

Organic Mineral Fertilizers Based on Aznek Phosphorites

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Abstract:

Composts were prepared using chicken manure and Aznek phosphorite at weight ratios of Dung to Phosphorite ranging from 100:2 to 100:25. Water was added to the mixture to achieve a moisture level of up to 70%. The kinetics and rate of transformation of organic matter from chicken manure into humic substances, as well as the conversion of non-assimilable phosphorus into plant-available forms within the mineralized mass, were analyzed.

Keywords: Chicken manure, mineralized mass, composting, phosphorus, calcium, and organic-mineral fertilizer.

Introduction. The soil fertility mainly depends from organic matter playing role in soil formation processes and improvement of soil physicochemical properties, supply of plants by nutritional and biological active substances. The soil is exhausted rapidly without organic fertilizers especially when intensive methods of farming management. Nutrients of mineral fertilizers cannot replace humus as nitrogen source and others ones releasing when it mineralization although they will apply into soil a lot. The soil practice and results numerous agrochemical researches show that application the same mineral fertilizer affect negatively on soil properties, that is, humus content is decreased, microorganisms' numbers and composition are changed, direction of chemical and biological transformations is changed, as a result the fertility of the soil is reduced. When high content of the humus and due to more favourable agrophysical properties, the return from fertilizer increases in 1,5-2 times [1-3].

Therefore, when use of the fertilizers it is important to include reserves of humus in the soil. Maintenance of the humus reserves level in the arable soil can be exercised by regular of organic

and organ mineral fertilizer application. Compost prepared based on waste from chicken farm amuses important place in the system of organic and organ mineral fertilizers. Many countries the composting organic wastes have already become sector on processing ones into fertilizers. Some enterprises, farm managements and scientific production associations work composting. In Uzbekistan there is no single science-based approach on preparation of the composts based on wastes from stock farms. The humus formation is made from organic substances in the composts is exclusive complex process which implements during the microorganisms' vital functions. The most valuable humus in the composts formed from stock farms in neutral oxidation and tempered moistening and during the optimal conditions for active vital functions of microorganisms. To create optimal condition during the composting stock farmer wastes it is added mineral fertilizers, phosphorite flour, lime carbonate and other matter. These substances are necessary to support pH, as well as nutrient for microorganisms' vital functions [4-6].

Formation of humus from organic matter in the compost is exceptional complex process conducting as a result of life activity of microorganisms, as well as physical and chemical processes. The most valuable humus in the compost from livestock farms is generated at neutral ambient under medium wetting and creation of optimal condition. For obtaining composts with high quality some mineral fertilizer, phosphorite powder, limestone and so on usually are added in chicken manure. These substances it is necessary to support pH medium and as nutrient elements for various microorganisms [7-9].

Composting chicken manure with addition of phosphorite powder is the most effective way. In [10-12] presented that during the decomposition of chicken manure with phosphorite powder fair quantity of organic acids piled up forming ammonium, potassium salts and others in the compost. These salts interact with phosphorite powder generating insoluble organic compounds of calcium and more movable compounds of phosphorus with ammonium and potassium.

It is necessary to note that in 2016 JSC "Uzkiymyosanoat" produced 153.8 thousand tonnes of phosphoric fertilizers (based on 100% of P_2O_5). As regards, need of agriculture of Uzbekistan is 691.7 thousand tonnes of P_2O_5 . These figures indicate that provision of agriculture for phosphoric fertilizer is insufficient. Today, at Kyzylkum phosphorite combine there are produced waste in form of off-balanced ore (13-15 % P_2O_5) and phosphorite sludge (10-12 % P_2O_5) during the beneficiation process of Central Kyzylkum phosphorite. Total number produced waste phosphorite has already reached 13 billion tonnes. One of the most rational approaches of low-grade phosphorite processing is usage of compost technology based on chicken manure.

Early we [13-14] carried out research on obtaining organic-mineral fertilizers on the basis of manure of chicken, avian litter with the addition of slime phosphorite of the Central Kyzylkum. It was shown that with increasing composting time, the formation of humic substances and mobile forms of phosphorus increases in all ratios.

The purpose of the present research is transfer of unassimilable P_2O_5 in Aznek phosphorite into assimilate form for plat, as well as investigation of losses decrease of nitrogen and organic matter into atmosphere in compost. Goal attainment allows to increase amount of phosphorus containing humic fertilizers that are large lack in Uzbekistan soils.

Methods and materials. In laboratory as an object it was used that mineralized mass content (weight. %): P_2O_5 - 22,84; P_2O_5 acceptable by EDTA - 5.57; CaO - 49.73; Al_2O_3 - 3.88; Fe_2O_3 - 0.79 %. Chicken manure (weight. %): moisture - 65.04; ash - 11.34; organic matter - 24.07; humic acid - 1.31; fulvic acids - 5.42; water soluble organic substances - 1.22; P_2O_5 - 1.24; N - 1.14; CaO - 1.62.

Composts were prepared under weight ratio of Dung : Phosphorite equal to 100 : 2; 100 : 5; 100 : 10; 100 : 15; 100 : 20 и 100 : 25. In prepared mixing it was poured water based on calculation to reach till 70%. Obtained mix was placed in vessel with 0.5 l then from above thin layer earth was

poured. Subsequently, vessels were placed and incubated in thermostat at 25 °C. Each 15 days some samples were selected to determine for composition then required quantity of water was poured subsequent stirring and setting in the thermostat more.

The results are summarized in figures 1-4.

Results and discussion. In figures 1-2 given the data of acceptable form of P_2O_5 and humic substances changing depending on composting duration and weight Dung : Phosphorite. So, when weight ratios of Dung : Phosphorite equal to 100 : 2 for 90 days relative content of P_2O_5 acceptable by EDTA and 2 % solution of citric acid increase from initial 5.57 % to 16.43 %, while at ratio of 100 : 25 P_2O_5 acceptable by EDTA and 2 % solution of citric acid grow to 10.54 % respectively.

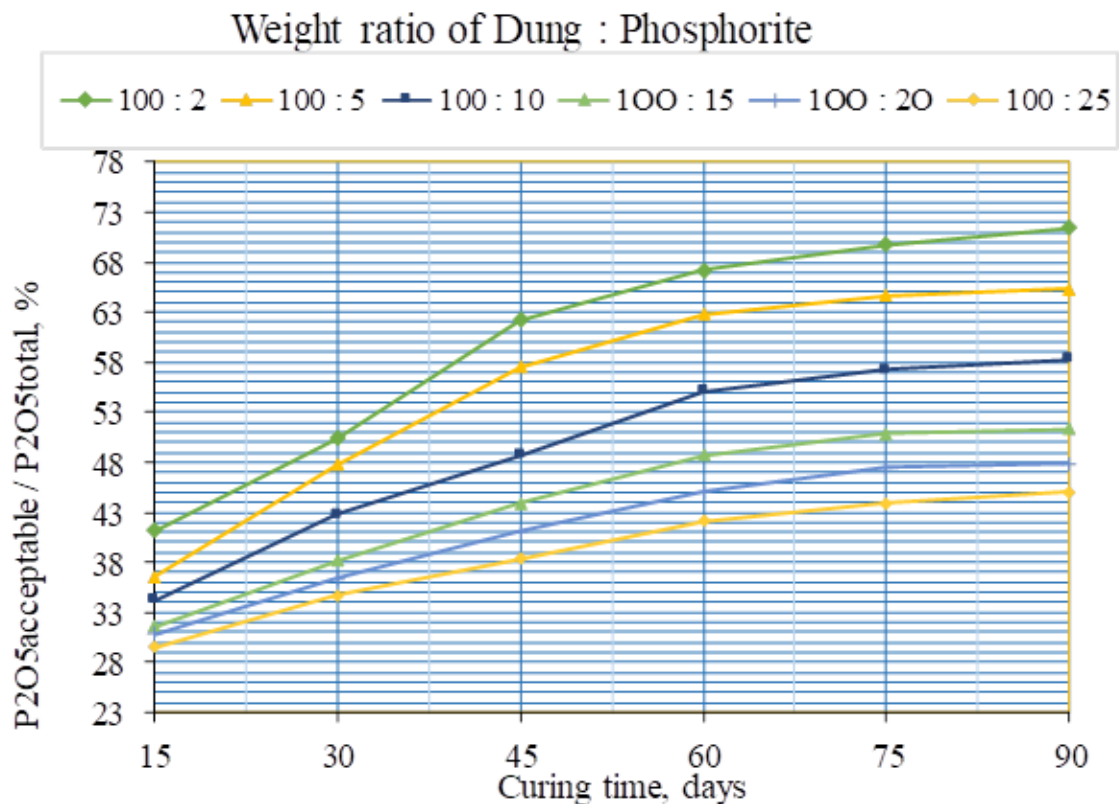


Fig. 1 Changing acceptable form of phosphorus by EDTA depending upon the curing time and weight ratio of Dung: Phosphorite

At figures 3 and 4 total there are presented the changing total content of organic matter and nitrogen in the composts depending upon weight ratio of Dung : Phosphorite. Thus, when weight ratio of Dung : Phosphorite 100 : 2 for 90 days losses of organic matter and nitrogen into atmosphere is 26.57 and 21.75 %, and at 100 : 25 that of indicated substances make up 14.22 and 9.87 %, that is with increase content of mineralized mass in the compost losses of the substances are reduced in gas phase.

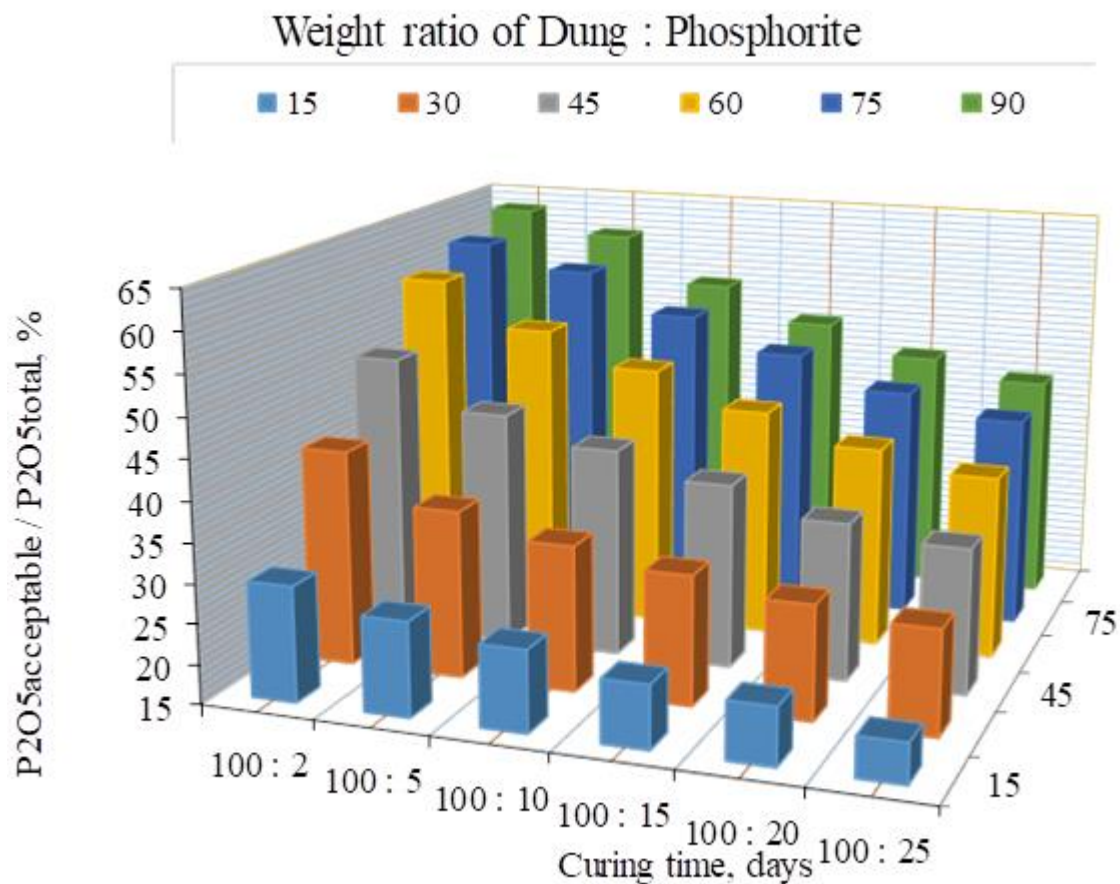


Fig. 2 Changing acceptable form of phosphorus by citric acid depending upon the curing time and weight ratio of Dung: Phosphorite

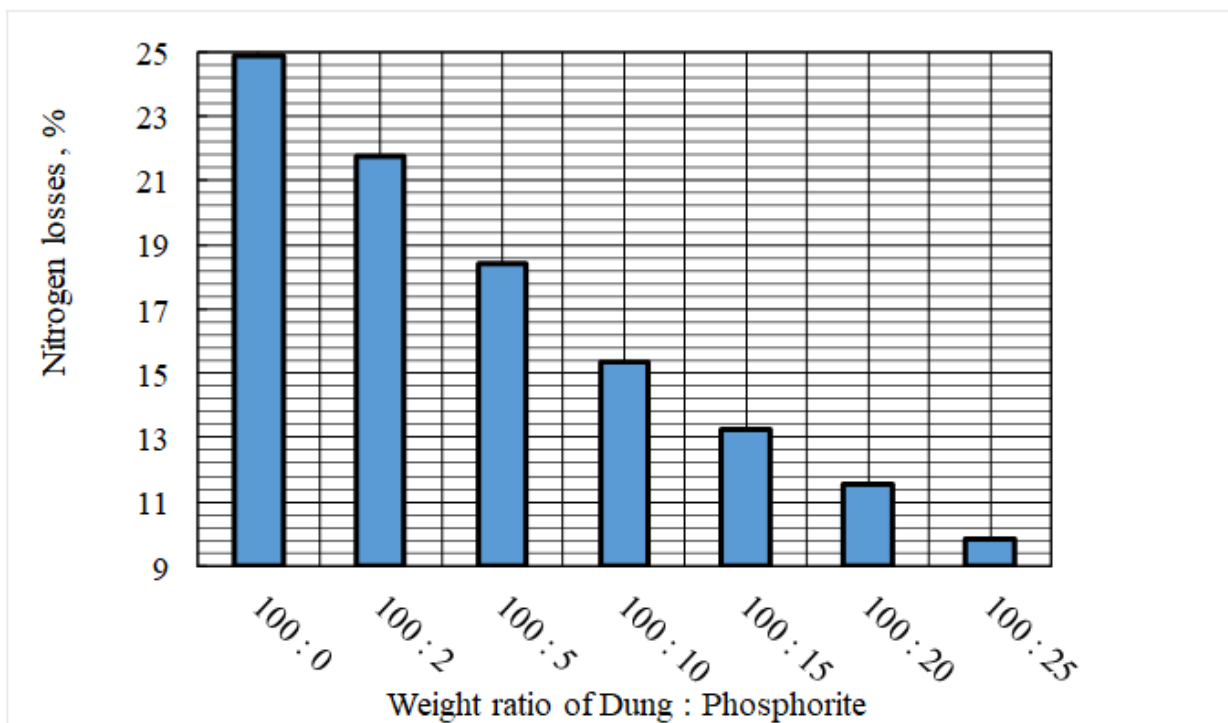


Fig. 3. Nitrogen losses in the composts based on Aznek phosphorite and chicken manure.

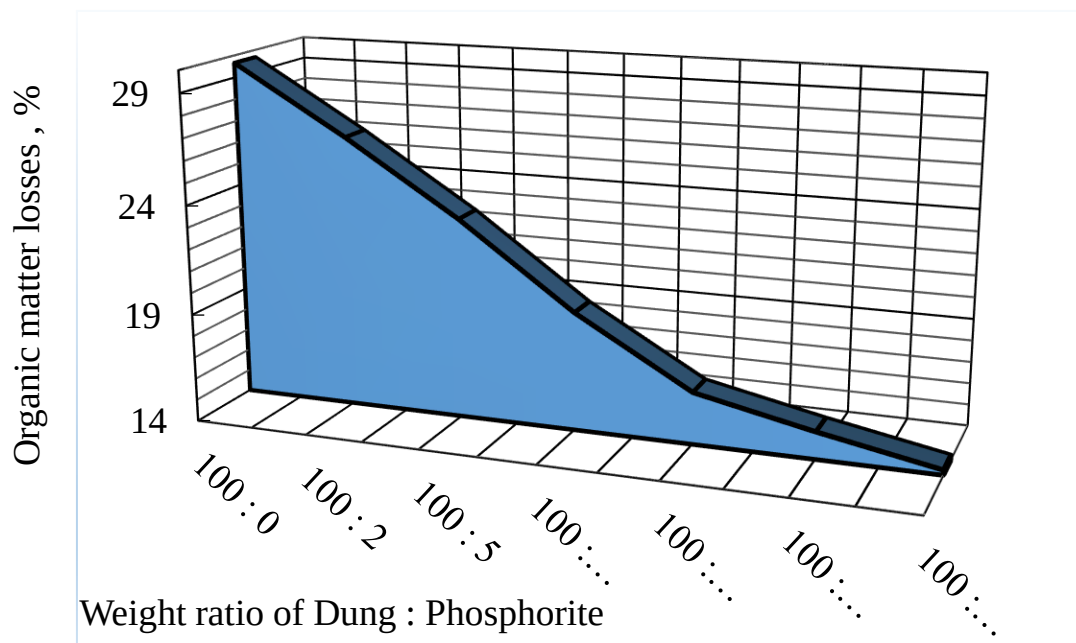
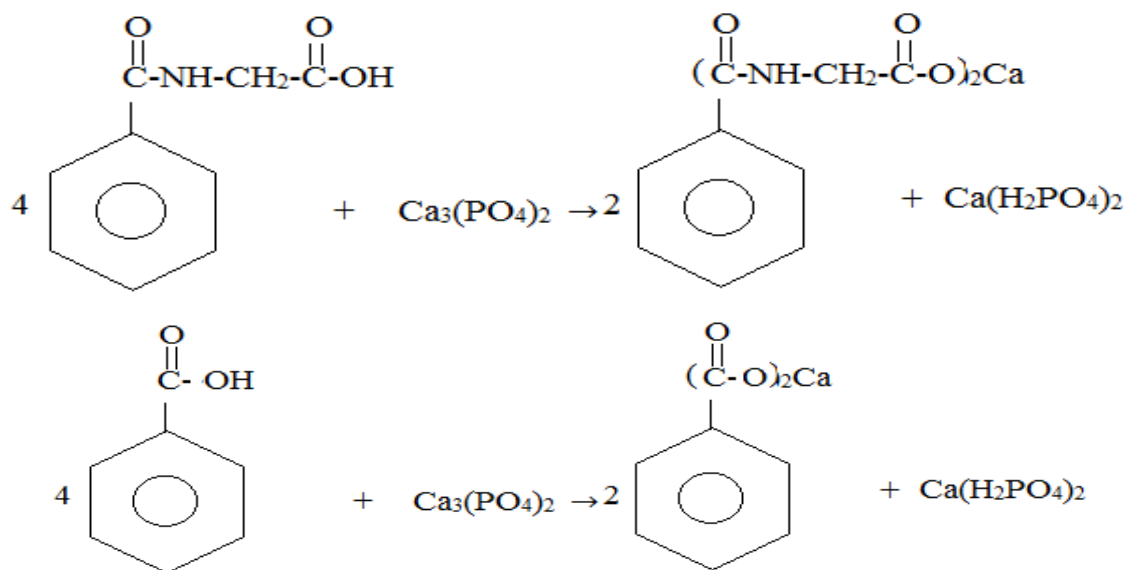
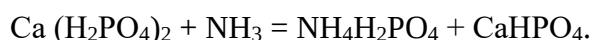
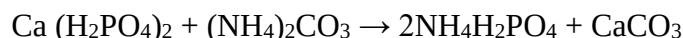
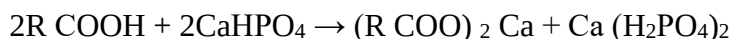
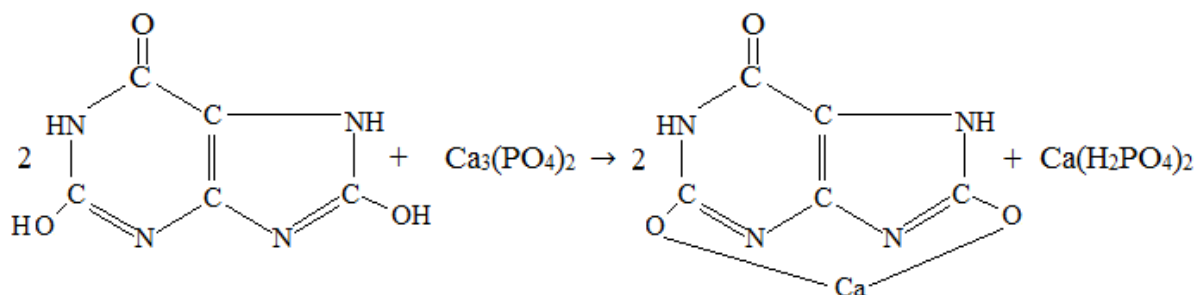
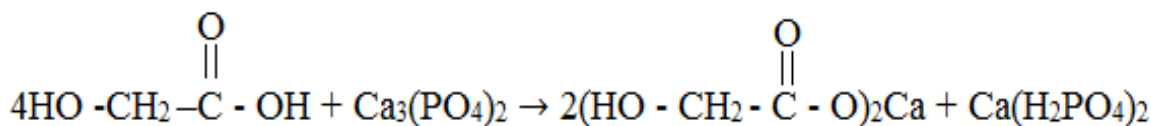
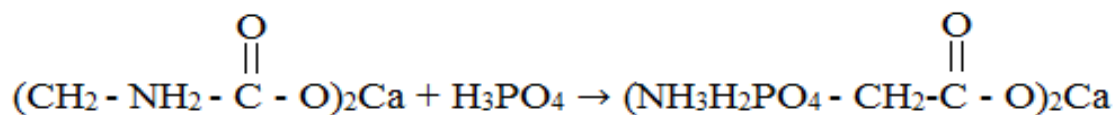
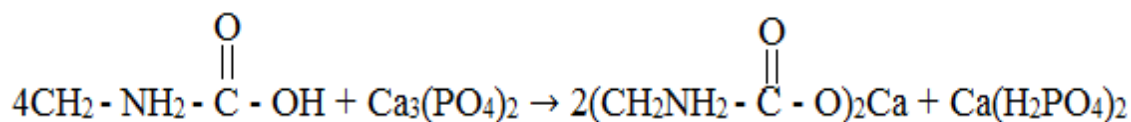


Fig. 4. Organic matter losses in the composts prepared based on Aznek phosphorite and chicken manure.

Furthermore, the results of the research show that conversion phosphorus in mineralized mass into acceptable form, decrease of emission ammonia and organic matter takes place due to interaction of organic acids with phosphates. In literature there are some information about decomposition of urea, hippuric acids and other organic acids to ammonia and more low-molecular acids, as well as till CO_2 and H_2O during the worsen packing. These substances possess all properties of carboxylic acid, which generate salts of complex ethers and amides. However, their anhydrides are unstable due to presence of NH_2 -groups. In case, composting chicken manure with mineralized mass the organic acids interact with phosphates and generate acceptable form of phosphorus such as monobasic calcium phosphate and water unsoluble compounds of calcium with organic acids. Due to interaction mono basic calcium phosphate with ammonia mono ammonium phosphate and acceptable form of phosphorus as dicalcium phosphate are generated. Chemical reaction between chicken manure and phosphate can be described as follows below:





Conclusion.

Thus, investigation of composts prepared in a range of weight ratios of Dung : Phosphorite = 100 : (2-25) have shown that when composting chicken manure with mineralized mass because of interaction of organic acids with phosphorite movable phosphorus content increases while losses of organic matter and nitrogen reduce considerably, which promote finally growth of product outlet. In addition, it was established that increasing the curing time of composts leads to raise acceptable form of phosphorus, humic and fulvic acids, as well as water-soluble organic matter while increase mass fraction of phosphorite in towards to chicken manure promotes to grow conversion rate of organic matter into humic acids, fulvic acids and water-soluble organic matter.

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