

Review on Organic Waste Materials in Value of Nitrogen, Phosphorus and Potassium

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Abstract: Fertilizers divided into organic fertilizers and chemical fertilizers. Chemical fertilizers contain chemicals which can harmful to plants if used regularly. This problem will lead to other problems such as plants are no longer fertile and harmful to the environment. Some of the harm chemical fertilizers may cause waterway pollution, chemical burn to crops, increased air pollution, acidification of soil and mineral depletion of soil. An initiative has been designed to reduce the usage of chemical fertilizers by using organic waste materials such as eggshells, banana peels, spent coffee grounds, onion peels and spent grain. From 179 journals have been published between 2000 until 2020, only 30 journals has been selected. The primary objective of this study is to review the effectiveness of the organic waste materials in aspect of N, P, K value. 17 journals complied N, P, K suggested range with different ingredients. Organic waste materials able to supply enough needed nutrients to plants which can be considered as organic fertilizer.

Keywords: Organic Fertilizer, Chemical Fertilizer, N, P, K Value, Organic Waste Material

1. Introduction

Fertilizer have been used since the start of agriculture. Fertilizers are used daily by farmers to help crops and gardens grow. Chemical ingredients help create fertilizers that promote plant growth and make the cost more effective. Commercial fertilizers are strictly regulated by both individual states and federal government to ensure that they are safe for consumer, people nearby and the surrounding environment.

Plants need nitrogen (N), phosphorus (P) and potassium (K). They are important nutrients in plant growth with small amounts in fertilizers due to most of soils naturally contain enough of these components. Other micronutrients are needed in relatively small amounts for plant growth such as iron, chlorine, copper, manganese, zinc, molybdenum and boron. These micronutrients are functioning as cofactors in enzymatic reactions. While they may be present in small amounts, these compounds also

important to plant growth and plant can die without it. However fertilizer has its own disadvantages which is able to harm plants and soil.

The level of nutrients present in organic fertilizer is often low due to varies of nutrients contain. In addition, the nutrients are usually complex in organic chemical structure and will not produce the pop colour of seen. Using an organic fertilizer is a process, it is not an event.

The purpose of review paper study is to proof the fertilizer that produced from the organic waste materials such as kitchen waste or residual waste able to supply enough nutrients to plant as commercial chemical fertilizer. The previous multiple study cases will be used to identify and compare the effectiveness of organic waste materials. Chemical fertilizers have their place to increase plant nutrients especially in adverse weather conditions or during plants need additional nutrients in short time.

2. Materials and Methods

The study methodology is the design method, technique and analyses the data to obtain evidence that can support a study. The purpose of the methodology is to help understanding more detail the application of the research methods. Besides, it is used to achieve the goals and objectives of the study systematically. This part explains the preferred reporting items used and the database used as a reference source throughout the production of the research paper.

In the first phase, all articles related to the title of the research project which is organic fertilizer were searched and researched. Some keywords have been selected to obtain articles from a designated Google Scholar database. The keywords are “Efficiency of waste material as fertilizer” AND “effectiveness of banana peels, coffee grounds, eggshells as fertilizer” AND “coffee grounds as fertilizer” AND “recycling solid waste into organic fertilizer” AND “production organic fertilizer from solid waste” AND “utilization in intensive organic based vegetable production and for sustaining soil health” AND “re-use of industrial orange wastes as organic fertilizer”.

There are few types of systematic review such as qualitative, quantitative and meta-analysis. Qualitative is the result of the study are summarized but not statistically aggregated. Quantitative is statistical methods for combining results of two or more studies. Meta-Analysis is statistical methods to integrate estimates of the effects of relevant but independent studies and summarize them such as Preferred Reporting Items for Systematic Reviews (PRISMA) [1].

To produce this research paper, Google Scholar database is used as the main source throughout the Systematic Review Process. Google Scholar become main reference as it meets all the criteria and has a lot of information on the research that being studied. Copy a link and paste at the Google Scholar searching area will give the reader a full text version of the article [2]. Rather than using a full sentence to find a literature, reader can use a keyword that related to the article and the Google Scholar will assist the reader by listing the suitable references.

3. Results and Discussion

Result is a collected group of information that have been gathered based on a chosen method. Generally, **Figure 1** shows the work step that have been run to complete the project is divided to the several main stages such as discussing objectives of project, search minimum 30 journals or articles and screening in finding related articles and journals.

3.1 Flow Diagram

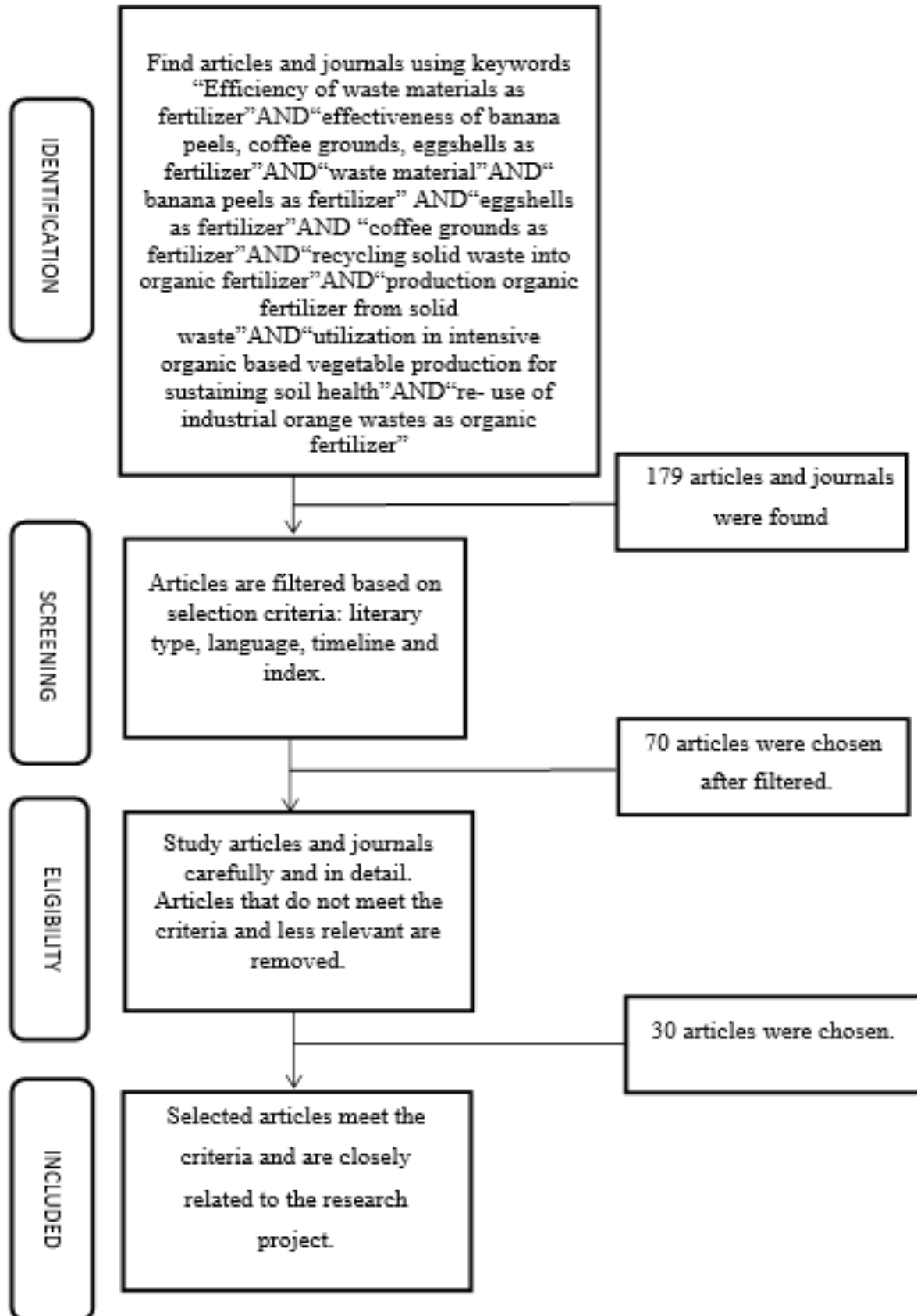


Figure 1: Flow diagram of articles selection

In phrase of identification, the keywords selection applies to select a topic which is organic fertilizers. There are various articles and findings related to organic fertilizer innovation. In the next step, 179 references from all articles and journals were selected.

Next phase is screening. Systematic Review Process involves filtering the selected articles based on the use of keywords in phase 1. Filters in phase 2 are performed according to the criteria of selection and removed any similar articles in the database. Then, the rest of the articles will be filtered according to the selection criteria. This is intended to reduce the quantity of articles to facilitate this study and to select the relevant articles in phase 3.

Phase 3 is the final phase in the selection of articles to be used as the primary source of references in helping to produce the review paper. All 70 articles beyond phase 2 will be researched and read in depth by the researcher to find articles that really have something in common with the research done from various aspects such as concept, type and purpose of the study and the results of the study that should be achieved. Upon review, at the end of this phase 30 articles were accepted and 40 articles were removed due to the lack of research related to such differences in manufacturing and production as well as the type of material used.

3.2 Discussion

Result from this review paper study proved that organic waste materials has the ability to be a fertilizer as chemical fertilizer.

Table 1: Findings Based on Nitrogen, Phosphorus and Potassium Percentage

No.	Author	List of Ingredients	N % (mean)	P % (mean)	K % (mean)
1.	[3]	Orange peel and orange pulp	0.05	2.52	1.07
2.	[4]	Empty fruit bunches of oil palm, paddy straw, cassava peel, banana peel, market waste, household waste, restaurant waste	0.95	0.26	0.57
3.	[5]	Eggshell powder, wood ash, banana peels, used tea waste	0.07	0.0015	0.0079
4.	[6]	Cow dung, kitchen waste, coffee grounds	1.74	0.28	0.73
5.	[7]	Food waste	3.56	0.012	0.24
6.	[8]	Eggshell	0.04	0.0005	0.012
7.	[9]	Tapioca peel, banana peel, banana chips, coconut candies, grated coconut	4.37	0.03	0.08
8.	[10]	Candy, chips, banana peel, tapioca peel, banana peel, coconut husk, bread fruit peel	0.22	0.0014	0.069
9.	[11]	Food waste, paper, vegetable scrap, plant leaves, banana, cassava, pawpaw peelings, plant cuttings	1.4	0.05	0.28
10.	[12]	Discarded vegetables, vegetable peel, fruit peel, coffee and tea grounds, dry leaves, soil, shredded paper, shredded newspaper	0.9	0.8	0.4
11.	[13]	Eggshells, salad leaves, fruit peel, vegetable residues, sawdust, fewer amounts of paper and worms	0.23	2.53	2.4
12.	[14]		20	20	20
			days:	days:	days:
		Cow dung, vegetable, fruit waste, agricultural waste, paper waste	1	0.25	0.3
			45	45	45
			days:	days:	days:
			1.09	0.27	0.42
13.	[15]	Spent coffee grounds	Fresh	Fresh	Fresh
			SCG:	SCG:	SCG:

			3.35 Compo sted SCG: 3.81	0.0084 Compo sted SCG: 0.0085	0.0015 Compo sted SCG: 0.0024
14.	[16]	Tomato	1.35	0.19	1.16
15.	[17]	Shrimp pond solid waste	0.58	3.33	0.82
16.	[18]	Fish and crab waste	1.18	0.48	0.58
17.	[19]	Chicken manure	5.33	2.41	1.34
18.	[20]	Rice	17.5	6	12
19.	[21]	Lettuce, goat manure	0.95	0.17	0.37
20.	[22]	Fish waste	8.3	4.8	1.6
21.	[23]	Okra	0.13	0.02	0.3
22.	[24]	Tomato, white lead tree, velvet bean, snap bean, elephant grass, chicken manure, cow manure, rabbit manure, goat manure, bat manure	5.41	0.32	1.87
23.	[25]	Cow dung, poultry manure, cassava peelings compost, rabbit droppings, cane rat droppings	1.3	0.58	2.15
24.	[26]	Banana, sweet lime	0.0001	0.0003	0.03
25.	[27]	Organic-based vegetable	1.72	2.6	1.75
26.	[28]	Cassava/maize/melon intercrop with relayed cowpea	1.65	0.91	0.52
27.	[29]	Okra	1.82	1.46	2.75
28.	[30]	Seed cake and chicken manure	3.2-4.6	1.2-1.7	1.4-2.1
29.	[31]	Turnip (<i>Brassica rapa</i>) plants	1.1	1.1	3.6
30.	[32]	Spent grain	20	10	10

Most of the listed organic waste materials in **Table 1** have passed the suggested range of minimum requirement as fertilizer. The suggested ranges are 0.6% and above for nitrogen, 0.22% and above for phosphorus 0.25% and above for potassium. Organic waste-based fertilizer can be highlighted as the greatest alternative way to reduce the usage of chemical fertilizer in agricultural sector as it provides essential nutrients to the soil and plant growth. Besides, it can also reduce the environment pollution that have been pointed out earlier.

4. Conclusion

All objectives of this review paper study have been achieved at the end of this project. The first objective of this study is to identify the effectiveness of the organic waste materials as a fertilizer in aspect of N, P, K values. It has been proven in **Table 1**. For the second objective, organic waste materials passed the minimum requirement as a fertilizer based on the N, P, K values. The results shows that organic waste materials can be a good fertilizer.

For the recommendation, government able to increase efforts to produce more organic fertilizers by using organic waste materials as a way to reduce the usage of chemical fertilizer. Besides, future research need to study other element for plant growth such as calcium, magnesium dan Sulphur. Although they may be present in small amounts, these nutrients are significant for plant growth and without them plants can die.

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