochemistry, UBKV, coochbehar-736165, West Bengal during February, 2019. Motive of this work was to characterize these liquid organic manures according to their Physical properties, macro and micro nutrient Content, Microbial population and amount of growth promoters present in them. Jeevumrutha recorded highest values in most of the parameters followed by Panchagavya and Sasyamrutha. It is recommended that all of these liquid organic manures can be used as an alternative against chemical fertilizers and pesticides.

Introduction

Excessive use of chemical fertilizers and pesticides deteriorates the soil quality by changing the physical, chemical and biological properties of soil. They adversely affect the microbial population present in the soil and due to that ecological balance is hampered. Now-a-days liquid organic manures are becoming popular to combat the adverse effect of chemical fertilizers. They can supply essential nutrients to the crop plant and also provide several growth promoters and bio-control agents to prevent disease and pest infestation. Liquid organic manures can be prepared by using several farm inputs and daily household materials. So the cost required to prepare these liquid organic manures are very less comparing with the chemical fertilizers and pesticides. In order to maintain sustainability in agriculture liquid organic manures should be adopted in a large extent (Kannaiyan, 2000; Kanwar, 2006). Panchagavya literally means “mixture of five cow products”. According to Hindu dharma, Panchagavya has high significance. It can be used as an Ayurvedic medicine and it has good potential as an organic fertilizer and pesticide (Dhama *et al.*, 2005; Kumar, 2005). Jeevumrutha is one of the four pillars of the

Zero Budget Natural Farming (ZBNF). As the name signifies, Jeevumrutha is highly cost effective for the farmers (FAO, 2016). Sasyamrutha is fermented liquid organic manure having different types of leaves with cow dung and cow urine. It has nutritional and bio-control properties for the crop plants (Green Foundation, 2009). All of them have significant nutrient content, beneficial microbial population load, growth promoters and bio-control agents. To popularize the use of Panchagavya, Jeevumrutha and Sasyamrutha, scientific validation of these manures is highly required. With this motive I decided to investigate the quality parameters of Panchagavya, Jeevumrutha and Sasyamrutha for their scientific characterization.

Materials and Methods

Methodologies of preparation of Panchagavya, Jeevumrutha and Sasyamrutha with their ingredients are described below.

Preparation of panchagavya

Ingredients

Jersey cow dung (3.5 Kg), Jersey cow urine (5 litres), Jersey cow milk (1.5 litres), Curd (1 litres), Jaggery (1.5 Kg), Ghee (0.5 Kg), Banana (6 numbers), Tender coconut (1.5 litres) and Water (5 litres).

Procedure

All of the above materials should be mixed in an earthen pot according to their proportion, keep it in shady place and close the container. Then stir the mixture twice a day in both the directions. After 30 days the solution is prepared and it should be filtered and collected (Sarkar *et al.*, 2011).

Preparation of Jeevumrutha

Ingredients

Water (8-10 litres), Jersey cow dung (0.4-0.6 kg), Jersey cow urine (0.12-0.16 litres) and Jaggery (0.04-0.08 kg).

Procedure

Mix all of them and keep them in a shade for 3-4 days. Stir the mixture once a day. After 20 days the mixture should be filtered and has to be collected (Shankaran, 2009).

Preparation of Sasyamrutha

Ingredients

Jersey cow dung (5 kg), Jatropha leaves (0.6 kg), Datura leaves (0.6 kg), Jersey Cow urine (0.6 litres), Mustard oil cake (0.4 kg), Jaggery (0.2 kg), Ash of Agnihotra (0.1 kg) and Water (40 litres).

Procedure

Chopped jatropha and datura leaves must be kept in the container. Then add water, cow dung, cow urine, oil cake, agnihotra ash and jaggery on it with above mentioned proportion. After that stir it well and close the container. Daily stirring for aeration should be done. After 20 days the fermented mixture must be filtered and Sasyamrutha has to be collected (Green Foundation, 2009).

Panchagavya Jeevumrutha Sasyamrutha

Characterization of Panchagavya, Jeevumrutha and Sasyamrutha

The physical, chemical, biochemical and biological properties of Panchagavya, Jeevumrutha, and Sasyamrutha were analysed to estimate their constituents using standard procedures. The standard procedures followed for estimation of various properties of these solutions are given in Table 1 to 2.

Results and Discussion

The physical and physico-chemical properties of Panchagavya, Jeevumrutha and Sasyamrutha are presented in Table 3.

The colour of freshly prepared Panchagavya was light brown and as the storage period increased, the preparation became darker in colour. It might be due to a series of non-enzymatic Maillard's reactions, started with binding of aldehyde group of lactose with ε-amino group of the lysyl – residues (amino-acid radical, or residue of amino-acid lysine) from different milk proteins during storage. These reactions caused the formation of brown-coloured pigments, such as pyralysins and melanoidins, polymers such as lactulose-lysine or fructose-lysine, as well as low-molecular weight acids. Cow dung and cow urine enhanced the rate of decomposition and for that dark brown colour was developed (Kneifel *et al.,* 1992) (Singh *et al.,* 1992). Fresh preparation of Panchagavya possessed a fruity smell. Foul odour was observed after 20 days and progressed up to the end of storage. The reason behind this might be the light sensitiveness of riboflavin and riboflavin absorbed visible and ultra violet light, converting that energy into highly reactive forms of oxygen. That induced a whole series of oxidative reactions, caused oxidation of fat. For that undesirable foul odours was formed (Min, 2002; Borle, 2001).

Fresh preparation of Jeevamrutha was moderate green in colour and with time the colour became darker. Jeevamrutha had mild odour in fresh preparation; it gradually increased after 20 days and was constant till the end of the storage period. The reason behind these might be the presence of jaggary. Presence of water with jaggery promoted growth of microbes and for that decomposition of cow dung was enhanced in Jeevumrutha. Due to that dark green colour and mild foul odour was produced (Ravindra *et al.,* 2016).

Freshly prepared Sasyamrutha was green in colour and it became dark green till the end of storage period. Fresh preparation of Sasyamrutha possessed a leafy smell but after 10 days mild foul odour was produced. Soaking of mustard cake in water induced the endogenous 'Myrosinase' enzyme and that react with glucosinolate resulting in substantial hydrolysis of glucosinolate to volatile metabolites viz. isothiocyanate, CNS, nitriles and other degradation products and decomposition of plant materials produce carbon dioxide. Due to that the change in colour and foul smell after during decomposition was noticed (Tyagi *et al.,* 1997; Chu and Jennifer, 2018). Jeevumrutha recorded highest pH (8.24) followed by Sasyamrutha (8.05) and Panchagavya (5.32).

Among them Panchagavya recorded highest EC (11.02 dS/m) followed by Sasyamrutha (6.56 dS/m) and Jeevumrutha (1.44 dS/m). Highest organic carbon (OC) value was found in Panchagavya (0.861%) followed by Sasyamrutha (0.247%) and Jeevumrutha (0.094%).

Pathak and Ram (2013) also found low pH in Panchagavya due to production of several organic acids in it during fermentation. Alcohol (methanol, propanol, butanol and ethanol) production in Jeevumrutha as a by-product of fermentation made it alkaline in nature (Natarajan, 2008). Sasyamrutha was alkaline in nature might be due to release of carbon dioxide and other volatile metabolites like isothiocyanate, CNS, nitriles and other degradation products (Tyagi *et al.,* 1997; Chu and Jennifer, 2018).

The macro and micro nutrient content of Panchagavya, Jeevumrutha and Sasyamrutha are presented in Table 4. Panchagavya had highest content of N (2366 ppm) followed by Sasyamrutha (742 ppm) and Jeevumrutha (658 ppm). Highest content of P was recorded in Jeevumrutha (195 ppm) followed by Panchagavya (187 ppm) and Sasyamrutha (96 ppm). K content was highest in Panchagavya (1354 ppm) followed by Jeevumrutha (821 ppm) and Sasyamrutha (323 ppm). Highest content of Ca was found in Sasyamrutha (194 mg/l) followed by Jeevumrutha (189 mg/l) and Panchagavya (152 mg/l). Panchagavya had highest content of Mg (48 mg/l) followed by Sasyamrutha (34 mg/l) and Jeevumrutha (19 mg/l). S content was highest in Jeevumrutha (564 mg/l) followed by Sasyamrutha (503 mg/l) and Panchagavya (485 mg/l). Highest Fe content was noticed in Jeevumrutha (42.44 mg/l) followed by Sasyamrutha (14.47 mg/l) and Panchagavya (9.17 mg/l), Jeevumrutha had highest content of Mn (0.394 mg/l), followed by Panchagavya (0.287 mg/l) and Sasyamrutha (0.238 mg/l). Highest amount of Zn was found in Jeevumrutha (1.56 mg/l) followed by Panchagavya (0.268 mg/l) and Sasyamrutha (0.249 mg/l). Cu content was highest in Jeevumrutha (2.44 mg/l) followed by Sasyamrutha (2.36 mg/l) and Panchagavya (2.18 mg/l). Dhanoji *et al.,* (2018) and Parvathi and Ushakumari (2017) also recorded N, P, K, Ca, Mg, S, Fe, Mn, Zn, And Cu in Panchagavya and Jeevumrutha.

The microbial population of Panchagavya, Jeevumrutha and Sasyamrutha are given in Table 5. For bacterial count, highest value was noticed in Jeevumrutha (14 x 10^5 cfu/ml) followed by Panchagavya (12 x 10^4 cfu/ml) and Sasyamrutha (9 x 10^4 cfu/ml). Highest fungi count found in Jeevumrutha (17 x 10^3) followed by Sasyamrutha (13 x 10^3) and Panchagavya (9 x 10^3). Highest value of Actinomycetes was found in Panchagavya (4 x 10^3 cfu/ml) followed by Jeevumrutha (2 x 10^3 cfu/ml) and Sasyamrutha (6 x 10^2 cfu/ml). *E coli* was highest in Panchagavya (9 x 10^5 cfu/ml) followed by Sasyamrutha (12 x 10^3 cfu/ml) and Jeevumrutha (5 x 10^2 cfu/ml). Highest count of Azospirilum was found in Jeevumrutha (8 x 10^3 cfu/ml) followed by Sasyamrutha (3 x 10^2 cfu/ml) and Panchagavya (2 x 10^2 cfu/ml). Jeevumrutha had highest Azotobacter count (15 x 10^6 cfu/ml) followed by Sasyamrutha (10 x 10^4 cfu/ml) and Panchagavya (2 x 10^4 cfu/ml). P solubilizers were highest in Sasyamrutha (14 x 10^5 cfu/ml) followed by Panchagavya (9 x 10^5 cfu/ml) and Jeevumrutha (3 x 10^4 cfu/ml). K solubilizers were absent in Jeevumrutha, they are highest in Panchagavya (4 x 10^3 cfu/ml) followed by Sasyamrutha (4 x 10^2 cfu/ml). Pseudomonas population was highest in Jeevumrutha (11 x 10^5 cfu/ml) followed by Panchagavya (6 x 10^5 cfu/ml) and Sasyamrutha (5 x 10^5 cfu/ml). Rhizobium population was highest in Jeevumrutha (7 x 10^6 cfu/ml) followed by Sasyamrutha (8 x 10^4 cfu/ml) and Panchagavya (6 x 10^4 cfu/ml).

Ram *et al.*, (2017) and Parvathi and Ushakumari (2017) also noticed bacteria, fungi, Actinomycetes, Pseudomonas, P solubilising microbes, K solubilising microbes, *E. coli*, Rhizobium, Azotobacter and Azospirilum in Panchagavya and Jeevumrutha.

Table.1 Physical and chemical properties of Panchagavya, Jeevumrutha and Sasyamrutha

Sl. No.	Parameters	Methods	Reference
1	Colour	Visual evaluation	
2	Odour	Sensory evaluation	
3	pH	pH meter method	Jackson (1973)
4	EC	Conductivity meter method	Jackson (1973)
5	Organic carbon	Walkley and Black wet digestion	Walkley and Black (1934)
6	Total Nitrogen	Microkjeldhal method	Jackson (1973)
7	Total Phosphorus	Nitric-Perchloric (9:4) digestion and colorimetry using vanado-molybdo phosphoric yellow colour method	Jackson (1973)
28	Total Potassium	Nitric-perchloric (9:4) digestion and flame photometry	Jackson (1973)
9	Total Calcium	Nitric-perchloric (9:4) digestion and AAS	Jackson (1973)
10	Total Magnesium	Nitric-perchloric (9:4) digestion and AAS	Jackson (1973)
11	Total Sulphur	Nitric-perchloric (9:4) digestion and Turbidimetry	Massoumi and Cornfield(1963)
12	Total Micronutrients Fe, Mn, Zn ,Cu	Nitric-perchloric(9:4) digestion and AAS	Jackson (1973)

Table.2 Biochemical and biological properties of Panchagavya, Jeevumrutha and Sasyamrutha

Sl. No.	Parameters	Methods	Reference
1	Ascorbic Acid content	Titrimetric method	Sadasivram and Manickam (1996)
2	Indole Acetic Acid	Spectrophotometric method	Ahmad *et al*., (2005)
3	Gibberelic Acid	Spectrophotometric method	Cho *et al*., (1979)
4	Cytokinin	Bioassay	Letham (1971)
5	Bacteria	Nutrient Agar medium	Atlas and Parks (1993)
6	Fungi	Martin's rose Bengal Agar	Martin (1950)
7	*Actinomycetes*	Ken knight's Agar medium	Cappuccino and Sheman (1996)
8	*E.coli*	Eosin methylene blue	Levine (1918)
9	*Azospirilum*	Nitrogen free Bromothymol blue medium	Dobereiner *et al*.,(1976)
10	*Azotobacter*	Jensen's medium	Jensen (1942)
11	P solubilizers	Pikovskaya's mediam	Sundaran and Sinha (1963)
12	K solubilizers	Aleksandrov Agar medium	Sugumara and Janartham (2007)
13	*Pseudomonas* sp.	King's B Agar medium	King *et al*., (1954)
14	*Rhizobium*	Yeast extract Mannitol Agar with Congo red	Fred *et al*., (1932)

Table.3 Physical and physic-chemical parameters of Panchagavya, Jeevumrutha and Sasyamrutha

Parameters	Panchagavya	Jeevumrutha	Sasyamutha
Colour	Light brown	Moderate green	Green
Odour	Fruity smell	Mild foul smell	Leafy
pH	5.32	8.24	8.05
EC (dS/m)	11.02	1.44	6.56
OC (%)	0.861	0.098	0.247

Table.4 Macro and micro nutrient content of Panchagavya, Jeevumrutha and Sasyamrutha

Parameters	Panchagavya	Jeevumrutha	Sasyamrutha
N (ppm)	2366	658	742
P (ppm)	187	195	96
K (ppm)	1354	821	323
Ca (mg/l)	152	189	194
Mg (mg/l)	48	19	34
S (mg/l)	485	564	503
Fe (mg/l)	9.17	42.44	14.47
Mn (mg/l)	0.287	0.394	0.238
Zn (mg/l)	0.268	1.56	0.249
Cu (mg/l)	2.18	2.44	2.36

Table.5 Microbial population of Panchagavya, Jeevumrutha and Sasyamrutha

Parameters	Panchagavya	Jeevumrutha	Sasyamrutha
Bacteria (cfu/ml)	12×10^4	14×10^5	9×10^4
Fungi (cfu/ml)	9×10^3	17×10^3	13×10^3
Actinomycetes (cfu/ml)	4×10^3	2×10^3	6×10^2
***E.coli* (cfu/ml)**	9×10^5	5×10^2	12×10^3
Azospirilum (cfu/ml)	2×10^2	8×10^3	3×10^2
Azotobacter (cfu/ml)	2×10^4	15×10^6	10×10^4
P solubilizers (cfu/ml)	9×10^5	3×10^4	14×10^5
K solubilizers (cfu/ml)	4×10^3	0	4×10^2
Pseudomonus (cfu/ml)	6×10^5	11×10^5	5×10^5
Rhizobium (cfu/ml)	6×10^4	7×10^6	8×10^4

Table.6 Biochemical parameters of Panchagavya, Jeevumrutha and Sasyamrutha

Parameters	Panchagavya	Jeevumrutha	Sasyamrutha
IAA (µg/ml)	4.45	6.02	3.87
GA (µg/ml)	26.76	36.22	30.00
Cytokinin (µg/ml)	3.12	2.86	2.48
AscorbicAcid(µg/ml)	13.00	12.94	16.24

The biochemical constituents of Panchagavya, Jeevumrutha and Sasyamrutha are written in Table 6. Jeevumrutha recorded highest value of IAA (6.02 µg/ml) followed by Panchagavya (4.45 µg/ml) and Sasyamrutha (3.87 µg/ml). Highest amount of GA was recorded in Jeevumrutha (36.22 µg/ml), followed by Sasyamrutha (30.00 µg/ml) and Panchagavya (26.76 µg/ml). Cytokinin content was highest in Panchagavya (3.12 µg/ml) followed by Jeevumrutha (2.86 µg/ml) and Sasyamrutha (2.48 µg/ml). Ascorbic acid was highest in Sasyamrutha (16.24) followed by Panchagavya (13.00 µg/ml) and Jeevumrutha (12.94 µg/ml). Parvathi and Ushakumari (2017), Dhanoji *et al.*, (2018) also observed IAA, GA, Cytokinin and Ascorbic Acid in Panchagava and Jeevumrutha.

The study concludes that Panchagavya, Jeevumrutha and Sasyamrutha have good potential as manure to improve the physical, chemical and biological properties of soil. This will directly help to increase the productivity of soil in long run and produce chemical residue free healthy crops. The ingredients needed to prepare these organic solutions are highly available and require very less investment. So using them instead of chemical fertilizers and pesticides are highly cost effective for the farmers. Among these organic solutions Jeevumrutha recorded highest values in most of the parameters. Proper use of these solutions in crop field will definitely increase the crop yield by supplying all the essential nutrients, growth promoters and bio-control agents.

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