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Biochemical quality of different liquid organic formulations

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Abstract
The laboratory experiment pertaining to "Biochemical quality of different liquid organic formulations" was carried out by the department of Soil Science and Agricultural Chemistry, N. M. College of Agricultural and Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat during the years 2020-2021 and 2021-2022. The liquid organic formulations were prepared by using indigenous native cow breed products. The highest EC was observed in jivamrut ranged (2.97-4.52 dS/m), followed by panchgavya (1.22-2.64 dS/m) and amritpani (1.29-1.97 dS/m). The mean pH of panchgavya (6.31) was higher than that of amritpani (5.99) and jivamrut (4.59). Panchgavya has the highest concentration of macro and micro nutrients, followed by jivamrut and amritpani. Panchgavya had the highest microbial count *viz*., bacteria and fungi followed by jivamrut and amritpani, while actinomycetes were higher in panchgavya, followed by amritpani and jivamrut.

Keywords: Liquid formulations, microbial quality, nutrient

Introduction
Modern conventional agricultural uses a wide range of synthetic agrochemical has adversely affect on soil fertility and crop production as well as environment (Pathak and Ram, 2013) [11]. Synthetic chemicals, which inevitably leave residues in the produce (Mogkos *et al.*, 2006) [9], present a 30 percent higher risk of pesticides contamination than organic (Crystal *et al.*, 2012) [3]. The preparation of liquid organic formulations is an age-old traditional practice in India. Liquid organic formulation preparations are obtained by active fermentation of animal and plant product over specific durations (Ram *et al.*, 2022) [14]. Liquid organic formulation enhance growth of plants indirectly by inhibiting plant pathogens or generating systemic resistance in plants, as well as directly by mobilizing nutrients and releasing plant growth hormones. The fermented liquid organic manures not only improve soil quality but also contributed much-needed organic and mineral matter to the soil. They also play a significant role in the development of soil organic matter, beneficial microorganisms and enzymes. Panchgavya contains minerals, auxins, gibberellins and microbial fauna and it functions as tonic to enrich the soil, encourage plant vigour with quality of production. Jivamrut is a liquid organic formulation which is an excellent source of natural carbon and biomass that contain macro and micro nutrients required to plant growth (Kumar *et al.*, 2021) [5]. Amritpani play a key role in organic farming by boosting agricultural production and quality of produce.

Material and Methods
The present investigation pertaining to "Biochemical quality of different liquid organic formulations" was carried out during the year 2020-2021 and 2021-2022 by department of Soil Science and Agricultural Chemistry, N. M. College of Agriculture, Navsari, at Organic Farm, ASPEE College of Horticulture and Forestry, Navsari, Navsari Agricultural University, Navsari, Gujarat. The preparation of liquid organic manures use byproduct by native local cow (Gir) and method was followed by (NCOF, 2017) [10]. The chemical analytical work was done in the Central Instrumental Laboratory, Department of Soil Science and Agricultural Chemistry, N. M. College of Agricultural, Navsari Agricultural University, Navsari (Gujarat), while microbial analytical works was done in the food quality testing laboratory, N. M. College of Agriculture, NAU, Navsari. Liquid organic manure pH was measured by using digital pH meter. Electrical conductivity (EC) was measured by EC meter and reported in dS/m, Total nitrogen determined by Micro Kjeldahl's method Piper (1966) [12],

Phosphorus by vanadomolybdate phosphoric acid, yellow color method using UV spectrophotometer (Jackson, 1973) [4], total potassium by flame photometer (Jackson, 1973) [4], micronutrient *viz*., Fe, Mn, Zn and Cu were determined by using atomic absorption spectrophotometer (Lindsay and Norvell, 1978) [6]. Isolation of microorganisms' *viz*., bacteria (Nutrient Agar media, Atlas and Parks 1993) [1], fungi (Martin's Rose Bengal Agar, Martin 19550) and actinomycetes (Ken knight's agar media, Coppuccino and Sheman, 1996) [2]. The nutrient and microbial quality of liquid organic formulation was observed in summer 2021, *kharif* 2022 and *rabi* 2022 season of different conditioning periods (*i.e*., 0 day, 7 days, 14 days, 21 days and 28 days) and n (15).

Results and Discussion

Chemical and microbial properties of different liquid formulations

Jivamrut

The results of biochemical properties of jivamrut are presented in Table 1. The electrical conductivity (EC) in jivamrut was range 2.97 to 4.02 dS/m with mean EC of jivamrut was 4.02 dS/m. Initially electrical conductivity of jivamrut was down after adverse increased might be due to the increased in soluble salts in this formulations. Moreover, pH of jivamrut strongly acidic in nature pH was 3.52. The preparation became acidic in condition pH 6.13 and mean value of slightly acidic in conditions pH was 4.59. The total major nutrient content in jivamrut was *viz*., N 0.115%, P 0.019%, K 0.070% and micro nutrient *i.e*., Fe 6.807 mg/l, Zn 0.367 mg/l, Cu 0.367 mg/l and Mn 1.743 mg/l, respectively. The chemical properties of the liquid organic formulations are subjected to changes according to the ingredients used during the preparations. The changes occurring due to fermentations of ingredients and subsequent reaction may be responsible, earlier reported by (Rameeza *et al*., 2016) [15].

The pronounced increased in microbial populations during fermentation periods is clearly evident from Table 1. The bacterial count range from 2.09-5.15x10^7 cfu/ml and its mean value of 3.05x10^4 cfu/ml. Moreover the population of fungi 2.07-7.17x10^4 cfu/ml and actinomycetes count was 1.84-4.78x10^4 cfu/ml, respectively. The variation of microbial count was observed during the fermentation periods. The higher microbial count of these liquid organic formulations made them as potent sources to maintain soil fertility and to enhance the nutrient availability by helping in faster decomposition of organic manures, similar result also observed by (Rameeza *et al*., 2016) [15].

Table 1: Chemical and microbial properties of Jivamrut

Parameters	n	Range	Mean	RSD (%)
EC (dS/m)	15	2.97-4.52	4.02	10.02
pH	15	3.56-6.13	4.59	16.16
N (%)	15	0.093-0.130	0.115	9.798
P (%)	15	0.016-0.022	0.019	8.306
K (%)	15	0.045-0.120	0.070	23.772
Fe (mg/l)	15	4.508-9.360	6.807	25.696
Zn (mg/l)	15	1.060-1.693	1.402	13.926
Cu (mg/l)	15	0.247-0.473	0.367	18.990
Mn (mg/l)	15	0.833-2.553	1.743	27.599
Bacteria (x10^7cfu/ml)	15	2.09-5.15	3.05	1.413
Fungi (x10^4 cfu/ml)	15	2.07-7.17	3.72	2.625
Actinomycetes (x10^4 cfu/ml)	15	1.84-4.78	2.86	1.992

Amritpani

The electrical conductivity of amritpani of liquid organic formulation is furnished in Table 2. Amritpani was analyzed during the different season *viz*., summer, *kharif* and *rabi* as well as different conditioning periods (0 day, 7 days, 14 days, 21 days and 28 days of conditioning periods) the range of electrical conductivity in amritpani was 1.29-1.97 ds/m, while mean 1.75 dS/m. The amritpani was acidic to alkali nature condition pH range from 4.79-7.13 and pH of mean 5.99 acidic in nature. The major nutrient content (mean value) *viz*., N 0.044%, P 0.011% and K was 0.034%, while micronutrient concentration was *i.e*., Fe 3.78 mg/l, Zn 0.72 mg/l, Cu 0.15 mg/l and Mn 1.08 mg/l, respectively. Increasing trend was noticed in conditioning periods from 0 to 21 days afterword less or more decreasing trends was noted due to the mineralization of solution of amritpani, similar results earlier reported by (Rakesh *et al.*, 2017) [13].

The total microbial count in amritpani was *viz*., bacteria range 1.79-4.06x10^7 cfu/ml, fungi 2.07-7.17x10^4cfu/ml and actinomycetes 1.58-4.42x10^4 cfu/ml, respectively. The increased the microbial population during the different conditioning periods.

Table 2: Chemical and microbial properties of Amritpani

Parameters	n	Range	Mean	RSD (%)
EC (dS/m)	15	1.29-1.97	1.75	12.38
pH	15	4.79-7.13	5.99	13.06
N (%)	15	0.029-0.066	0.044	23.21
P (%)	15	0.009-0.014	0.011	11.13
K (%)	15	0.010-0.066	0.034	53.40
Fe (mg/l)	15	2.30-4.51	3.78	16.28
Zn (mg/l)	15	0.57-0.90	0.72	11.86
Cu (mg/l)	15	0.11-0.19	0.15	17.81
Mn (mg/l)	15	0.87-1.28	1.08	11.39
Bacteria (x10^7cfu/ml)	15	1.79-4.06	2.47	1.50
Fungi (x10^4cfu/ml)	15	2.07-7.17	7.17	2.63
Actinomycetes (x10^4cfu/ml)	15	1.58-4.42	2.92	2.40

Panchgavya

Results of biochemical characteristics of panchgavya are presented in Table 3. The electrical conductivity (EC) of panchgavya was varied form 1.22-2.64 dS/m, while mean value of EC 1.75 ds/m. Initially pH of panchgavya was acidic in nature pH was 5.60, while keeping in conditioning periods slightly increasing the pH in acidic conditions 6.76 and mean value of pH was 6.31. The major nutrients content in panchgavya range was *viz*., N, P and K (0. 42-0.62%, 0.12-0.19% and 0.33-0.46%), and mean value (N 0.55%, P 0.15% and K 0.41%). Moreover, micronutrients content in range was *i.e*., (Fe 64.52-83.90 mg/l, Zn 10.94-20.65 mg/l, Cu 2.03-2.87 mg/l and Mn 25.63-38.53 mg/l) and mean values of micronutrients was (Fe 74.13 mg/l, Zn 15.57 mg/l, Cu 2.37 mg/l and Mn 32.59 mg/l), respectively.

The microbial population was increased during the different conditioning periods range from bacteria 2.73-5.93x10^7 cfu/ml, fungi 2.74-7.22x10^4 cfu/ml and actinomycetes 2.58-5.52x10^4 cfu/ml, while mean value bacteria 4.12x10^7 cfu/ml, fungi 4.36x10^4 cfu/ml and actinomycetes 3.63x10^4 cfu/ml, respectively.

Table 3: Chemical and microbial properties of panchgavya

Parameters	n	Range	Mean	RSD (%)
EC	15	1.22-2.64	1.75	22.62
pH	15	5.60-6.76	6.31	4.49
N	15	0.42-0.62	0.55	11.83
P	15	0.12-0.19	0.15	13.07
K	15	0.33-0.46	0.41	8.61
Fe	15	64.52-83.90	74.13	6.18
Zn	15	10.94-20.65	15.57	16.39
Cu	15	2.03-2.87	2.37	10.62
Mn	15	25.63-38.53	32.59	8.80
Bacteria ($x10^7$cfu/ml)	15	2.73-5.93	4.12	1.09
Fungi ($x10^4$ cfu/ml)	15	2.74-7.22	4.36	1.97
Actinomycetes ($x10^4$ cfu/ml)	15	2.58-5.52	3.63	1.78

Conclusion

It can be conclude that panchgavya are rich in major and micronutrients as compared to jivamrut and amritpani. The higher microbial count bacteria and fungi were noticed in panchgavya, followed by jivamrut and amritpani, whereas actinomycetes population was increased in panchgavya followed by amritpani and jivamrut.

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