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ASSESSMENT OF QUALITY OF FARM YARD MANURES SURVEYED FROM WESTERN MAHARASHTRA

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Abstract: *One hundred twenty five farm yard manure samples were collected from farmer's pits in ten districts, under the jurisdiction of M.P.K.V., Rahuri by following the grid method of sampling. The FYM samples were analyzed and assessed for physical and chemical quality parameters viz., colour, odour, temperature, water holding capacity, pH, EC, cation exchange capacity, C/N ratio, water soluble organic carbon, NH_4^+-N/NO_3^--N ratio, NH_4^+-N content, and nutrient status. Out of 125 FYM samples, 83.2, 91.2, 86.4 and 79.2 per cent samples found to be good quality and 16.8, 8.08, 13.6 and 20.8 per cent found poor quality in respect to colour, odour, temperature and WHC respectively as physical quality parameters while 87.2, 39.2, 69.6, 56.0, 42.4 and 75.2 per cent samples were good quality for pH, EC, C/N ratio, CEC, NH_4^+-N/NO_3^-- N ratio and HA/FA ratio respectively, while 12.8, 60.8, 30.4, 44.0, 57.7 and 24.8 per cent samples were poor for respective chemical parameters. All samples found to be good for water soluble organic carbon and NH_4^+-N content.*

The average total N, P, K and S content in good quality FYM was 0.92, 0.36, 0.98 and 0.44 per cent, respectively while in poor quality the content was 0.82, 0.29, 0.97 and 0.43 per cent, respectively. The mean total Fe, Mn, Zn and Cu content in good quality samples was 8543, 474, 243 and 131 mg kg-1,respectively while in poor quality samples the respective mean content was 8073, 455, 216 and 115 mg kg^{-1} FYM.

Key words*: Farm yard manures, survey, quality parameters, nutrient status.*

Indian agriculture is passing through a dilemma of resource shortage on one hand and waste disposal problem on the other. In view of the widening gap between addition of plant nutrient and their removal from soils, the soil's ability to supply nutrients is becoming strained day-by-day. Though the organic farming system may be the most desirable proposition but is not feasible due to inadequacy of organic manures, slow nutrient releasing capacity and poor source of nutrients in modern commercial agriculture and cannot sustain at high levels of production in prevailing semi-arid or tropical climatic conditions. Organic materials can differ widely in their properties and characteristics. Maturity of organic manures critically affects their successful utilization in agriculture (Kalaiselvi and Ramasamy, 1996). The preparation and use of different grades of composts has created a need for assessing the quality of the composts/FYM. A mature compost is hygienic and humified so that it improves soils and nourishes plant. The major sources of organic matter in the cultivated soil are farmyard manure, compost, green manure, cakes and meals. Organic inputs of different nature play an important role in setting new equilibrium level in the soil. In India, farmyard manure and compost provides significant source of organic matter as they are obtained mainly by the processing of animal excreta, domestic wastes, crop residues and agricultural wastes. Therefore the present investigation was carried out to study the quality of farm yard manures prepared by farmers of Western Maharashtra.

Material s and Methods

One hundred twenty five farm yard manure samples were collected from farmer's pits in 10 districts, under the jurisdiction of M.P.K.V., Rahuri by following the grid method of sampling. The FYM samples were analyzed and assessed for physical and chemical quality parameters *viz.,* colour, odour,

temperature, water holding capacity, pH, EC, cation exchange capacity, C/N ratio, water soluble organic carbon, NH_4^+-N/NO_3^--N ratio, NH_4^+-N content and HA/FA ratio and nutrients status of total nitrogen, phosphorus, potassium, sulphur and total micronutrients *viz.,* Fe, Mn, Zn and Cu, and compared with standard critical limits proposed by different scientists (Table 1).

Results and Discussion

Quality and maturity of farmyard manures

Out of 125 FYM samples, 83.2, 91.2, 86.4 and 79.2 per cent samples found to be good quality and 16.8, 8.08, 13.6 and 20.8 per cent found poor quality in respect to colour, odour, temperature and WHC respectively as physical quality parameters while 87.2, 39.2, 69.6, 56.0, 42.4 and 75.2 per cent samples were good quality for pH, EC, C/N ratio, CEC, NH_4^+-N/NO_3^-- N ratio and HA/FA ratio respectively, while 12.8, 60.8, 30.4, 44.0, 57.7 and 24.8 per cent samples were poor for respective chemical parameters. All samples found to be good for water soluble organic carbon and NH_4^+-N content. Out of 125 surveyed FYM samples, 42 (33.6 %) samples were found to be good in respect to all 12-quality parameters under study when compared with critical values reported by different workers. The remaining 83 (66.4 %) samples showed poor quality in respect to one or more than one quality parameters under study.

The good quality samples were brown to dark grayish brown in colour with earthy to no noxious odour and an average 45.9 per cent moisture content Similar observations were also reported by Pawar (2004) and Chanyasak et al. (1982) respectively. The good quality sample contained 27.68 per cent ash, 26.38 per cent total organic matter with 186.1 per cent water holding capacity. These samples were neutral in reaction having 1.39 dSm^{-1}EC, 15.30 per cent TOC, 0.24 per cent WSOC, 96.47 Cmol P^+ kg^{-1} CEC with 16.85 C/N ratio. The ammonical and nitrate-N content were 42.4 and 274.6 μg g^{-1} respectively with 0.154 NH_4^+-N/NO_3^--N ratio. These observations are in conformity with results reported by Patil et al. (1984).

The poor quality samples have dark yellowish brown to grayish brown colour and earthy to noxious odour. These samples contained 24.3 per cent ash, 30.9 per cent total organic matter with high water holding capacity (203.3 %). The poor quality samples also showed acidic to alkaline reaction with high EC (2.57 dSm^{-1}). These samples have 17.91 percent TOC, 0.33 per cent WSOC, 108.8 μg g^{-1} NH^+_4-N and 226.9μg g^{-1} NO3$^-$-N but having high C/N ratio (22.6) and low CEC (67.58 C mol P^+ kg^{-1}) with high NH_4^+-N/NO_3^--N ratio (0.56). These results are in conformity with earlier findings of Jimenez and Garcia (1989), Bernal et al. (1998), Patil (1994) and Sharma et al. (2004).

Relationship among the quality parameters and nutrients

Good quality FYM samples

The most important quality parameter like C/N ratio was significantly and positively correlated with WSOC, temperature and WHC while significantly and negatively correlated with pH, EC, NH_4^+-N and CEC, while the CEC showed significant positive correlation with pH, EC, NH_4^+-N and negative with WSOC, C/N ratio, temperature and WHC. All nutrients showed significant positive correlation with pH, EC, NH_4^+-N HA, FA and CEC while significant negative relation with WSOC, C/N ratio, temperature and WHC. Similar relation for different quality parameters also reported by Roig et al. (1988),Bernal et al. (1998), and Hellal (2007) for different composts and FYM prepared from wide range of organic materials.

Poor quality FYM samples

The C/N ratio of poor quality FYM showed significant negative correlation with quality parameters *viz.,* pH, EC, NH_4^+-N and CEC and significant positive with WSOC, NH_4^+-N/NO_3^--N ratio, temperature and WHC. The CEC showed significant positive relation with pH, EC, NH_4^+-N and negatively correlated with WSOC, NH_4^+-N/NO_3^--N ratio, HA/FA ratio, temperature and water holding capacity while EC have significant positive relation with NH_4^+-N, CEC and significant

negative with WSOC, NH_4^+-N/NO_3^--N ratio, C/N ratio, temperature and WHC. All nutrients were significantly and positively correlated with pH, EC, NH_4^+-N, CEC except total N with EC and CEC and significantly and negatively with WSOC, NH_4^+-N/NO_3^--N ratio, C/N ratio, HA/FA ratio, temperature and WHC. Similar simple correlations for compost and FYM also reported Bernal et al. (1998), Manna et al. (2000), Eneji et al. (2001) and Hellal (2007).

Nutrient status

The average content of N, P, K, S and micronutrient cations found to be higher under good quality samples. The average total N, P, K and S content in good quality FYM was 0.92, 0.36, 0.98 and 0.44 per cent, respectively while in poor quality the content was 0.82, 0.29, 0.97 and 0.43 per cent, respectively. The mean total Fe, Mn, Zn and Cu content in good quality samples was 8543, 474, 243 and 131 mg kg-1,respectively while in poor quality samples the respective mean content was 8073, 455, 216 and 115 mg kg^{-1} FYM.

Conclusions

Out of 125 surveyed FYM samples, 42 samples (33.6 %) showed good quality in respect to all twelve-quality parameters under study. The average nutrient composition of good quality FYM samples for total N, P, K and S were 0.92, 0.36, 0.98 and 0.44 per cent, respectively and it was higher than poor quality FYM samples. The average micronutrients content *viz.,* Fe, Mn, Zn and Cu of good quality surveyed FYM samples were 8543, 474, 243 and 131 mg kg^{-1} FYM, respectively and found to be higher than poor quality samples. C/N ratio of good quality FYM samples showed significant negative correlation with EC (-0.877**), CEC (-0.986**), pH (-0.957**) and significantly positive correlation with WSOC (0.723**), temperature (0.957**), WHC (0.959**). Cation exchange capacity of good quality FYM samples were significantly and positively correlated with pH, EC, NH_4-N and negatively with WSOC and NH_4-N/NO_3-N ratio.

Table 1: Standard quality values for good quality organic manures

Sr. No	properties	Standard Value	Reference
1	Temperature (°C)	30-45	Kalaiselvi and Ramasamy (1996)
2	Colour	Black– brown	Jothimani and Maheswari (2002)
3	Odour	Earthy	Jothimani and Maheswari (2002)
4	WHC (%)	150-200	Subramanian (2002)
5	pH (1:10)	6.5-8.0	Kalaiselvi and Ramasamy (1996)
6	EC (dSm^{-1})	<1.5	Jothimani and Maheswari (2002)
7	WSOC (%)	<1.7	Bernal *et.al.* (1998)
8	C:N ratio	<20.0	Kalaiselvi and Ramasamy (1996)
9	CEC (Cmol p+kg^{-1})	>70.0	Kalaiselvi and Ramasamy (1996)
10	NH_4^+-Ncontent (%)	<0.04	Bernal *et.al.* (1998)
11	NH_4^+-N/NO_3^--N ratio	<0.16	Bernal *et.al.* (1998)
12	HA/FA ratio	<1.0	Jothimani and Maheswari (2002)

Table 2: Physical and chemical quality indices performance of surveyed FYM samples

Sr. No.	Quality Indices	Good quality		Poor quality	
		No. of samples	%	No. of samples	%
A	Physical Indices				
1	Colour	104	83.2	21	16.8
2	Odour	114	91.2	11	8.8
3	Temperature	108	86.4	17	13.6
4	Water holding capacity	99	79.2	26	20.8

B	Chemical Indices				
1	pH	109	87.2	16	12.8
2	EC	49	39.2	76	60.8
3	Water soluble organic carbon	125	100.0	Nil	---
4	C/N ratio	87	69.6	38	30.4
5	Cation exchange capacity	70	56.0	55	44.0
6	NH_4^+ -N	125	100.0	Nil	---
7	NH_4^+ -N/NO_3^- -N ratio	53	42.4	72	57.6
8	**HA/FA ratio**	94	75.2	31	24.8

Table 3: Physico-chemical properties of good quality surveyed FYM samples

Sr. No.	Properties	Range		Mean
		Minimum	Maximum	
A	Physical			
1	**Colour**	10YR 4/3 Brown	10YR 4/2 Dark grayish brown	----
2	Odour	No noxious	Earthy	---
3	Temperature (0C)	30.0	43.0	34.69
4	Water holding capacity (%)	153.1	200.0	186.11
5	Ash (%)	18.50	37.30	27.68
6	Total organic matter (%)	17.30	34.00	26.38
7	Moisture content (%)	43.0	48.5	45.9
B	Chemical			
1	pH (1:10)	6.76	7.92	7.43
2	EC (1:10) dSm^{-1}	0.99	1.50	1.39
3	Water-soluble organic carbon (%)	0.07	0.86	0.24
4	C/N ratio	12.90	19.90	16.85
5	Cation exchange capacity ($CmolP^+kg^{-1}$)	70.00	136.0	96.47
6	$NH4^+$-N ($\mu g\ g^{-1}$)	25.0	67.0	42.40
7	$NO3^-$ - N ($\mu g\ g^{-1}$)	154.0	420.0	274.6
8	NH_4^+-N / NO_3^--N ratio	0.13	0.16	0.154
9	Total organic carbon (%)	10.10	19.70	15.30

Table 4: Physico-chemical properties of poor quality surveyed FYM samples

Sr. No.	Properties	Range		Mean
		Minimum	Maximum	
A	Physical			
1	Colour	10YR3/4 Dark yellowish brown	10YR5/2 Grayish brown	----
2	Odour	Noxious	Earthy	----
3	Temperature (0C)	23.0	47.0	34.7
4	Water holding capacity (%)	126.4	368.3	203.3
5	Ash (%)	7.9	41.9	24.3
6	Total Organic matter (%)	14.3	61.2	30.9
7	Moisture content (%)	28.0	50.0	44.84
B	Chemical			
1	pH (1:10)	6.10	8.46	7.47
2	EC (1:10) dSm^{-1}	1.28	4.92	2.57
3	Water soluble organic carbon (%)	0.06	0.98	0.33

4	C/N ratio	11.90	59.60	22.60
5	Cation exchange capacity ($CmolP^{+}kg^{-1}$)	24.70	116.8	67.58
6	NH_4^+-N ($\mu g\ g^{-1}$)	28.0	392.0	108.8
7	NO_3^- - N ($\mu g\ g^{-1}$)	84.0	391.0	226.9
8	NH_4^+-N / NO_3^--N ratio	0.12	2.86	0.56
9	Total organic carbon (%)	8.30	35.50	17.91

Table 5: Nutrient status of good quality surveyed FYM samples

Sr. No.	Nutrient	Range		Mean
		Minimum	Maximum	
A	**Macronutrients (%)**			
1	Nitrogen	0.58	1.43	0.92
2	**Phosphorus**	0.18	0.44	0.36
3	Potassium	0.60	1.45	0.98
4	**Sulphur**	0.22	0.65	0.44
B	**Micronutrients (mg kg^{-1})**			
1	Iron	5465	10860	8543
2	Manganese	302	848	474
3	Zinc	206	317	243
4	Copper	70	198	131

Table 6: Nutrient status of poor quality surveyed FYM samples

Sr. No.	Nutrient	Range		Mean
		Minimum	Maximum	
A	**Macronutrients (%)**			
1	Nitrogen	0.48	1.20	0.82
2	Phosphorus	0.11	0.46	0.29
3	Potassium	0.45	1.75	0.97
4	Sulphur	0.13	0.70	0.43
B	**Micronutrients (mg kg^{-1})**			
1	Iron	3980	11970	8073
2	Manganese	301	755	455
3	Zinc	102	326	216
4	Copper	60	190	115

Table 7: Simple correlations ('r' value) amongst the quality indices of good quality surveyed FYM samples

Sr. No	Quality indices	EC	WSOC	NH_4^+-N	NH_4/NO_3 ratio	CEC	C/N ratio	HA/FA ratio	Temp	WHC
1	pH	0.951**	-0.845**	0.929**	-0.230	0.936**	-0.957**	-0.138	-0.979**	-0.876**
2	EC	__	-0897**	0.858**	-0.193	0.838**	-0.877**	0.213	-0.952**	-0.743**
3	WSOC		__	-0.702**	0.233	-0.697**	0.723**	0.214	0.839**	0.581**
4	NH_4^+-N			__	0.015	0.960**	-0.968**	-0.070	-0.939**	-0.923**
5	NH_4^+/NO_3^-				__	-0.220	0.220	0.102	0.225	0.233
6	CEC					__	-0.986**	-0.063	-0.933**	-0.969**
7	C/N ratio						__	0.077	0.957**	0.959**
8	HA/FA							__	0.197	-0.059
9	Temperature								__	0.860**

* - at 0.05 level and ** - at 0.01 level

Table 8: Simple correlations ('r' value) amongst the quality indices of poor quality surveyed FYM samples

Sr No	Quality indices	EC	WSOC	NH_4^+-N	NH_4/NO_3 ratio	CEC	C/N ratio	HA/FA ratio	Temp	WHC
1	pH	0.207	-0.489**	0.324**	-0.308**	0.247*	-0.407**	-0.134	-0.395**	-0.324**
2	EC	__	-0.586**	0.576**	-0.256*	0.543**	-0.583**	0.157	-0.308**	-0.411**
3	WSOC		__	-0.521**	0.608**	-0.506**	0.636**	0.271*	0.425**	0.675**
4	NH_4^+-N			__	0.762**	0.483**	-0.520**	0.367**	-0.242*	-0.403**
5	NH_4^+ / NO_3^-				__	-0.404**	0.292**	0.401**	-0.186	-0.426**
6	CEC					__	-0.611**	-0.583**	-0.295**	-0.385**
7	C/N ratio						__	0.143	0.283**	0.585**
8	HA/FA							__	0.207	0.086
9	Temperature								__	0.572**

* - at 0.05 level and ** - at 0.01 level

Table 9: Relationship between nutrients content and quality indices of good quality surveyed FYM samples

Sr. No.	Properties	pH	EC	WSOC	NH_4^+-N	NH_4/NO_3	CEC	C/N ratio	HA/FA ratio	Temp	WHC
1	NO3-N	0.948**	0.866**	-0.715**	0.979**	-0.198	0.984**	-0.993**	-0.083	-0.956**	-0.956**
2	N	0.411**	0.353*	-0.323	0.405**	-0.210	0.436**	-0.457**	0.065	-0.404**	-0.487**
3	P	0.900**	0.872**	-0.840**	0.825**	-0.234	0.836**	-0.852**	-0.290	-0.908**	-0.743**
4	K	0.806**	0.705**	-0.588**	0.872**	-0.141	0.894**	-0.885**	0.003	-0.835**	-0.873**
5	S	0.885**	0.779**	-0.673**	0.884**	-0.262	0.922**	-0.918**	-0.151	-0.891**	-0.882**
6	Fe	0.945**	0.889**	-0.744**	0.946**	-0.197	0.949**	-0.967**	-0.161	-0.961**	-0.883**
7	Mn	0.854**	0.707**	-0.618**	0.868**	-0.312	0.936**	-0.921**	0.037	-0.823**	-0.961**
8	Zn	0.916**	0.841**	-0.754**	0.911**	-0.120	0.930**	-0.920**	-0.023	-0.893**	-0.868**
9	Cu	0.967**	0.899**	-0.746**	0.952**	-0.228	0.976**	-0.989**	-0.098	-0.953**	-0.944**

* - at 0.05 level and ** - at 0.01 level

Table 10: Relationship between nutrients content and quality indices of poor quality surveyed FYM samples

Sr. No	Properties	pH	EC	WSOC	NH_4^+-N	NH_4/NO_3 ratio	CEC	C/N ratio	HA/FA ratio	Temp	WHC
1	NO3-N	0.227*	0.291**	-0.226*	0.382**	-0.372**	0.291**	-0.428**	-0.160	-0.389**	-0.175
2	N	0.277*	0.170	-0.273*	0.253*	-0.288*	0.170	-0.430**	-0.284**	-0.217*	-0.266*
3	P	0.236*	0.305**	-0.409**	0.270*	-0.344**	0.305**	-0.419**	-0.401**	-0.497**	-0.258*
4	K	0.306**	0.332**	-0.492**	0.311**	-0.332**	0.332**	-0.506**	-0.254	-0.387**	-0.481**
5	S	0.271*	0.455**	-0.640**	0.386**	-0.391**	0.455**	-0.488**	-0.389**	-0.328**	-0.594**
6	Fe	0.285**	0.261*	-0.368**	0.383**	-0.355**	0.261*	-0.481**	-0.200	-0.453**	-0.436**
7	Mn	0.250*	0.291**	-0.443**	0.328**	-0.287*	0.291**	-0.222*	-0.122	-0.356**	-0.271*
8	Zn	0.332**	0.395**	-0.527**	0.544**	-0.573**	0.395**	-0.737**	-0.574**	-0.264*	-0.492**
9	Cu	0.289**	0.346**	-0.354**	0.298**	-0.408**	0.346**	-0.484**	-0.317**	-0.529**	-0.428**

n= 83, * - at 0.05 level and ** - at 0.01 level

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