Original Article

Organomineral Fertilizers Based Phosphorite Flour Of Central Kyzylkum

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Abstract

The article presents the results of studying the effect of a solution of a consortium of microorganisms containing on changes in the chemical composition of composts prepared on the basis of cattle manure and fhosphorite flour of Central Kyzylkum depending on the mass ratio of the initial components and the duration of composting. At the mass ratios of cattle manure: phosphate flour: solution of a consortium of microorganisms = 100: 10: 2 and keeping for 40 days at a reducing the loss of nitrogen and organic matter from 14.68 to 8.91% and from 19.31 to 13.13%, respectively.

Keywords. cattle manure, fhosphorite flour, phosphorus, humus, humic acid, fulvic acid.

Introduction.

It is known that the source for obtaining organic and organomineral fertilizers are: litter manure, litterless manure, bird droppings, peat, brown coal, green fertilizer, straw, sapropel, household and industrial waste, as well as sewage sludge. The cheapest source of organic matter for the reproduction of humus in agriculture is cattle manure from livestock farms, the average content of N, P, K in which is, respectively: 0.62; 0.34 and 0.64%, the high efficiency of cattle manure has been proven by a centuries-old history of use. Manure after transformation into organic fertilizer is a huge resource for humus replenishment, and therefore, the key to increasing soil fertility and improving its physical and chemical properties [1-3].

Soil is a natural habitat for a variety of microorganisms and the best environment for their preservation; it is the main reservoir and supplier of microbes to water and air. The soil has all the necessary conditions for the life of microorganisms: nutrients, sufficient moisture, protection from exposure to sunlight. Without microbes, the existence of soil is impossible. Microbes are a necessary link in the cycle of all biogenic elements, participate in soil formation and maintenance of soil fertility. Soil solution is an excellent culture medium for many microorganisms. The main reserves of nutrients are concentrated on the surface of solid soil particles; humus, organomineral calloids, Ca^{2+}, Mg^{2+} cations, etc. for microorganisms. In relation to the total soil surface, microorganisms occupy only hundredths or tenths of a percent, they do not form a single continuous film, but are located in small colonies in micro-foci.

We [4-9] carried out a number of studies on obtaining organomineral fertilizers by composting cattle manure with the addition of substandard phosphorites of the Central KyzylKum and various mineral fertilizers. As a result of research, it has been shown that the preparation of composts based on cattle manure with the addition of phosphate raw materials leads, on the one hand, to an increase in the assimilable form of P_2O_5 due to the interaction of humic acids, fulvic acids and water-soluble organic substances with phosphates, on the other hand, to a decrease in the loss of nitrogen and organic substances. At the same time, the assimilable form of P_2O_5 of the phosphate raw material increases 6.5-7.0 times, the loss of nitrogen and organic matter decreases almost 2.5-3 times, and the degree of humification of organic substances increases 2 times.

The available information in the scientific and technical literature as well as the studies carried out show the promise of using phosphate raw materials and various mineral fertilizers as an additive in the preparation of composts based on waste from livestock farms and other organic farms. However, in order to obtain a complex organic-mineral fertilizer in this way, it is necessary at least 3-4 months to ripen the composts, which creates certain difficulties in providing farms. From the literature data, it is clear that one of the methods of accelerating the humification of organic matter in manure and the

maturation of compost is the use of solutions containing microorganisms involved in the destruction of organic matter in the preparation of composts; in addition, many microorganisms play an important role in maintaining soil fertility.
From all of the above, it can be seen that soil fertility depends on its physical, chemical and biological state. Therefore, when developing a technology for obtaining organic or organomineral fertilizers, based on the current state of soils, it is necessary to take into account the production of fertilizers containing humic, various mineral nutrients and beneficial microorganisms for the restoration of soil fertility. In this regard, in this work, we have studied the processes of obtaining organomineral fertilizers by bioconversion of composts prepared on the basis of cattle manure and phosphate rock from the Central Kyzylkum using solutions of a conservative of beneficial microorganisms.

Materials and methods. To study the processes of obtaining organic fertilizers, cattle manure was used as a feedstock, which has the following composition (wt.%): Moisture - 73.21; ash - 4.32; organic matter - 22.56; humic acids - 2.5; fulvic acids - 2.67; water-soluble organic matter - 2.52; insoluble organic matter - 14.79; P_2O_5 - 0.18; N 0.43; K_2O - 0.58; CaO - 0.4. Phosphate flour (PF) of the Central KyzylKum (CK) was used as a phosphate raw material.

For the processing of phosphate rock, information is required on the physicochemical and physicomechanical properties - dispersed composition, moisture content, bulk density, angle of repose, fluidity, pH, hygroscopicity, moisture capacity. These properties were determined by the methods described in.

Compost based on cattle manure with the addition of PF was prepared at weight ratios of manure: PF = 100: 10. The resulting mixtures were treated with solutions of a consortium of microorganisms and then a biological product. The consortium of microorganisms, which includes Azotobacter chroococcum, Bacillus licheniformis, Streptomyces sp, Bacillus subtilis, as well as Pseudomonas stutzeri 73, Bacillus cereus 356 and Bacillus sp. stimulants of plant growth and development, and also suppresses pathogenic, opportunistic and putrefactive microflora. In laboratory conditions, in specially adapted vessels, experiments were carried out with the following ratios of cattle manure: PF: biological product = 100: 10: (0.5-5). Initially, the biological product was diluted in water without chlorine and the mixture was processed based on the calculation that the moisture content of the compost did not exceed 75%.

The solid phase after separation of alkali-soluble organic substances from it contains residual organic matter. It was thoroughly washed with disc water, dried to constant weight, and the content of organic matter was determined. The difference between the amounts of alkali-soluble organic substances and humic acids gives us the fulvic acid content.

Table 1. Loss of nitrogen, organic matter and the degree of humification of organic matter during composting of cattle manure and phosphate rock with biological treatment

Mass ratio	100 : 10	100 : 10 : 0,5	100 : 10 : 1	100 : 10 : 2	100 : 10 : 4	100 : 10 : 5
Loss of nitrogen,%	19,31	18,41	17,17	16,52	14,92	13,13
Loss of org. substances,%	14,68	13,28	12,38	11,51	9,53	8,91
Degree of humification of organic matter,%	67,81	69,58	70,11	71,31	72,34	73,17

The preparation of compost by treatment with a biological product had a positive effect on the acceleration and increase in the assimilable forms of phosphorus, on the increase in the content of humic acids (HA), fulvic acids (FA) and water-soluble organic substances (WOS) in composts. For example, if in composts prepared at the ratio of cattle manure: PF: biological product = 100: 10: 0, that is without adding a biological product, after 60 days the relative content of $P_2O_{5\ ass}$. for Trilon B and 2% citric acid solution increased from the initial 16.57 and 17.74% to 48.43 and 49.92%, respectively, the content of HA, FA and WOS was 4.05%, 4.15% and 3.92%, then in composts prepared at the ratio of cattle manure: PF: biological product = 100: 10: 2 the relative content of P_2O_{5ass}. for Trilon B and 2% citric acid solution increased from the initial 16.57 and 17.74% to 69.09 and 66.45%, respectively, the content of HA, FA and WOS was 4.97%, 5.18% and 4.77%. It was also studied the effect of the biological product on the reduction of the content of nitrogenous and organic substances due to the release into the gas phase during the composting process. It has been established that the preparation of compost by treatment with a biological product significantly reduces the loss of nitrogenous and organic substances. With the above ratios, the reduction in nitrogen loss was from 19.31 to 13.13%, and organic matter from 14.68 to 8.91% (Table 1). Based on the degree of humification of organic matter, the content of assimilable forms of phosphorus, and from an agrochemical point of view, the optimal ratios of the initial substances and the duration of compost maturation have been determined. In this case, the optimal ratio is cattle manure: FS: biological product = 100: 10: 2. The composition of the organomineral fertilizer

obtained under optimal conditions has the following composition (wt%): P_2O_{5total}. -1.826; $P_2O_{5\ ass}$. Trilon B -1.21; $P_2O_{5\ ass.}$ citric acid -1.26; organic matter - 19.79; HA - 4.97; FA – 5.18; WOS - 4.82; nitrogen - 0.43; K_2O -0.63. Thus, the results show that the treatment of a mixture prepared on the basis of manure and phosphate raw materials using a solution of a consortium of microorganisms before composting increases the content of humic substances, assimilable forms of phosphorus for plants and accelerates the process of compost maturation and also reduces the release of nitrogen compounds and low molecular weight organic substances into the gas phase.

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