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Physico-Chemical Parameters ofOrganic Compost and Its Impact onPigeon Pea andJowar Crop Plants Productivity

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Abstract: *Organic fertilizers contain relatively low concentrations of the actual plant nutrients and are not immediately available for plant utilization. Hence, the fortification of organic wastes and their composts as a source of organic nutrients are imperative for sustainable agriculture. This paper was representedthe 18physico-chemical parameters from different compost. Among tested organic fertilizers,Fard Yard Manure (FYM)(56%) showed highest ash content followed by vermicompost (53.15%). pH contents found almost alkaline in nature except cow dung manure.EC was found highest in poultry manure (0.83) while less in baggase ash(0.17).Nitrogen content is found highest in baggase ash than other compost. In Poultary manure, Phosphorus, Potassium and Sodium are found very less as compared to other compost. The study also aimed at evaluating the effect of organic manure on the growth and yield of CajanuscajanPigeonpea (BSMR-736) and Sorghum vulgare Jowar (Maldandi-35-1) with six treatments each of which was replicated five times in farm field. All the growth parameters were differed significantly due to the application of organic compost.In case of Pigeonpea, poultry manure, cow dung and FYM observed beneficial results among treatments. The result revealed that the treatment of vermicompost,cow dung and FYM found significant difference among the treatments in jowar.*

Keywords*: Organic Composts, physicochemical parameters, Growth and Yieldof crop plant.*

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I Introduction

Generally, organic fertilizers contain relatively low concentrations of the actual plant nutrients, and are not immediately available for plant utilization. Hence, the fortification of organic wastes and their composts as a source of organic nutrients are imperative for sustainable agriculture. Also the fortification of compost with chemical fertilizer enhances agronomic effectiveness of both the organic matter and nutrients by reducing the amount of fertilizer and improving the quality of compost. Many workers have studied the beneficial effects of organic wastes as fertilizers and soil amendments and its fortification to enhance the nutrient content. Plant and animal wastes are freely available on most organic holdings and these can be composted for the supply of nutritious organic matter to be returned to the soil [1]. The use of compost or organic manure is currently being advocated as an option for improving soil fertility conditions for poor farmers. The use of organic fertilizers increases the soil organic carbon pool and soil pH, improves the soil structure, decreases bulk density, provides macro- and micronutrients and enhances microbial activity. According to [2], maize treated with organic materials plus inorganic fertilizer had higher grain yield compared to the recommended rate of inorganic fertilizer. It was evaluated the effect of vermicompost on crop productivity, Organic manures provide a good source for the growth of microorganisms and maintain nutritional balance and soil properties [3]. It is recognized that combined source of organic matter and chemical fertilizers play a key role in increasing the productivity of soil. Furthermore the composting process, if performed correctly, transforms wet and odorous organic waste into an aesthetically, dryer, decomposed and reusable product [4]. Compost has relatively low nitrogen content, between 0.5 to 2.0 %, that is slowly mineralized in soil [5,6]. Compost additions improve soil particle stability, moisture retention, greater aeration and microbial diversity, cause porosity increase and a lower density, preserves and restores soil organic carbon and its positive effect on crop yields persists for several years [7,8].The main objective of this study is to determine the difference in the physicochemical properties and mineral contents in the unfortified compost and its effect on pigeon pea and Jowar

II Materials And Methods

II.1. Compost sampling site

Study site is Marathwadaregions in of Maharashtra state of India. The region comes under Aurangabad Division. It was a part of Nizam's domain, which was known as The Princely State of Hyderabad. This region lies between 170 35' N & 200 40' N Latitude and 700 40' E & 780 15' E Longitude. It falls in Deccan Plateau Zone of India with geographical area of 6.5 million hectare occupying 21 % of total area of the Maharashtra. This region is situated at an average height of about 300-650 m. above mean sea level, gradually sloping ranges originating from the Sahyadris in the west and Satpuda ranges in the north.

II.2. Physico-chemical analysis of compost

Different composts were collected from study area and used for physicochemical characterization. Composts were spread out on a tray for air drying. It was sieved over a 150 mm sieve and used for characterization. Each sample is weighed using digital balance. The samples were then oven-dried at a temperature of 110^0C for 24 hours and reweighed.Electrical conductivity,moisture and pH of compost were measured [9]. Samples of each composting heap were taken to the laboratory for moisture content determination. Nitrogen content was determined by the Kjeldahlmethod [10]. The carbon-nitrogen ratio was calculated using the results obtained from carbon and nitrogen contents. The carbon content of compost was determined by titration method as described [11]. Organic Carbon was evaluated [12] method by oxidizing organic carbon with potassium dichromate and sulphuric acid. Phosphorus in soil was determined by Olsens method by using spectrophotometer [13,14].Water soluble and exchangeable Potassium was calculated by Ammonium acetate method [15] using Flame photometer.Calcium and Magnesium cations were estimated by EDTA titration [16]. Analysis of Ferrous, Mangenese, Copper and Zinc were done by acid digestion of soil [17]. Samples of each composting heap were taken to the laboratory for moisture content determination. Each sample is weighed using digital balance.

II.3. Growth and yield of crop plants

The variety of *Cajanuscajanm*, Pigeonpea (BSMR-736) and *Sorghum vulgare*, Jowar (Maldandi-35-1) seeds were used from local farmers& sterilized with 1% $HgCl_2$ solution.Viability test was conducted to ascertain that the seeds were viable at 95%. The study started during June, 2017 for Pigeonpea and ended in Sept-Oct, 2017 and in November, 2017 and ended in Feb-March 2018 for Jowar. The treatments of compost (poultry manure,vermicompost, FYM (Farm Yard Manure), Cow dung and bagasse ash) 5g/plants wereapplied for the study in farm field. The parameters measured include;plant height, shoot &root fresh wt.,shoot &root dry wt.,number of branching at 11 weeks after planting and wt. of pods/plant and number of pods/plant after harvesting. In case of jowar,plant height, fresh wt, of shoot and root, dry wt. of shoot & root and leaf area at 9 weeks after planting and weight of head, number of grains/head and weight of grains/head after harvesting. Dry weight of the separate organs (root, stem) was determined after 48 h oven drying at 60 °C[18,19]. Leafarea was measured at harvest by disc method[20]. The study was evaluating the effect of organic manure on the growth and yield of pigeonpeaand jowarwith five replications.

III Statistical Analysis

All data were statistically analyzed and the significance of differences was determined byusing book [21].

IV Results And Discussion

IV.1. Physico-chemical analysis of compost

Organic fertilizers contain relatively low concentrations of the actual plant nutrients and are not immediately available for plant utilization. Hence, the fortification of organic wastes and their composts as a source of organic nutrients are imperative for sustainable agriculture. This work presents the 18 physico-chemical and mineral analyses of different compost samples. Among tested organic fertilizers, FYM(56%) showed highest ash content followed by vermicompost (53.15%). pH contents found almost alkaline in nature except cowdung manure.This pH range is in the optimum range for growing media as mentioned [22] who stated that the optimal range is from 5.2 to 7.3. EC was found highest in poultry manure (0.83) while less in baggase ash(0.17). This EC range is in the optimum range (2.0 to 4.0) for growing media as mentioned [23]. Nitrogen content is found highest inbaggase ash than other compost. These results are in agreement with those obtained [24] it found that the total nitrogen rate ranged from 0.99 to 2.01%. In Poultary manure, Phosphorus, Potassium and Sodium are found very less as compared to other compost.These results are in agreement with the results obtained [25] it found that the C/N ratio ranged from 15:1 to 20:1 is ideal for ready-to-use compost. Moisture (%) content was found more in cow dung,

FYM and bagasse ash. Ash (%) content was found in all compost. Regarding the total organic matter results it was found that it ranged from 44 to 60.50% for different compost types under study, where, the lowest value of total organic matter was found for FYM compost and the highest for poultry mannur. These results are in agreement with [24]whose found that the highest value of total organic matter about 44%.Regarding the total carbon results it was found that it ranged from 27.15to 35.88 % for different compost types under study.These results are in agreement [26] who found that the optimum value of total organic matter higher than 10%.

IV.2. Growth and yield production

In this investigation, the impact of six different treatments such as control (without compost), poultry manure, vermicompost, FYM, Cow dung and bagasse ash were checked on *Cajanuscajan* (pigeon pea) biomass productivity with 8 different parameters. All the growth parameters were differed significantly due to the application of organic manures. Plant height was found more in almost all compost except bagasse ash as compared to control. Shoot fresh and dry wt. was increased in vermicompost (419.8g & 230g) followed by cow dung (334g & 196.67).Root fresh and dry wt was maximum in vermicompost (66.25g &35.23g) followed by poultry manure.The number of branching was highest in FYM (22) while least in control (9).Pod wt per plant was maximum in poultry manure (243g) followed by cow dung (190g) compared with control. Highest Number of pods was observed in poultry manure(400) as compared to others (Table 2).

Table 3 represented that the Jowar, biomass productivity with nine different parameterswas studied. In plant height,cow dung and FYM (195cm) was found maximum as compared to others. Shoot fresh & dry weight was more in Vermicompost(299.10&31.27g) while least in bagasse ash(178.25&26.58g) respectively. Root fresh &dry weight was highest in vermicompost(56.75g&24.08g) as well as leaf area (584cm^2),weight grain(108.68g) and number of grain (2717) were maximum than others.Weight of head(197.50g) was found more in cow dung as compared to others.

Earlier reports that increase in these attributes might have been on an account of the improvement in vegetative growth of plants, due to the application of composts, FYM and biofertilizers along with Recommended Dose of Fertilizers (RDF) [27]. It was observed that an increasing positive trend between stalk biomass productivity and compost additions for all nitrogen levels tested as well as maximum stalk productivity of 56 and 57 Mg/ha on wet basis were obtained with 100 % compost at 100 and 150 kgN/ha levels respectively and minimum value of 32 Mg/ha on wet basis was obtained by the first cut samples at 50 kgN/ha employing only inorganic fertilization [28]. The growth of sorghum in the mixtures of 75% of vermicompost produced by *Perionyxexcavatus* and 25% soil was significantly higher than that of the plants grown in mixtures of vermicompost produced by *Octonochaetaphillotti* and *O. rosea*[29]. It has been reported that vermicompost possessed 1.60%, 2.20% and 0.67% (dry basis) of N, P_2O_5 and K2O respectively [30].However, if farmers can afford fertilizers, they generally use it on staple food crops like maize and common bean (*Phaseolus vulgaris* L.) [31] .It was reported an increase in maize grain yield when low doses of N and P fertilizers were applied with different organic materials such as farmyard and compost, as compared with the control treatment [32,33]. The positive effect of compost on plant growth and yield are observed [34,35]. Moreover, repeated compost application improves soil physical properties and growing conditions (water uptake, aeration) for the crop [36].It was reported the application of recommended dose of fertilizers (RDF)+FYM recorded higher seed quality

parameters viz. germination (96.76%), seedling vigour index (3713) and field emergence (93.33%)[37].It was showed that treatment with compost had had significant effect on the shoot and root dry weights, number of leaves and number of tillers [38]. The matured compost had a positive effect on plant height, leaf length, leaf number, and leaf diameterof Kale (*Brassica oleracea)* [39]. It was reported the productivity of spinach shows maximum amount of yield produced by weed vermicompost, weed compost and green manure as compared to chemical fertilizers and control [40].

Table: Physico-chemical parameters of different organic compost.

Sr. No.	Parameters	Poultry manure	Vermicompost	FYM	Cow dung	Bagasse ash
1.	pH	8.14±2.01	7.08±1.22	7.03±1.22	4.88±1.22	8.70±2.22
2.	EC(dS/m)	0.83±0.2	0.37±0.11	0.54±0.12	0.57±0.11	0.17±0.01
3.	Nitrogen %	0.84±04	0.90±0.21	0.78±0.12	0.84±0.22	1.12±0.12
4.	Phosphrous %	0.07±0.1	0.05±0.01	0.02±0.01	0.16±0.03	0.13±0.01
5.	Potassium %	0.01±0.001	3.77±0.97	1.42±0.33	4.01±1.01	1.28±0.19
6.	Sodium %	1.46±1.0	28.05±2.44	19.05±4.12	9.65±1.23	14.30±2.22
7.	Calcium %	1.70±1.1	5.00±0.67	6.00±2.11	4.50±2.01	2.30±1.77
8.	Magnesium %	0.30±0.1	0.11±0.01	0.14±0.12	0.10±0.01	0.05±0.01
9.	Sulphur %	3.54±1.2	6.20±1.33	1.47±0.22	3.65±1.01	4.40±1.01
10.	Zinc (ppm)	0.32±0.3	0.95±0.03	1.14±0.13	0.85±0.04	0.43± 0.3
11.	Ferrous (ppm)	0.34±0.01	1.02±0.01	1.22±0.11	0.91±0.03	0.46±0.04
12.	Copper (ppm)	0.14±0.1	0.43±0.01	0.51±0.01	0.38±0.08	0.19±0.12
13.	Manganese (ppm)	0.46±0.11	1.43±0.32	1.71±0.27	1.28±0.12	0.65±0.05
14.	Total Carbon %	35.09±2.33	27.15±4.45	25.50±6.21	35.88±2.66	34.23±6.33
15	Sand silica %	1.12±0.54	2.57±1.01	0.83±0.11	2.53±1.01	1.96±0.23
16	Total Organic Matter%	60.50±3.11	46.85±5.56	44.00±4.11	61.87±2.22	59.05±9.11
17	Moisture %	8.70±2.31	6.95±2.11	28.39±5.23	50.99±7.01	58.97±7.11
18	Ash %	39.50±4.23	53.15±7.11	56.0±5.11	23.75±6.12	40.96±3.03

±standard error.

Table 2.Impact of different compost on growth and productivity of Pigeonpea (BSMR-736).

Sr.No.	Compost	Plant Height (cm)	Shoot Fresh Wt. (g)	Shoot Dry Wt. (g)	Root Fresh Wt (g)	Root Dry Wt.(g)	No.of branching/plant	Wt. of Pods (g)/plant	No. of Pods/plant
1	Control	140±3.53	230±4.17	173±3.76	30.2±0.73	22.3±0.67	09±0.58	140±2.03	210±5.78
2	Poultrymanure	196±3.29	298.1±4.71	175.89±6.0	55.04±0.57	39.18±0.52	10±0.34	243±2.97	400±10.14
3	Vermicompost	172±3.49	419.8±7.32	230±4.41	66.25±0.58	35.23±0.76	12±1.21	136±5.51	186±8.39
4	FYM	158±1.44	256±2.91	137.17±2.34	34.67±0.64	22.10±1.13	22±1.46	151±7.1	300±7.27
5	Cow dung	156±3.52	334±3.47	196.67±3.91	39.79±0.43	31.63±0.51	20±0.58	190±2.09	388±4.59
6	Bagasse ash	134±3.85	210±5.21	114.85±1.16	29.21±2.41	22.46±1.24	19±0.58	126±2.31	252±5.80

Each data point represents the mean value of five plant samples, ±standard error.

Table 3.Impact of different compost on growth and productivity of Jowar (Maldandi-35-1).

Sr.No.	Compost	Plant Height (cm)	Shoot Fresh Wt. (g)	Shoot Dry Wt. (g)	Root Fresh Wt (g)	Root Dry Wt.(g)	Leaf area (cm^2)/plant	Wt. of Head (g)/plant	No. of Grain/head	Wt. of Grains (g)/plant
1	Control	172±4.81	237.30±2.97	29.3±0.55	25.70±1.28	11.39±0.57	544±8.67	159.30±7.29	1274±22.12	50.96±0.72
2	Poultry manure	175±2.34	213.16±6.18	31.54±0.51	18.75±0.41	7.46±0.35	574±12.78	162.15±1.55	1688±12.12	67.52±1.21
3	Vermicompost	193±2.03	299.10±4.85	31.27±0.38	56.75±1.76	24.08±0.59	584±7.69	196.4±3.44	2717±17.35	108.68±1.47
4	FYM	195±2.03	204±5.79	27.4±0.71	29.41±0.50	19.03±0.50	390±3.61	159.92±1.41	1751±26.32	70.04±1.1
5	Cow dung	195±2.03	214.55±4.17	29.32±0.64	31.98±0.45	16.62±0.80	560±7.64	197.50±2.77	1912±39.19	76.48±0.67
6	Bagasse ash	170±3.06	178.25±6.36	26.58±0.68	20.13±0.73	6.39±0.21	490±7.22	119.76±0.34	1557±14.45	62.28±0.77

Each data point represents the mean value of five plant samples, ±standard error.

V Conclusion

An experimental study concluded that successively to determine the chemical and physical properties of different compost types. The compost can supply all micro and macronutrients necessary for plant growth.Therefore, based on the findings, poultry manure, cow dung and FYM were recommended to farmers for optimum growth and yield of crop production.

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