COMPOSITE SOILS - THE BASIS FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT

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Abstract. The article reviews scientific publications on artificial soils. The ambiguity of this thematic problem is a great interest to the world community as resource endowment on a planetary scale is declining without the right to recovery. Humanity as a whole has no choice but to think of scientifically based concepts to recreate the conditions for survival. The paper describes the main directions of combining soil mixtures, developed technologies of application, results of influence of composite materials on plant growth functions.

Keywords: soil fertility, composite soils, soil structure, humus mixtures.

1. Introduction
The characteristic of technological processes of growing plants make demands on soil resources. Plants for normal physiological growth require a set of nutrients, certain humidity and aerobic soil conditions. Human activities have a significant impact on habitat change and in particular on soil potential. The impact of such changes is seen in land use, where large areas of land are no longer rotated due to total or partial degradation. The missed possible timing of the introduction of such land into crop rotation threatens to develop a catastrophic situation later, as it alters the biota as a whole. In this situation the right direction will be the formation of composite soils with appropriate selection of certain components. Consideration of factors-creating conditions is strictly determinative. By creating an entirely new soil substrate with set parameters, the producer is able to program crop yields under certain growing conditions. But since the main goal of any agricultural producer is to produce a high yield at a minimum cost and the use of natural raw materials in composite soils will be a priority.

2. Results and discussion
Fertile soil containing a rich spector of nutrients is an important indicator of growth development of any plant. The scale of soil research has increased in recent year. In natural planetary conditions the soil is limited which is primarily related to a certain climate and topography [1]. The creation of composite soils makes up for the lack of natural fertility of the land, as they are formed from a foundation and related components of some value. The main criterion for the use of a certain component is accessibility, low price and availability of a raw material base.

Every year, the number of raw material bases decreases catastrophically. Newly created components and materials are not always recycled, which exacerbates the environmental stress of the natural...
environment. In this context, scientists are looking for the use of non-traditional materials and components to create new directions. Such processes are also introduced into the production of fertile impurities or composite soils.

In literary sources, soils are treated as organic matter with a humus-containing component with added mineral impurities. The soil is any fertile soil with no permanent composition. The composition depends on the material and on the method of its production (place, time, extraction method and artificial processing process). There is no classification by soil type, nor is there a proportion of the content of the components. The variation of the different components and their number allows the production of different soil types with special characteristics where the micro- and macro-elements are in a form that is accessible to plants.

Artificial soils are of interest not only to scientists and mixers, but also to consumers, who use these mixtures directly for further production [2 - 4].

Balanced soils are primarily intended for greening urbanized areas. The limitations of natural resources, the search for new technologies and the waste from the refineries make it possible to realize the most ambitious ideas for assembling the necessary compositions, primarily focusing on the components of local raw materials. The compositions developed on the basis of large-tonnage brewery residues, the comparison of the main agrochemical indicators of finished peat-powder compost and organic fertilizer show positive results in the research of Ganin G.N. (2007) [5].

Complex soil mixtures are produced for a specific crop, as the filling of the soil depends on the plant’s consumption of important nutrients. The produced complex soils are tested for influence of composite mixtures with growth periods of culture. Complex soil mixtures are produced for a specific crop, as the filling of the soil depends on the plant’s consumption of important nutrients. The produced complex soils are tested for influence of composite mixtures with growth periods of culture. Scientists of the Far East region have conducted tests, in a mixture of soils the addition was made: a complex action preparation on the basis of glauconite (MPC), sapropel deposits and a peat substrate «Bionic» containing fertilizer of the prolonged action of Basacote 6M. The test-culture was the cherry-sweet cherry hybrid seedlings in containers under protected soil conditions. Throughout the growing season, Basacote 6 M fertilizer variants provided a nitrate nitrogen content of 90... 110 mg/kg soils. The application of sapropel sediments did not provide an unbeaten mineral nitrogen balance. Excess nitrate and ammonium nitrogen in the PBC variant led to plant oppression. Variants with the use of the peat substrate «Bionic» and sapropel until the sixth week of vegetation did not differ significantly from control. Since then, there has been a more active growth of seedlings in these variants, which has affected the quality of seedlings received in September. Maximum permeability for cherry-sweet cherry hybrid seedlings was noted in peat substrate «Bionic» without adding other components. For cherry-sweet cherry hybrid Melitopolskaya joy according to 2016 results is the most favorable development in peat substrate «Bionik». The calculated profit in the version with the peat substrate «Bionic» exceeds control by 370%. Biotestic investigations were also carried out, and the phytotoxicity of the soils was determined after the biodegradation of the polymer composite film based on starch, polyvinyl alcohol and L-asparaginic acid. [6, 7]. Fillers used as additional components play an important role in the structure of the soil. The studies carried out by the group of scientists prove that the formulation of soil preparation from precipitation of water processing stations and loam has shown good structuring, the ground is resistant to adverse mechanical and physico-chemical effects [8].

Red sludge is being recycled and processed in many countries around the world in an attempt to create different types of soils [9].

In this work [10] Conducted a study of red sludge containing a large number of microparticles less than 1 μm. This paper shows that the size of the fine fraction is detrimental to earthworms. Microparticles clog the skin pores of earthworms.

Mixing of organic furfurol residues and inorganic volatile ash to create artificial soil has been shown to be useful in agriculture after irrigation and desalination [11].

In this work [12] studied the growth and development of microbes in artificial soil when mixing different elemental components.
Artificial soil is used for various toxicity tests. In this paper [13] shown how various artificial soils influence the behaviour of pollutants.

Authors [14] carried out research on agricultural characteristics of artificial soils of various plant-growing modifications.

Field experiments have proved the effectiveness of the use of processed municipal sewage sludge in combination with sand, mineral fertilizers and humates on oats [15]. Also, the soil-based compost from wood and plant residues showed effective results of survival of hardwoods seedlings [16].

Fomin N.V. (2015) considers peat and soloshlak components with humus base as filler. The biofitness ratios of 1:0.5:0.5 and 1:1:0.5 were established. A comprehensive environmental safety assessment based on the activity analysis of oxidative and hydrolytic enzymes confirms the high efficacy of the ground [17 - 21].

At the current stage of development of the world community, agricultural production has reached a level where creative processes surpass those of natural origin. Artificial soil runners are fertility optimized mixtures capable of providing plants with all the necessary nutrients [22, 23]. An optimized model of black soil is proposed by a group of researchers in their work [24]. It is designed for long-term herbaceous vegetation. The indicators were based on the granulometric composition and addition density. The artificial soil model developed has a ratio between sand, peat and clay in a ratio of 1:2:7 (with the addition of a mixture per 100 kg - 0.5 kg of diammophos and 0.2 kg of dolomite flour). The mixture was successfully tested in the forest-steppe zone of Zauralya.

Variety of soil mixtures considered that take into account the environmental aspects derived from recycled wastes in a mixture with composts [25 - 28].

Composite mixtures take into account not only the soil basis but also the interactions of the mixtures. The experimental activity of micro-organisms in the mixture, the activity of these communities interacting and their predicted effects are observed [29 – 31].

Studies of the composite mixtures obtained begin with a clear definition of the soil’s production purpose which addresses issues affecting classification indicators, namely:
- territorial aspects [32 – 39];
- raw components [3, 20, 40, 41, 42];
- intended qualification indicators [7, 43 - 49];
- Methodological and technological aspects of soils production [50 – 54].

The soils produced are divided into priority uses: culture, conditions of use, efficiency of application. The basic requirement for the mixtures to be used is to undergo a safety check, since the materials used do not always meet these requirements. Control is a priority in the continuous monitoring of the entire technological process:
- growth parameters of culture [55 – 60].
- effects of soil nutrient growth on habitability [61 – 65].

An indicator that is of interest not only to scientists but also to producers of agricultural produce is the efficiency of application of the mixture [21, 66, 67, 68]. Thus, Fomine N.V. and Demidenko G.A., carried out testing work on the influence of the composition of specialized soils on the development of tomato plants. Experiments were carried out with: «Folk Soil», «Ground of Russia» and «Little Boy». The structural composition of these mixtures is intended for growing vegetable seedlings, and the existing nutritional composition favours seed germination. Composite test mixtures are created using peat of different classification. Natural structuring materials have acidifying fertilization qualities and are balanced by additional materials such as agropermite, calcareous materials and highly effective granulated organo-mineral fertilizers. The study identified the best mixtures and highlighted the best quality tomato varietal components. [21, 42, 69, 70].

Testing of soil mixtures cannot be considered without the necessary laboratory tests. The work of Baldanova E.V. (2017) assesses the effectiveness of cultivation activities on sites contaminated with heavy metals. The reduced phytotoxicity of recultivated sites is determined by the test culture method [2]. The researches were carried out on different biometric indicators, such as Bojova L.V., Zinchuk E.G. and others carried out ecological evaluation of soils and complex composts using the method of
biotestation. The results provided integrated data on the biological quality of composts and soils as multifunctional systems. Chemical analysis found exceedances of MACs for Zn, Pb, Cu, and the toxicity of these substrates was also determined [71 – 73].

Research on the influence of the component composition of soils is also being carried out in neighbouring States of the Russian Federation, so scientists from the Republic of Belarus have identified phytostatic influence of introduced Bacillus subtilis strains in interaction with composition composition of soils. The results showed high permeability in the soil runners and bacterial rhizosphere, as well as their interaction with active components. Studies have identified certain strains with an overwhelming effect on pathogen development when bentonite and clay are added to the substrate [74].

Literary sources identify work on methodological recommendations and developments in the conduct of specific laboratory studies. Scientists from the Republic of Belarus have developed a method for preparing soil samples to determine nitrogen, phosphorus and potassium. The method is based on the mineralization of the sample using a digestor, which makes it possible to determine the necessary parameters from one soil footprint, thereby increasing the economic efficiency [75].

Interesting studies have been carried out with the MPG model soils (200-1500 mg/kg at P2O5) by biotesthetizing a wide range of mobile phosphorus concentrations at different phases of field and laboratory herbaceous plant development. The results of the experiments showed acute toxicity of MPG at P2O5 a content above 800 mg/kg in the early stages of plant development, namely in the growing phase in laboratory and vegetation tests, whereas in the field the results of the green mass analysis showed no excess phosphorus [76].

Fried A.S. and Ermakov A.V. (2015) studied the dynamics of soil properties for lawn planting. The composition included a torfo-sand and a torfo-earth mixture. After the removal of the topsoil of the original urban soil, a rapid mineralization of the organic substance of the peat-land mixture was detected, where the initial losses of the calcination were large (50%). Agrochemical properties of soils changed in different directions. The above-ground biomass of grasses was higher in all cases of use of peat-land mixture and application of mineral fertilizers [77].

3. Conclusion

Any survey work in this direction has a positive impact on the natural processes of soil formation, as the society tries to create acceptable conditions for the development of crop culture.

The analysis of literature sources in the thematic direction revealed certain views on the formation of compositional soils for the authors of this article. Much of the research does not clarify the use of such structural soil compositions, namely:
- what climatic conditions can be used;
- which biotic constituents accompany the substrate;
- influence on pathogenic constituents;
- time of use of the composite soil, etc.

All these questions indicate the insufficiency of the conducted exploratory research. This research topic is very relevant, because it considers the vital aspects of human existence on Earth.

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