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Evaluation of the Effect of Agro Waste Formulated Compost from Goat Dropping on the Germination of Different Seeds

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Abstract:

Agricultural wastes are often managed poorly because of the limited access to disposal facilities, hence most of agricultural wastes are burned or incinerated. One way that helps maintain the sustainability of agro-ecosystems land is the application of compost because it can recover and maintain the soil nutrients. Composting is a method for preparing organic fertilizers and it is economically and ecologically sound. In this work, the effects of agro waste compost made from goat droppings was studied to ascertain its effects on the germination of ten different seeds for seven weeks. Standard methods were used both in sample and material preparation. From the results of the germination index, cucumber rose from 30.22 at the beginning to 1148.4 after seven weeks. Cabbage from 211.9 to 185.92, Soya bean from 94.87 to 435, millet; 32.57 to 150. Tomato; 0 to 81, maize; 160 to 209, wheat; 900 to 400, Sorghum 30.56 to 169, and no value for both Rice and Onions. Their vigor index values increased as the week progresses. There was over 80% increase in the germination index of the seeds, and staggering rise in the values of the vigor index. There, for the fact that germination index and vigor index increased it shows that the compost is matured and good and has the ability to increase the germination rate as well as make the seeds to produce normal seedlings.

Keywords: Compost, germination index, vigor index

1. Introduction

Agricultural wastes are wastes produced from agricultural activities in agricultural premises. Agricultural wastes are often managed poorly because of the limited access to disposal facilities, hence most of agricultural wastes are burned or incinerated. The production of compost has long been the object of great interest to researchers, since compost may be used as a fertilizer or as a material for producing plant nursery substrates. From an economic point of view, composting can therefore bring reductions in the cost of disposing of organic residues, as well as providing an income, by virtue of compost being used as a substitute for other materials (chemical fertilizers and peat) that may be quite expensive. In addition, composting can have a strong ecological environmental value, allowing organic by-products to be subtracted from the disposal cycle and put back into the production cycle, enhancing it and closing the organic carbon cycle, while also being a tool for the economic and social sustainability of production activities in rural areas (Scarpato *et al.*, 2013). Composting is a valuable way of waste treatment that contributes to reduce organic waste destined to landfill disposal or incineration. Home and community composting have proven to be a sustainable strategy for waste management (Barrena *et al.* 2014, Proietti *et al.*, 2016)

Composting is a low temperature bio-oxidative process with a stage of the organic matter degradation and the mineralization of labile organic compounds (readily available for the microorganisms) and belongs to important trends in recycling organic and mineral components of wastes (Baran *et al.*, 2009). So composting is a method for preparing organic fertilizers and amendments economically and ecologically sound and may well represent an acceptable solution for disposing of municipal solid waste, at the same time increasing its value (Akram *et al.*, 2009, Danso *et al.*, 2006, Mary *et al.*, 2010). Composting provides a valuable material improving physical and chemical properties of soil. For example, the

agroindustry waste compost application in soil showed a significant increase in the nitrogen, phosphorus, potassium and organic matter content in amended plots Hernández *et al* (2015)

2. Statement of Problem

The use of inorganic fertilizers and other chemicals in cultivation of plants and agriculture in general has shown to cause environmental impact, destruction of the soil microbial population, unbalances the soil pH and degradation of the soil nutrient quality in general.

3. Objectives of the Study

There are claims that composts addition to the soil can minimize the impact of pathogens, control the impact of diseases and improve the crop growth rate. The aim of this work is to study the effect of agro waste compost from goat dropping with the objective of evaluating the germination index, vigor index, the root length and shoot length, relative seed germination and relative root growth for seven weeks.

4. Materials and Methods

4.1. Sample Collection

The goat droppings were collected at Central Animal Market Owerri, Imo State. The sorghum, millet, wheat, maize, rice, soyabeans, cucumber, tomato, onion and cabbage seeds were purchased from Nkwo Ogbe Market Ihiala L.G.A Anambra State.

4.2. Compost Preparation

All the non-compostable materials contained in the waste were sorted out and not included in the compost preparation. The waste materials were shredded to 5mm in size with the shredder. 3kg dried weight each were prepared from air dried and shredded wastes. The compost was prepared according to the method described by Selimet *al.* (2012).

5. Seed Germination Technique

This was carried out by the modified method of Selimet *al.* (2012) and Gopinathan and Thirumurthy, (2012). The compost extracts were evaluated by the seed germination technique in which water extract of each compost was prepared by shaking the samples with distilled water at 1:10 w/v ratio for 1 hr, and then filtered. Seeds of cabbage, onions, cucumber, soyabeans, tomato, maize, sorghum, millet, rice and wheat were surface sterilized by immersion in 75 % alcohol for three minutes and finally thoroughly washed with sterilized distilled water to get rid of the ethanol. 10 ml of water compost extract was applied to filter paper in a Petri dish and 10 seeds were then placed on the filter paper.

6. Calculation of Germination and Vigor Index

$$\text{Germination Index} = \frac{(\% \text{ Germination}) \times (\% \text{ Root length})}{100}$$

$$\% \text{ Germination} = \frac{\text{Average number of germination seed in test sample}}{\text{Average number of germination seed in control sample}} \times 100$$

$$\% \text{ Root Length} = \frac{\text{Average number of root in test sample}}{\text{Average number of roots in control sample}} \times 100$$

$$\text{Vigor Index} = \% \text{ Germination} \times (\text{mean root length} + \text{mean shoot length})$$

7. Results and Discussion

Parameter	No of seed germinated (SG)	Root length (RL)	Shoot length (SL)	% Relative seed germination (RSG)	% Relative Root Growth (RRG)	Germination index (CI) (%)	Vigour index (VI) (%)
Control/cabbage	6	2.20	2.10				
Test cabbage	7	4.00	1.50	116.60	181.80	211.90	641.30
Control/cucumber	7	9.50	9.00				
Test cucumber	3	6.70	7.00	42.85	70.50	30.22	587.00
Control/soyabean	4	3.90	8.10				
Test soyabean	4	3.70	6.00	100.00	94.87	94.87	970.00
Control/millet	5	17.50	6.80				
Test/millet	3	9.50	4.05	60.00	54.28	32.57	813.00
Control/maize	4	8.20	6.60				
Test/ maize	5	10.50	6.00	125.00	128.00	160.00	2062.50
Control/tomatoes	3	4.50	3.70				
Test/tomatoes	Nil	Nil	Nil				
Control/wheat	1	4.00	2.00				
Test/wheat	4	9.00	6.00	400.00	225.00	900.00	6,000.00
Control/sorghum	6	10.90	5.50				
Test/ sorghum	5	4.00	3.50	83.30	36.69	30.56	624.75
Control/rice	Nil	Nil	Nil				
Test/rice	Nil	Nil	Nil				
Control /onion	Nil	Nil	Nil				
Test/onion	Nil	Nil	Nil				

Table 1: Germination Profile of Goat Compost on Ten Plant Species at Week 0

Parameter	No of seed germinated (SG)	Root length (RL)	Shoot length (SL)	% Relative seed germination (RSG)	% Relative Root Growth (RRG)	Germination index (GI) (%)	Vigour index (VI) (%)
Control/cabbage	3	0.20	1.00				
Test cabbage	7	4.80	1.45	230.00	240.00	552.00	1437.50
Control/cucumber	5	12.15	11.05				
Test cucumber	6	10.40	11.90	120.00	85.00	102.00	2676.00
Control/soyabean	6	6.85	6.75				
Test soyabean	6	10.90	5.75	100.00	159.00	159.00	1665.00
Control/millet	3	16.75	5.50				
Test/millet	5	14.50	3.95	166.00	86.00	142.76	3062.70
Control/maize	10	12.00	7.75				
Test/maize	6	13.40	9.60	60.00	112.00	67.20	1380.60
Control/tomatoes	Nil	Nil	Nil				
Test/tomatoes	4	8.20	7.30	400.00	820.00	328.00	6200.00
Control/wheat	3	5.10	9.30				
Test/wheat	1	13.10	11.20	33.00	256.00	84.48	801.90
Control/sorghum	6	5.50	6.75				
Test/ sorghum	4.5	9.75	6.45	75.00	177.00	132.75	1215.00
Control/rice	Nil	Nil	Nil				
Test/rice	Nil	Nil	Nil				
Control /onion	Nil	Nil	Nil				
Test/onion	Nil	Nil	Nil				

Table 2: Germination Profile of Goat Compost on Ten Plant Species at Week 1

Parameter	No of seed germinated (SG)	Root length (RL)	Shoot length (SL)	% Relative seed germination (RSG)	% Relative Root Growth (RRG)	Germination index (GI) (%)	Vigour index (VI) (%)
Control/cabbage	4	4.00	2.50				
Test cabbage	5	4.35	3.30	128.00	108.00	138.24	979.20
Control/cucumber	5	12.15	11.05				
Test cucumber	5	15.75	12.00	100.00	129.00	129.00	2775.00
Control/soyabean	6	6.88	6.75				
Test soyabean	6	13.00	9.00	100.00	189.70	189.70	2200.00
Control/millet	3	16.75	5.95				
Test/millet	5	11.35	5.85	166.00	67.70	112.30	2855.20
Control/maize	10	12.00	9.75				
Test/maize	4	10.60	4.90	40.00	88.00	35.20	620.00
Control/tomatoes	Nil	Nil	Nil				
Test/tomatoes	Nil	Nil	Nil				
Control/wheat	3	5.10	9.30				
Test/wheat	Nil	Nil	Nil				
Control/sorghum	6	5.50	6.75				
Test/ sorghum	3	6.35	8.50	50.00	115.00	57.50	742.50
Control/rice	Nil	Nil	Nil				
Test/rice	Nil	Nil	Nil				
Control /onion	Nil	Nil	Nil				
Test/onion	Nil	Nil	Nil				

Table 3: Germination Profile of Goat Compost on Ten Plant Species at Week 3

Parameter	No of seed germinated (SG)	Root length (RL)	Shoot length (SL)	% Relative seed germination (RSG)	% Relative Root Growth (RRG)	Germination index (GI) (%)	Vigour index (VI) (%)
Control/cabbage	6	2.20	2.10				
Test cabbage	4	3.80	9.70	66.60	172.70	115.02	899.10
Control/cucumber	7	9.50	9.00				
Test cucumber	7	9.60	6.40	100.00	101.00	101.00	1,600.00
Control/soyabean	4	3.90	8.10				
Test soyabean	4	11.50	5.60	100.00	294.00	294.00	1,710.00
Control/millet	5	17.50	6.80				
Test/millet	2	5.10	10.70	40.00	29.10	11.64	632.00
Control/maize	4	8.20	6.60				
Test/maize	4	9.10	12.50	100.00	10.90	110.90	2,160.00
Control/tomatoes	3	4.50	3.70				
Test/tomatoes	2	7.70	7.70	66.60	171.10	113.95	1,025.64
Control/wheat	1	4.10	6.20				
Test/wheat	Nil	Nil	Nil				
Control/sorghum	6	10.90	5.50				
Test/ sorghum	4	12.80	8.80	66.60	117.40	78.19	1,438.56
Control/rice	Nil	Nil	Nil				
Test/rice	Nil	Nil	Nil				
Control /onion	Nil	Nil	Nil				
Test/onion	Nil	Nil	Nil				

Table 4: Germination Profile of Goat Compost on Ten Plant Species at Week 5

Parameter	No of seed germinated (SG)	Root length (RL)	Shoot length (SL)	% Relative seed germination (RSG)	% Relative Root Growth (RRG)	Germination index (GI) (%)	Vigour index (VI) (%)
Control/cabbage	3	20.00	1.00				
Test cabbage	5	2.25	2.25	166.00	112.00	185.92	747.00
Control/cucumber	8	12.65	12.90				
Test cucumber	7	16.75	12.25	870.00	132.00	1,148.40	25,230.00
Control/soyabean	1	1.00	4.00				
Test soyabean	3	14.50	5.00	300.00	145.00	435.00	5,850.00
Control/millet	2	7.00	6.00				
Test/millet	2	10.50	5.65	100.00	150.00	150.00	1,615.00
Control/maize	5	7.15	6.75				
Test/maize	5	15.00	5.75	100.00	209.00	209.00	2,075.00
Control/tomatoes	2	7.00	7.70				
Test/tomatoes	2	5.70	6.50	100.00	81.00	81.00	1,220.00
Control/wheat	Nil	Nil	Nil				
Test/wheat	1	4.00	0.65	100.00	400.00	400.00	465.00
Control/sorghum	3	8.00	7.75				
Test/ sorghum	5	8.50	9.75	160.00	106.00	169.00	2920.00
Control/rice	Nil	Nil	Nil				
Test/rice	Nil	Nil	Nil				
Control/onion	Nil	Nil	Nil				
Test/onion	Nil	Nil	Nil				

Table 5: Germination Profile of Goat Compost on Ten Plant Species at Week 7

Tables 1 - 4 shows the result of the germination profile of goat compost on ten plant species at different weeks. The result of the analysis showed the germination index of the test cabbage during the start-up (week zero) to be 211.9 while that of the control was 0 but during the 7th week the germination index of the test cabbage decreased to 185.92 even as that of the control cabbage remained at zero. For the testcucumber the germination index was 30.22 at the start up but increased to 1,148.4 at the 7th week even as the control remained at zero. For the test soyabean the germination index at the start up was 94.87 but increased to 435 during the 7th week. The germination index of the test millet at the start-up week was 32.57 but increased to 150 at the 7th week even as the control remained at zero. For the test maize, the germination index was 160 at the start up week but increased to 209 during the 7th week even as the germination index of the control maize remained at zero. The germination index for the test tomatoes was 0 at the start-up week but increased to 81 at the 7th week. For the test wheat the germination index was 900 during the start-up week but decreased to 400 at the 7th week. The germination index for the test sorghum at the start up week was 30.56 but increased to 169 during the 7th week. Also the vigor index of the test cabbage during the start-up (week zero) is 641.3 but during the 7th week the vigor index of the test cabbage increased to 747. For the test cucumber the vigor index was 587 at the start up but increased to 25230 at the 7th week. For the test soyabean the vigor index at the start up was 970 but increased to 5850 during the 7th week. The vigor index of the test millet at the start-up week was 813 but increased to 1615 at the 7th week. For the test maize, the vigor index was 2062 at the start up week but increased to 2075 during the 7th week. The vigor index for the test tomatoes was 0 at the start-up week but increased to 1220 at the 7th week. For the test wheat the vigor index was 6000 during the start-up week but decreased to 465 at the 7th week. The vigor index for the test sorghum at the start up week was 624.7 but increased to 2920 during the 7th week.

8. Summary and Conclusion

From the results and analysis, there was a significant increase in the germination index of the seeds, and staggering rise in the values of the vigor index. Therefore the fact that germination index and vigor index increased shows that the compost is matured and good and has the ability to increase the germination rate as well as make the seeds to produce normal seedlings.

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