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Organic-Mineral Fertilizer Based On Manure

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Abstract

In this article, composts are prepared based on manure and phosphorite at mass manure ratios: phosphorite (from 100 : 5 to 100 : 30). Water was added to the prepared mixture based on the calculation to achieve 70% moisture content. It was determined the kinetics and degree of organic part transformation of manure into humic substances and indigestible phosphorus forms into a form assimilable for plants in slime phosphorite.

Keywords: Manure, phosphorites, compost, humic acids, organomineral fertilizers, composition and properties

Introduction

Humus is major composite of soil determining its property and fertility. Significance of humus in soil is vast. As humus improves soil's chemical, physical and biological properties promoting generation of strong structure that provides plant by nitrogen and other substances in exposed form during the mineralization. It should be note that livestock farm's manure is the main source of organic matter for reproduction of humus in agriculture [1]. The main value of manure as a fertilizer is content of more nitrogen and carbon, which can increase growth of crop a span of manure application. Carbon-base material supplies or grows humus content of humus in soil, therefore, piling soil fertility in the future. In that case, after application manure works in soil during the some years that is as a fertilizer with prolonged activation.

The manure-phosphorite composts preparation is the conditions creation for the humus formation from various organic substances. The humus formation from organic matter in compost is an extremely complex process carried out as an active vital activity result of microorganisms. The most valuable humus, in composts from livestock farms waste, is formed in a neutral environment, moderate moisture and the optimal conditions creation for the microorganisms' life [2]. To obtain high quality composts, mineral fertilizers, phosphate rock, lime and other substances are usually added to the manure. These additives are necessary to maintain the medium pH and as nutrients for various microorganism types [3-4].

The work [5] shows that the manure decomposition composted with phosphate rock accumulates a significant amount of organic acids that form salts with ammonium, potassium and other substances. These salts interact with phosphorite flour, form insoluble organic compounds with calcium and more mobile compounds of phosphorus with ammonium and potassium.

The work [6] indicates that when composting manure with improper stacking, a large amount of nutrients, primarily nitrogen, are lost. According to the All-Union research institute of fertilizers and agricultural soil science, the total nitrogen loss for 3 composting months was 20-25%, the organic matter loss was 25-30%. When composting manure with phosphate rock, the liquid fraction loss decreases, and the organic matter humification rate in the manure increases. At the same time, as a rule, the nitrogen loss from manure is reduced, and the phosphate rock phosphorus is converted into more mobile compounds available for plants. Also in this work it is shown that the manure efficiency composted with phosphate rock (1-2%) and used in a clean fallow for winter crops is 1,5-2 times higher than the ordinary manure efficiency.

The work [7] shows that a decrease in the concentrated phosphorus-containing mineral fertilizers availability for agriculture, produced by industry, leads to the soil fertility depletion and to a drop in the crop yields level. In order to solve this problem, the All-russian scientific research institute of agrochemistry named after D.N. Pryanishnikov developed a technology for producing low-tonnage phosphorus-containing organomineral fertilizers implemented on the agro-industrial complex equipment as raw materials used cattle manure, zeolite and glauconite concentrate, which is a mixture of the latter with phosphate flour.

There are various agro-ores in the soil of Karakalpakstan, such as phosphorite, glauconite, bentonite. Phosphorites in Karakalpakstan (KP) are physicochemically different from other phosphorites in our country.
Today, Karakalpak phosphorites mainly consist of water-insoluble medium salts. At present, these phosphorites are not directed to processing on the basis of traditional existing technologies, as the available reserves are low and structurally low-grade phosphorites. Today in acute shortage of phosphorus fertilizers, these phosphorites application to agricultural needs is one of the urgent problems.

One of the rational ways to process substandard phosphorites is their use in the composts preparation based on cattle manure.

Earlier, we [8-10] conducted research on the organic fertilizers production based on cattle manure or poultry manure and substandard phosphorites.

It was shown that with an increase in the composting duration in all ratios, the humic substances formation and mobile forms of phosphorus increases, with an increase in the amount of substandard phosphorite in composts, the loss of organic matter decreases, and the organic part conversion degree of manure into humic substances increases.

This work purpose is to convert the indigestible form of P_2O_5 acid phosphatase (AP) into an assimilable form for plants, to convert organic matter of manure into humic substances by composting and obtaining phosphorus-containing organomineral fertilizers. The goal achievement will allow increasing the amount of phosphorus-containing humus fertilizers, which are in great deficit in Uzbekistan.

Methods and Materials

In laboratory conditions, phosphorite with the following composition was used as raw materials(wt%): P_2O_5 – 19,05; CaO – 39,19; Al_2O_3 - 3,19; Fe_2O_3 – 2,08; MgO – 0,91; CO_2 – 3,93 and cattle manure (wt. %): moisture – 72,74; ash – 4,19; organic matter – 23,02; humic acids – 2,23; fulvic acids – 2,65; water-soluble organic matter – 2,11; P_2O_5 – 0,21; N – 0,48; K_2O – 0,74; CaO – 0,41. The composts were prepared at a weight ratio of manure: phosphorite 100: 5; 100: 10; 100: 15; 100: 20; 100: 25; and 100: 30. Water was added to the prepared mixture based on the calculation to achieve 70% moisture content. The resulting mixtures were placed in a 0,5 L polyethylene vessel. A thin layer of soil was poured on top of the mixture. Then the cans were placed in a thermostat and kept at 25°C. Every 15 days, samples were taken to determine the composition, and then the required amount of water was added, mixed and again placed in a thermostat.

In the samples taken, the total and various assimilable forms content of P_2O_5 was determined according to the well-known method [9]. Ash content according to SS 26714-85, moisture content according to SS 26712-85, organic matter was determined according to GOST 27980-80. The water-soluble fraction of organic substances was extracted from the products with water, filtered, and its amount was determined by evaporating the filtrate in a water bath and drying the solid residue to constant weight, followed by burning it to determine the ash content and subtract it. Humic acids were isolated by treating the products with a 0.1 n alkali solution and acidifying the solution with mineral acid [10]. The solid phase after alkali-soluble organic substances separation from it is the residual organic matter. It was thoroughly washed with distilled water, and then dried to constant weight, and the yield on organic matter was determined. The difference between the amounts of alkali-soluble organic substances and humic acids gives us the fulvic acid content in the compost.

Results and Discussion

So, with a weight manure ratio: phosphorite 100: 5 for 90 days, the relative $P_2O_{5acceptable}$ by EDTA and 2% citric acid solution increases from 41,26 and 28,46% to 72,54 and 63,40%, and at 100: 30 ratio, $P_2O_{5acceptable}$ by EDTA and 2% citric acid solution increases to 55,07 and 46,73%, respectively. This means that with an increase in the amount of phosphorite in the mixture, the assimilable forms content of P_2O_5 decreases.

Table 1-3 shows the changes results in the humic acids, fulvic acids and water-soluble organic substances content.

The tables show that with a weight ratio of manure: phosphorite 100: 5, after 15 days, the humic acids, fulvic acids and water-soluble organic substances content in organic mass is 2,12%, 2,51%, 2,10%, and after 90 days already reaches 3,33%, 3,85%, 3,21%, respectively. With a weight manure ratio: phosphorite 100: 30 after 15 days, the above and organic substances content is 1,89%, 1,94%, 11,67%, and after 90 days it already reaches 3,09%, 3,32%, 2, 89% respectively.

At figures 1 and 2 total there are presented the changing total content of organic matter and nitrogen in the composts depending upon weight ratio of Manure : Phosphorite. Thus, when weight ratio of Manure : Phosphorite 100 : 5 for 90 days losses of organic matter and nitrogen into atmosphere is 19,32 and 23,12 %, and at 100 : 25 that of indicated substances make up 10,65 and 14,23 %, that is with increase content of mineralized mass in the compost losses of the substances are reduced in gas phase.

Table 1: The humic acids content changes in composts depending on the exposure time and mass ratios manure: phosphorite

Mass ratio of manure to phosphorite	Humic acids content in composts on the total mass, %					
	Exposure time, days					
	15	30	45	60	75	90
100 : 5	2,12	2,38	2,73	3,02	3,21	3,33
100 : 10	2,05	2,34	2,69	2,99	3,17	3,28
100 : 15	2,04	2,26	2,56	2,85	3,06	3,18
100 : 20	1,98	2,21	2,53	2,83	3,04	3,14
100 : 25	1,93	2,19	2,51	2,81	3,01	3,12
100 : 30	1,89	2,16	2,47	2,79	2,99	3,09

Table 2: The fulvic acids content changes in composts depending on the exposure time and mass ratios manure: phosphorite

Mass ratio of manure to phosphorite	Fulvic acid content in composts on the total weight, %					
	Exposure time, days					
	15	**30**	**45**	**60**	**75**	**90**
100 : 5	2,51	2,75	3,14	3,46	3,70	3,85
100 : 10	2,40	2,66	3,05	3,39	3,63	3,76
100 : 15	2,33	2,62	3,02	3,37	3,59	3,72
100 : 20	2,14	2,48	2,88	3,24	3,46	3,55
100 : 25	2,00	2,34	2,71	3,09	3,29	3,38
100 : 30	1,94	2,29	2,66	3,04	3,24	3,32

Table 3: The water-soluble organic substances' content change depending on the exposure time and mass ratios manure: phosphorite

Mass ratio of manure to phosphorite	Water-soluble organic matter content in composts on the total weight, %					
	Exposure time, days					
	15	30	45	60	75	90
100 : 5	2,10	2,29	2,61	2,87	3,07	3,21
100 : 10	2,07	2,28	2,59	2,86	3,06	3,20
100 : 15	2,01	2,29	2,65	2,96	3,14	3,26
100 : 20	1,84	2,14	2,5	2,82	3,01	3,1
100 : 25	1,71	2,01	2,34	2,67	2,85	2,93
100 : 30	1,67	1,97	2,3	2,63	2,81	2,89

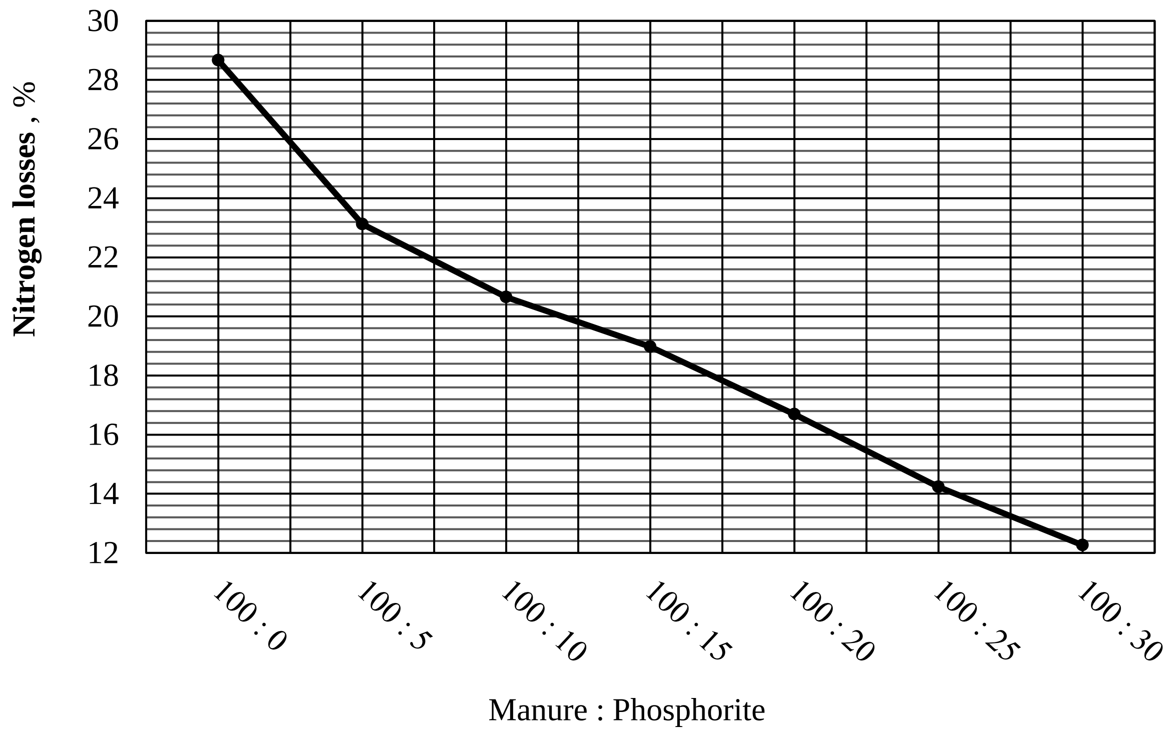

Figure 1. Nitrogen losses in the composts based on cattle manure and phosphorite.

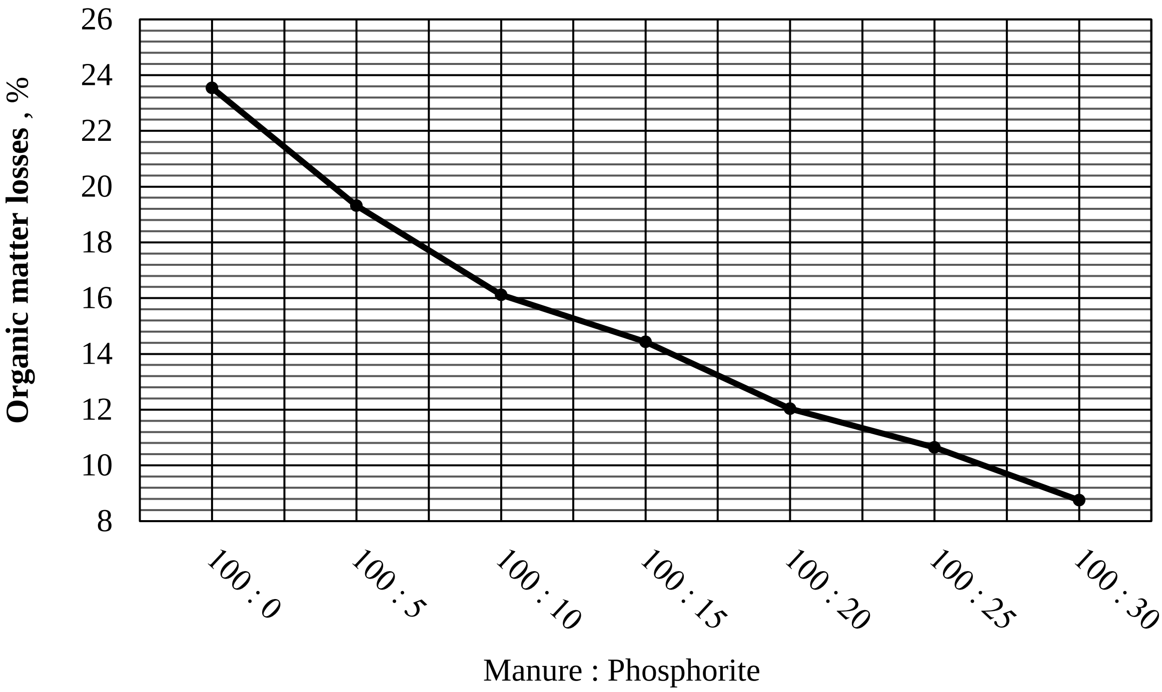

Figure 2. Organic matter losses in the composts prepared based on manure and phosphorite.

The data in the tables clearly show that an increase in the exposure time of composts contributes to an increase in the humic and fulvic acids and water-soluble organic substances content, an increase in the mass fraction of phosphorite in relation to manure leads to a decrease in their content.

Conclusion

On the basis of laboratory studies, it is shown the fundamental possibility of obtaining phosphorus-containing organic fertilizers. It is shown that an increase in the exposure time of composts contributes to an increase in the phosphorus, humic and fulvic acids, and water-soluble organic substances forms assimilated for plants, and an increase in the mass fraction of sludge phosphorite, on the contrary, leads to a decrease in these indicators.

REFERENCES

Sergeev Yu.A. Preparation of compost from wood processing waste and cattle manure // Achievements of science and technology of the agro-industrial complex, 2008, №11, p. 59-61.

Belyuchenko I.S. The role of living organisms in the development of complex compost // Polythematic network electronic scientific journal of the Kuban state university. Krasnodar: KubSAU, 2014. -№ 95 - p. 232-241.

MC Manna, A. Subra Rao, Asha Sahu and UB Singh. Compost Handbook: research-production-application. 2012. P.132.

Tranua P. A practical guide to composting and improving soil fertility - M. Eksmo, 2014. p. 112

Mamchenkov I.P. Compost, their preparation and application - L .: Selhozizdat, 1962. – p. 10-23.

Korovkin M.A. Organo-mineral fertilizers. - M.: Publishing house Knowledge,1954. – p. 11-12.

Budkov V.A. Adrianov S.N. Shabarova E.V. Technology for the preparation of phosphorus-containing organomineral fertilizers. M: Fertility,2009, №5, p. 24-25.

T.J.Pirimov, Sh.S.Namazov, A.R.Seytnazarov, U.Sh.Temirov, N.Kh.Usanbaev. Obtaining of magnesium oxide from serpentenites of the arvaten deposit of Uzbekistan. // International Journal of Advanced Science and Technology. – Austria, 2020. -Vol. 29, № 8. -pp. 1619-1627.

Methods of analysis of phosphate raw materials, phosphoric and complex fertilizers, feed phosphates / M.M. Vinnik, L.M. Erbanova, P.M. Zaitsev etc. - M .: Chemistry, 1975. p. 218

Dragunov S.S. Methods of analysis of humic fertilizers // Humic fertilizers. Theory and practice of their application. - Kharkov: Publishing house of Kharkiv State University, 1957. p. 55