REPORTS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
ISSN 2224-5227
Volume 2, Number 306 (2016), 96 – 99

УДК 339.9:658:630

INFLUENCE OF COAL HUMIC FERTILIZERS ON DEVELOPMENT OF AGRICULTURE

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Key words: carbon of a humin, humic acid, humus, encouragement, research, coal humic preparation, oxidation-reduction process, ammoniated coal, hummophos, superphosphate, soil.

Annotation. In the Republic of Kazakhstan the deficiency of humus is the reason of soil erosion and decrease of soil fertility, especially under conditions of intensive agriculture. For compensation of this deficiency peat, manure - which in turn is deficient for many regions - and various vegetable remains are used. The common ingredient of natural humus in soil, of manure and of peat, are the humic acids being the most important constituents influencing the plant growth activty.

Therefore, it is necessary to add humic acids to increase the productivity of agriculture. The Republic of Kazakhstan is rich with stocks of brown coal, being a possible fossil source of humic substances.

As a result of fertilizing soil with carbon-humic fertilizers the productivity of any vegetable organisms like e.g. crops raises between 10 to 60%. If applied in an economical manner fertilizer have long-term positive effect on the soil, improve the viability of seeds and germination of tubers, survival of seedling, stimulate growth of plants and promote significant increase in productivity.

Thus, the application of humate containing organic-mineral fertilizer increases the productivity and promotes the improvement of quality of production, because humic acids are the key component to increase plant growth efficiency owing to the large scale preservation of useful properties of artificially prepared humus. Further more, the application of such fertilizers decrease the labor force input and energy consumption in comparison to the process of peat preparation.

Introduction

Recently, the steady tendency of agricultural soil deterioration has been outlined in land fund. One of the important living conditions of agricultural plants and a prerequisite for high yield harvests is the existence of enough soil with an optimum ratio of macro - and microorganisms. The absence of ingredients in soil solution has a severe impact on the growth of plants. It is connected with a decrease in volumes of introduced mineral and organic fertilizers concomitant with a soil status of unbalanced amounts of the basic nutritious elements and living microorganisms.

With respect to the above stated problematic soil situation we want to suggest the use of non-conventional organic fertilizers, first of all, humic acids gained from fossil sources like brown coal. The advantage of such fertilizers derives from the fact that they have a positive impact on plant growth even in small doses.

Research objective

Determination of the efficiency of humates and carbon-humin fertilizer for the application in crop growing.

Search for new approaches to the reconstruction of fertile soils, development of new technologies to process the coal-humin fertilizer and its application in agriculture as growth factor, development of plants and organic fertilizers; development of methods to determine the optimum doses of fertilizers for the application to various different agricultural cultures.

Development of the theoretical basis connected with the analysis of the molecular structure of humic

acids, derive a causal relationship between their structures and their efficiency at different applications for plant growth.

Reassure the positive impact on plant growth even in small doses.

Results. The valuable impact of natural humus on the increased fertility of soils is a well-established fact. The decrease of the natural humus amount in a soil cover leads to the development of erosive processes, structure violation, and change of absorbing ability as well as to the change of physical and chemical properties of the soil. This results in turn to a drastic diminishing of the efficiency of pure mineral fertilizers, to the pollution of ground waters and, finally, to a quantitative and qualitative decrease in plant growth.

The major reason for the loss of natural humus in the soil is due to the drastic decrease of plant remnants after harvesting processes starting at the middle of the last century as no more rotting plant remains have been left over on agricultural cultures. In regions where there are peat bogs, this shortage was compensated by peat introduction. With the constant increase of cultivated areas it was not possible to provide manure introduction on all fields, especially, because there are not enough habitats for the non-nesting animals, and peat bogs are not available in all regions. This resulted in a considerable decrease of soil fertility. Aiming for higher yields in crop harvest farmers increased the doses of introduced of mineral fertilizers on their fields. However, this is not always successful since the growth of productivity wasn't directly dependent on the amount of introduced mineral fertilizers as each plant has a "threshold" of their comprehensibility [1]. It has been established that with an increase of the amount of introduced mineral fertilizers the coefficient of their uptake and use by the plant decreased [2]. Therefore, this problem has to be solved in a scientific manner yielding more sophisticated fertilizers safe guarding the preservation of the fertility of soils, increasing the efficiency of mineral fertilizer constituents and thus increasing the quality of production of crops.

To target the above stated problem a variety of organic substances were studied: peat, lignin, wood sawdust, rice peel and brown coal as a fossil organic source [3], which in the course of its decomposition within soil forms humus-like substances. One common constituent – although in different quantities – of manure, peat and brown coalare the humic acids, which feature similar properties to natural soil humus. However, they are immobilized with respect to the mineral part of the pristine raw materials.

It is known from the literature studying the influence of humic acids on the mobility of mineral elements of food, agrochemical, microbiological, biochemical processes, growth and development of plants, that the humic acids show their physiologically active properties only in the water-soluble form called humates. Some of them can be prepared using chemical reactions of the pristine raw material with hydroxides of sodium, potassium and ammonium.

The first attempts to use brown coal and peat for such organic-mineral hybrid-fertilizer sstarted in the 1930ies, but didn't lead to desirable results. It was mainly due to the lack of understanding the nature and principles of action of humic acids on a plant. Moreover, their introduction in large quantities lead instead of a positive effect to a negative effect, reflected by an oppression of growth and development of plants [4]. Some preliminary studies revealed the positive effect at introduction of small doses of humic fertilizers. Therefore, the questfor a more sophisticated application of humic acid containing fertilizers in agriculture continued to interest researchers.

As a result of the performed studies concerning the efficiency of the application the carbon-humin containing fertilizers two different modes of action are discussed by scientists. One consider that humates, due to their positive influence on physical and chemical properties of the soil, create more favorable conditions for growth and development of plants [2]. Other authors assume a direct impact of humic acids on a plant by influencing oxidation-reduction processes thus leading to a stimulated growth.

According to the first point of view the activity of carbon-humin compounds has to be directly dependent on the introduced doses. But already small doses of carbon-humates seem to have positive influence on development of plants. This may indicate a carbon-humate influence on physiological plant activity, which can be increased with a chemical processing of brown coal by hydroxides of sodium, potassium and ammonium. For instance, a formulation of the ammoniated brown coal and the organic-mineral fertilizers yielded by mixing of ammoniated coal with superphosphate, contain between 2.5 and 10% of active humates. It should be noted that the humates yielded by chemical processing of coal by treating them with hydroxides of sodium, potassium and ammonium, represent 60-95% of soluble product

in water. It is obvious that in this case humic acids are in an active form. At deploying them into soil in a dose of 10 to 20 kg/hectare a positive effect [5] is achieved.

So, carbon-humin fertilizers in the form of the ammoniated coal and "humophos", producedby mechanical mixing of brown coal with superphosphate were tested in the Republic of Uzbekistan at cotton crops on a field of the area of 3,5 thousand hectares. At a dose of introduction of 0,4-0,5 t/hectare in all cases an increase of the crop growth of 1-2 c/hectare was observed. However, the quality of these carbon-humin fertilizers was directly dependent on the quality of the pristine raw materials where the content of humic acids fluctuated between 5 and 40%, and the cindery rest between 10 and 40%. Therefore, this process method proved unsatisfactory and unreliable forcing scientists and chemical engineers to look for new ways of processing the raw materials aiming for a reproducible and qualitatively standardized production method. As a recent result of investigations of T.Zh.Umarov and O.I.Pobedonostseva new process technology has been developed to produce a fertilizer from carbon-humates treated with hydroxides of potassium, sodium and ammonium with a plant physiological activity increased to 7-10 times in comparison to the fertilizer containing in the ammoniated coal. This new process opened opportunities to use these mixtures not only as organic-mineral fertilizer/FAGUM/prepared by a introducing humates into a pulp during the processing of phosphorites, but also as physiologically active agents and growth factors of plants. The above named authors revealed that humate scan already be applied in very small quantities, probably enhancing its activity owing to a greater mobility thus yielding a considerably bigger effect. In their resseaches they used the method of soaking of seeds of various cultures. According to their experiments the soaking of seeds of cotton in a solution of humate treated with ammonium hydroxide yielded an improved viability, i.e. growth of seeds improved in comparison with control by 10,4 and 20,8%, whereas with a potassium hydroxide treated humatean improvement of 11,9 and 9,2% was gained, respectively. Furthermore, if a preseeding soaking of seeds of cotton takes place in a solution of a humate treated with ammonium hydroxide at adose of 250 g/hectare of seeds, the growth and cotton development was considerably accelerated. As a result of the first and second harvesting the yield of crop was 2,5 c/hectare higher than for a control group, thus the increase of crop harvest reached 2,1 c/hectare.

According to soaking of seeds of vegetable cultures for outdoor cultivation, watering of seedling and extra root top dressing at an expense of 1,25 kg/hectare gave an increase of crop of tomatoes on 45-70 c/hectare, harvest of eggplant increased about 30-35 kg/hectare, whereas the harvest of cabbage increased using humate at a dose of 0,63 kg/hectare to 80-85 c/hectare, the harvest of grain with a dose of 250 g/t increased to 4 c/hectare and the harvest of potatoes with using of humate with a dose of 20 kg/hectare during watering showed an increase of crop of 75 c/hectare. A test of humates on vegetable cultures in indoor cultivations also yielded positive results [5].

Conclusions

Thus, the application of humate containing organic-mineral fertilizer increases the productivity and promotes the improvement of quality of production Additionally to the fact, that soaking of seeds before seeding by humate solution in concentration of 0,001% accelerated the flourishing of seeds about 2-3 days, it improved the growth and development of plants as well. The plant´s blossoming and fructification phase thus was shifted temporally 8-10 days ahead. Furthermore, the spraying of tomato and especially of cucumber indoor cultivations during the vegetative period promoted juvenescence of plants, thus the shriveling of their low hanging leaves was postponed about 8-14 days. As a result of the stronger foliation the vegetative period of a tomato lasted for 20 and of a cucumber for 30 days. This finally yielded a crop increase of 2,2-2,4 kg/m2of tomatoes and 2,0-3,0 kg/m2 of cucumbers. Therefore, the production technology of the carbon-humates as surprising substances, derived from low-calorie brown coals unsuitable for power purposes, is industrially implemented.

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ВЛИЯНИЕ УГЛЕГУМИНОВЫХ УДОБРЕНИЙ НА РАЗВИТИЕ СЕЛЬСКОХОЗЯЙСТВЕННЫХ КУЛЬТУР

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Ключевые слова: углерод гумина, гуминовая кислота, гумус,поощрение,исследование, углегуминовый препарат, окислительно-восстановительный процесс, аммонизированный угль, гумофос, суперфосфат, грунт.

Аннотация. В Республике Казахстан дефицит гумуса является причиной эрозии почвы и снижение плодородия почв, особенно в условиях интенсивного сельского хозяйства. Для компенсации недостатка этого торфа используется навоз и различные растительные остатки, которые в свою очередь, являются недостаточным для многих регионов. Общий ингредиент природных гумусов и гуминовых кислот в почве, навозе и торфе является наиболее важным составляющим, влияющий на активность роста растений. Таким образом, необходимо добавить, что гуминовые кислоты применяются для повышения производительности сельского хозяйства. Республика Казахстан богат запасами бурого угля, которые являются ископаемыми источниками гуминовых веществ.

В результате обработки почвы углегуминовыми удобрениями производительность сельскохозяйственных культур поднимается от 10 до 60%. Применение углегуминовых удобрений имеет долгосрочное позитивное воздействие на почву, улучшает жизнеспособность семян и проращивания клубней, выживания сеян, стимулирует рост растений и значительного увеличивает урожай.

Таким образом, применение органоминеральных удобрений содержащие гумат, увеличивает производительность и способствует улучшению качества продукции, так как гуминовые кислоты являются ключевым компонентом для повышения эффективности роста растений из-за большого масштаба сохранения полезных свойств искусственно подготовленных гумусов. Кроме того, применение таких удобрений снижает энергетические и трудовые затраты по сравнению с процессом подготовки торфа.

АГЛЕГУМИНДІ ТЫҢАЙТҚЫШТЫҢ АУЫЛ ШАРУАШЫЛЫҒЫНА ӘСЕРІ

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Кілтті сөздер: көміртегі гумині, гумин қышқылы, гумус, исследование, углегуминовый препарат, тотығу-тотықсыздану үрдісі, аммонизденген көмір, гумофос, суперфосфат, грунт.

Андатпа. Қазақстан Республикасында гумус дефициті, әсіресе белсенді ауыл шаруашылығы жағдайда, жердің эрозиясы мен құнарлығы төмендеуінің себебі болып табылады. Бұл торфтың жетіспеушілігінің орнын толытыру үшін қи және басқа да органикалық қалдықтары қоланылады, алайда көптеген региондар үшін ол жеткіліксіз болып табылады. Өсімдік өсуінің белсенділігіне әсері бар жер, қи, торфта табиғи гумус гумин қышқылының жалпы ингридиенті аса маңызды құрамдасы болып табылады

Осылайша, гумин қышқылдары ауыл шаруашылығының өнімділігін арттыруға қолданылатынын айтқан жөн. Қазақстан Республикасы гумин заттарының көзі болып табылатын қоңыр көмір қорларына бай. Жерді углегуминді тыңайтқыштармен өңдеу нәтижесінде ауыл шаруашылық өнімділігі 10 нан 60% дейн артады. Углегуминді тыңайтқыштардың қолданысы жерге узақ мерзімді жақсы әсер етеді, тұқым мен бой түйнектерінің өміршеңдігін арттырады, өсімдік өсуін жақсартады және өнімділікті едәуір ұлғайтады.

Осылайша, гумат құрамдас органоминералды тыңайтқыштардың қолданысы өнімділікті арттырады және өнім сапасының жақсаруына әсер етеді, себебі жасанды жасалған гумустардың пайдалы қасиеттердің үлкен мөлшерін сақтауына байланысты гумин қышқылдары өсімдік өсуінің белсенділігін арттыру үшін кілтті компонент болып табылады.Сондай-ақ мұндай тығайтқыштардың қолданысы торфты дайындаумен салыстырғанда энергетикалық және еңбек шығындарын азайтады.

Поступила 21.03.2016 г.