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Quality assessment of organic substances: Cow urine, Vermiwash and plant leaf extracts during their successive storage period

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Abstract
The physico-chemical and nutritional study of cow urine, vermiwash, moringa leaf extract (MLE), glyricidia leaf extract (GLE) and pongamia leaf extract (PLE) was undertaken to estimate changes in the essential nutrient elements *viz*., N, P and K content as well as physico-chemical characters i.e. pH and electrical conductivity of the extracts at an interval of 1st, 2nd, 3rd, 4th, 8th and 12th weeks after storage in comparison to initial content. From the study it was observed that the cow urine and the vermiwash were alkaline in nature while, the plant leaf extracts were acidic in reaction and their acidity and alkalinity were found to be increased from initial to 2nd and 3rd weeks after storage, respectively and further it was shifted towards neutrality. The electrical conductivity of cow urine, Vermiwash and plant leaf extracts were declined during the successive storage period. The primary nutrients *viz*., nitrogen, phosphorus and potassium content of cow urine, Vermiwash, Moringa leaf extract, Glyricidia leaf extract and pongamia leaf extract was found to be decreased throughout the storage period. Therefore, it was clearly noted that, it is better to use fresh form of animal originated sources as well as plant leaf extracts to obtain maximum nutrient benefits of these sources.

Keywords: cow urine, vermiwash, plant leaf extracts, storage period

1. Introduction
The residual effect of fertilizers, synthetic bio-stimulants, pesticides and plant growth regulators due to conventional farming causes too many issues for the environment and human health. The groundwater contamination, soil erosion and degradation issues, chemical residue in food, increase in the soil acidity, soil depletion, imbalance of nutrients, loss of organic matter in the soil leads to degradation of the soil (Nguyen and Tran, 2020) [3]. Many scientists agree that organic agriculture is the most appropriate factor to protect the environment, humans, climate and product quality from the residue of chemical usages. The organic products reduce public health risks in all levels, including farmworkers, their families, and consumers by minimizing their exposure to toxic and persistent chemicals. Organic standards set strict regulations to ensure final products for consumption are free from synthetic chemical components. The liquid organic manures and plant extracts for plant nutrition and control of plant diseases are cheaper, assessable, readily available, quite specific, environment friendly and harmless to human compared to the synthetic compounds. Therefore, an attempt has been made to evaluate nutrient content and to find out the physico-chemical and nutritional changes in cow urine, vermiwash, moringa leaf extract, glyricidia leaf extract and pongamia leaf extract during successive storage period.

2. Material and Methods
The laboratory experiment was conducted at Department of Soil Science and Agricultural Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during 2020-21. For the experiment, fresh cow urine and vermiwash was collected from Department. of Agronomy, College of Agriculture, Dapoli. However, for the preparation of Moringa, glyricidia and pongamia leaf extracts, the green leaves of *Pongamia pinnata* and *Glyricidia sepium* were collected from trees located at Agronomy Research Farm, Department of Agronomy, College of Agriculture, Dapoli. While, *Moringa oleifera* leaves were collected from Central Experimentation Station, Wakawali.
The leaves were hand plucked and collected in plastic bags. The collected leaves were sun dried. The completely dried leaves were hand crushed to such extent that it look like powder

form. Then crushed leaf powder of each leaf species were taken into separate drum. In which, water @ 1:10 ratio (w:v) and silicone surfactant @ 3 per cent were added. The solutions were stirred with the help of wooden stick, and then the mouth of drum was covered with muslin cloth and kept under shed. After 4 days the solutions obtained were filtered through muslin cloth. The obtained leaf extracts were used for storage study. The obtained leaf extracts as well as cow urine and vermiwash were stored in a plastic container having capacity of 250 ml with mouth covered by muslin cloth at a room temperature. The content of essential nutrient elements *viz*., N, P, K as well as physico-chemical characters i.e. pH and electrical conductivity of the initial sample as well as the samples collected at an interval of 1st, 2nd, 3rd, 4th, 8th and 12th week after storage were estimated.

The pH and electrical conductivity were estimated by using potentiometric and conductometric methods, respectively as described by Jackson, 1973. However, for estimation of the total nitrogen content, samples were digested with conc. H_2SO_4 and were determined by using Kjelplus apparatus as method described by Tandon, 1993. For determination of P and K the samples were digested by using di-acid mixture (HNO_3 + $HClO_4$) having the ratio of 9:4 and acid extract was used for determination of P and K content as described by Tandon, 1993.

3. Results and Discussions

3.1 Physico-chemical properties

3.1.1 pH

The data presented in Table 1 depicted in Fig. 1. a revealed that the cow urine and vermiwash was found to be alkaline in nature; however, the plant leaf extracts were acidic in nature. The pH of cow urine was varied from 8.42 to 8.89 throughout the storage period. The pH of cow urine was found to be increased (from 8.51 to 8.85) from initial period to 3rd week after storage, thereafter, it started decreasing up to 12th week after storage (8.85 to 8.42). The increased in pH of cow urine from initial period to 3rd weeks after storage was due to conversion of nitrogenous compound i.e. uric acid into ammonia. Similarly, the pH of the vermiwash was found to be varied between 8.05 and 8.94 through the storage period. The minimum pH (8.05) of vermiwash was recorded in the initial week after storage and then it was found to be drastically increased (8.94) in 1st week after storage. The increase in the pH of vermiwash might be due to decomposition of nitrogenous organic material excreted by earthworms and production of ammonia. Further, the decreasing trend was observed from 1st week after storage to 12th week after storage.

In respect of the plant leaf extracts *viz.*, moringa leaf extract, glyricidia leaf extract and pongamia leaf extract were acidic in nature throughout the storage period of 12 weeks. The acidic nature of the plant leaf extracts might be due to decomposition of organic material and production of organic acids during its decomposition as well as due to the organic compounds released from leaves. The pH of moringa leaf extract varied between 3.99 to 5.59 throughout the storage period. The decrease (from 4.27 to 3.99) in pH of moringa leaf extract was observed from initial period to 1st week after storage. Then it was found to be increased from 2nd to 8th week after storage (from 5.49 to 5.59) and again it was decreased in 12th week after storage (5.55). Similarly, the pH of glyricidia leaf extract was varied from 4.87 to 5.92 during the storage study. The decreasing trend of pH (from 5.92 to 4.87) was observed from initial period to 4th week after storage with slight increase at 2nd week after storage. Then it was increased (from 4.92 to 5.12) from 8th week after storage to 12 week after storage. Regarding the pH of pongamia leaf extract, it was ranged between 4.45 to 5.54 throughout the storage period of 12 weeks. There was decreasing trend of pH (from 5.54 to 4.45) was noted from initial to 4th weeks after storage. Further, it was found to be increased (from 4.69 to 4.80) from 8th to 12th week after storage. The decrease in the pH of plant leaf extracts might be due to decomposition of organic material and production of organic acids during its storage.

3.1.2 Electrical conductivity

From the data presented in Table 1 and fig 1 b it was noticed that the electrical conductivity (EC) of cow urine and vermiwash was decreased. The EC of cow urine was decreased from 0.370 to 0.202 dSm^{-1} and vermiwash from 0.069 to 0.030 dSm^{-1} throughout the storage period of 12 weeks.

In case of plant leaf extracts, the electrical conductivity of moringa leaf extract was found to be decreased from 0.046 to 0.020 dSm^{-1}, glyricidia leaf extract from 0.060 to 0.046 dSm^{-1} and pongamia leaf extract from 0.020 to 0.018 dSm^{-1} from initial period to 1st week after storage. Thereafter, the EC of moringa leaf extract (0.080 dSm^{-1}), glyricidia leaf extract (0.052 dSm^{-1}) and pongamia leaf extract (0.056 dSm^{-1}) was drastically increased in 2nd week of storage and further it was declined from 3rd week till 12th week after storage. The decrease in the electrical conductivity of moringa leaf extract was from 0.080 to 0.030 dSm^{-1}, glyricidia leaf extract from 0.052 to 0.015 dSm^{-1} and pongamia leaf extract from 0.056 to 0.028 dSm^{-1} throughout the storage period of 12 weeks. The decrease in the EC of all the sources during its storage period might be due to decomposition as well as microbial utilization of soluble salts present.

3.2 Nutrient content

As far as the macro nutrients were concerned, the nitrogen, phosphorus and potassium content of the five sources used in the study were found to be decreased throughout the storage period (Table 1. and Fig 1. c). The decrease in total nitrogen content of cow urine was observed from 0.355 to 0.202 per cent, in vermiwash from 0.086 to 0.060 per cent, in moringa leaf extract from 0.109 to 0.082 per cent, in glyricidia leaf extract from 0.123 to 0.071 per cent and in case of pongamia leaf extract, it was decreased from 0.106 to 0.051 per cent was recorded from initial to 12th week after storage. The total nitrogen content from cow urine and vermiwash were declined sharply in the initial period of storage, which may be due to the conversion of uric acid and other nitrogenous compounds into ammonia in alkaline pH condition. Similarly, the nitrogen losses from plant leaf extracts may be due to conversion of nitrogenous compounds into ammonia and its subsequent gaseous losses.

Similarly, the total phosphorus content of cow urine, vermiwash, moringa leaf extract, glyricidia leaf extract and pongamia leaf extract were decreased from 0.030 to 0.005 per cent, from 0.017 to 0.001 per cent, from 0.036 to 0.020 per cent, from 0.018 to 0.011 per cent and from 0.013 to 0.004 per cent, respectively (Table 1 and fig 1. d). Further, there was slight decrease in the total potassium content of cow

urine (from 0.180 to 0.161%), vermiwash (from 0.089 to 0.082%), moringa leaf extract (from 0.097 to 0.080%), glyricidia leaf extract (from 0.087 to 0.074%) and pongamia leaf extract (from 0.056 to 0.045%) was documented from initial to 12th week after storage (Table 1 and fig 1. e). Jaikishun *et al*. (2018) [2] also reported the decline in the nutrient composition of vermiwash over the period of time.

Table 1: Storage study of cow urine, vermiwash and plant leaf extracts

Storage period	Name of organic source	pH	EC (dSm^{-1})	Total N (%)	Total P (%)	Total K (%)
Initial	Cow urine	8.51	0.370	0.355	0.030	0.180
	Vermiwash	8.05	0.069	0.086	0.017	0.089
	Moringa leaf Extract	4.27	0.046	0.109	0.036	0.097
	Glyricidia leaf Extract	5.92	0.060	0.123	0.018	0.087
	Pongamia leaf Extract	5.54	0.020	0.106	0.013	0.056
1st Week	Cow urine	8.79	0.341	0.324	0.015	0.173
	Vermiwash	8.94	0.065	0.078	0.012	0.089
	Moringa leaf Extract	3.99	0.020	0.098	0.031	0.094
	Glyricidia leaf Extract	4.93	0.046	0.120	0.018	0.083
	Pongamia leaf Extract	4.86	0.018	0.092	0.010	0.055
2nd Week	Cow urine	8.89	0.306	0.296	0.013	0.171
	Vermiwash	8.82	0.060	0.075	0.001	0.091
	Moringa leaf Extract	5.49	0.080	0.098	0.030	0.092
	Glyricidia leaf Extract	5.06	0.052	0.106	0.018	0.079
	Pongamia leaf Extract	4.48	0.056	0.086	0.011	0.056
3rd Week	Cow urine	8.85	0.285	0.245	0.010	0.171
	Vermiwash	8.76	0.054	0.075	0.001	0.091
	Moringa leaf Extract	5.46	0.075	0.108	0.029	0.090
	Glyricidia leaf Extract	4.92	0.023	0.108	0.015	0.079
	Pongamia leaf Extract	4.50	0.044	0.096	0.010	0.054
4th Week	Cow urine	8.74	0.282	0.242	0.009	0.171
	Vermiwash	8.70	0.052	0.070	0.001	0.091
	Moringa leaf Extract	5.52	0.074	0.106	0.029	0.090
	Glyricidia leaf Extract	4.87	0.022	0.108	0.015	0.079
	Pongamia leaf Extract	4.45	0.041	0.096	0.008	0.054
8th Week	Cow urine	8.56	0.256	0.238	0.005	0.163
	Vermiwash	8.45	0.048	0.064	0.001	0.082
	Moringa leaf Extract	5.59	0.066	0.095	0.022	0.081
	Glyricidia leaf Extract	4.92	0.018	0.080	0.012	0.074
	Pongamia leaf Extract	4.69	0.032	0.055	0.005	0.047
12th Week	Cow urine	8.42	0.202	0.230	0.005	0.161
	Vermiwash	8.31	0.030	0.060	0.001	0.082
	Moringa leaf Extract	5.55	0.061	0.082	0.020	0.080
	Glyricidia leaf Extract	5.12	0.015	0.071	0.011	0.074
	Pongamia leaf Extract	4.80	0.028	0.051	0.004	0.045

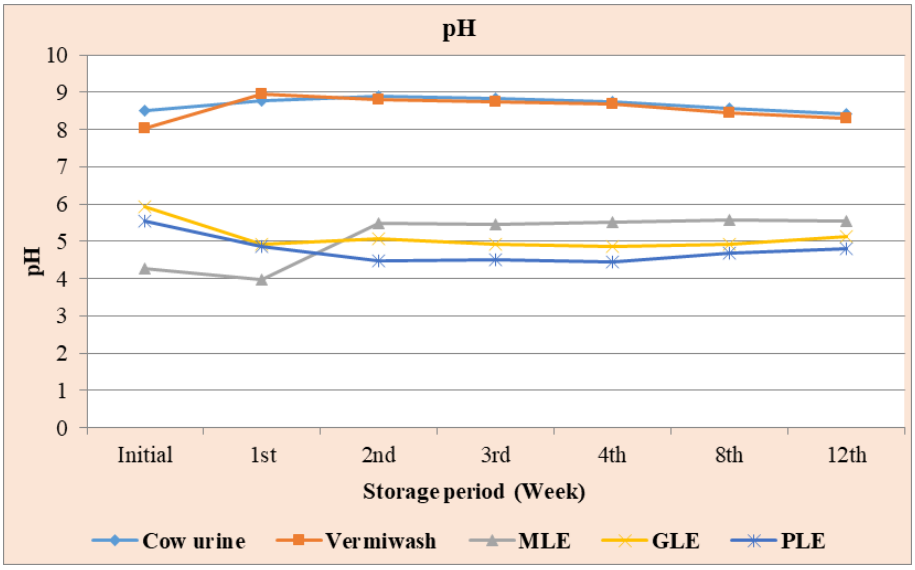

Fig 1a: pH

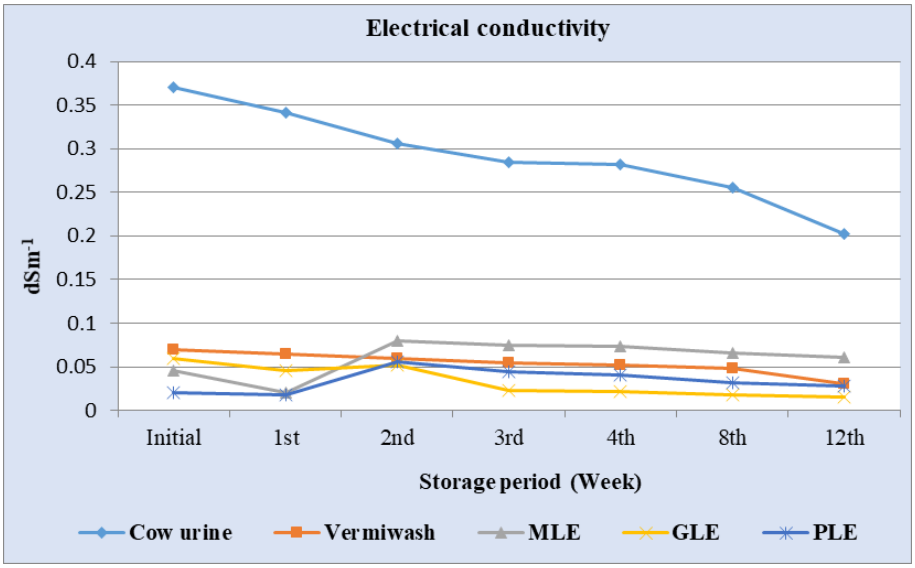

Fig 1b: Electrical conductivity

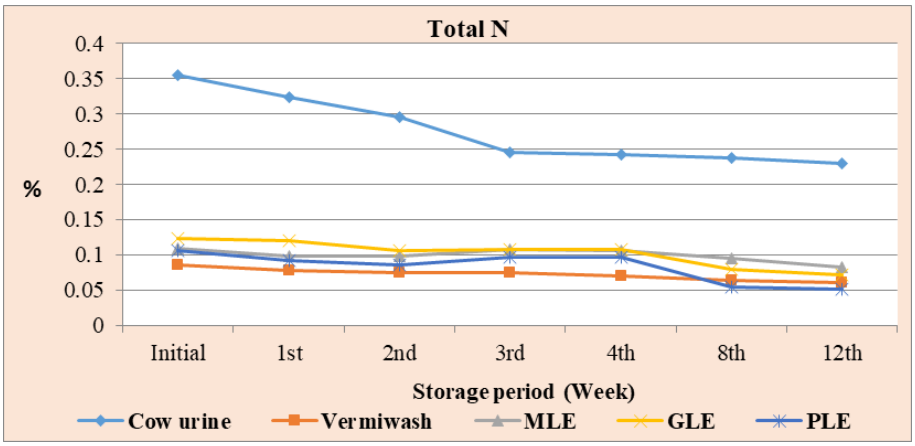

Fig 1c: Total Nitrogen

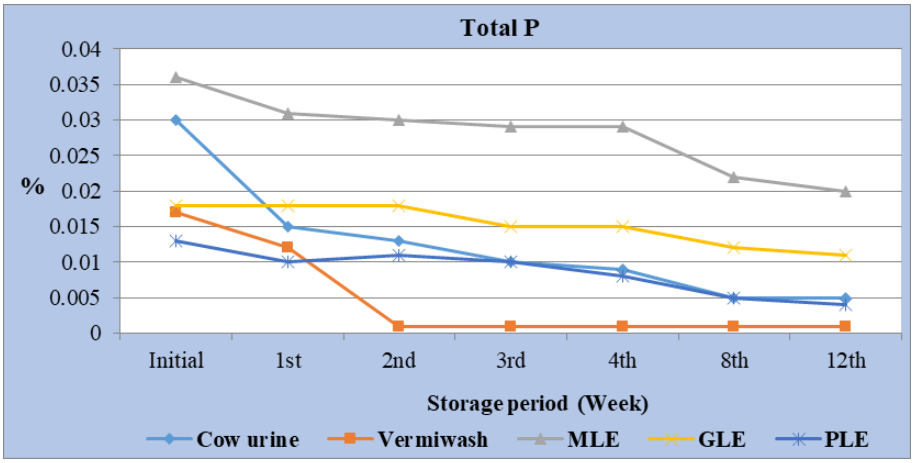

Fig 1d: Total Phosphorus

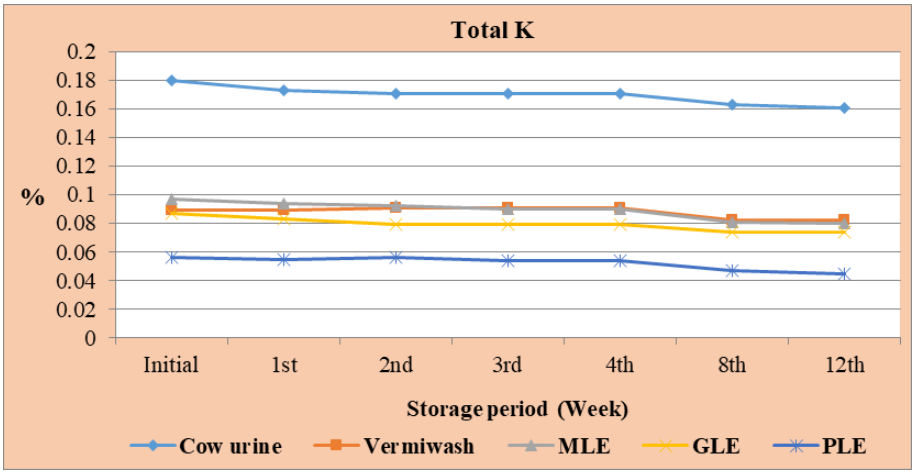

Fig 1e: Total Potassium

Fig 1: Storage study of cow urine, vermiwash and plant leaf extracts

4. Conclusion

During the successive storage period of cow urine, vermiwash, moringa leaf extract, glyricidia leaf extract and pongamia leaf extract, the non-linear variation in the pH was observed. However, the decrease in the electrical conductivity of all organic sources was observed throughout storage period. Similarly, the nutrients *viz*., nitrogen, phosphorus and potassium content of cow urine, vermiwash, moringa leaf extract, glyricidia leaf extract and pongamia leaf extract was found to be decreased throughout the storage period of 12 weeks.

From the above study, it is concluded that the nutrient content of cow urine, vermiwash, moringa leaf extract, glyricidia leaf extract and pongamia leaf extract was declined over period of time and therefore, it is better to use fresh form of these sources to obtain maximum benefits of nutrients.

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