Chapter 3
Food Security–Related Issues and Solutions

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ABSTRACT

The food problem has been and has remained relevant throughout the history of mankind. At the end of 20th and the beginning of the 21st century, in the lives of many nations and countries, there have been significant changes. Health status and level of education of the population, such as, for example, food security, is the priority in many countries since, in the absence of sufficient food reserves, there is an economic and political dependence of some countries on others. Having not yet received the required amount of food, the world is faced with the problem of ensuring security in its quality. Anthropogenic pollution of the environment complicates the problem with the quality of food and the exception of harmful chemicals in food. There is a problem of using environmentally friendly agrotechnical means, ensuring the production of high yields of environmentally safe products with a desirable reduction in their cost, and shortening the time required for their production.

INTRODUCTION

The most important task of agricultural production is to increase the yield and quality of agricultural crops, as well as accelerate the ripening of food products. The use of innovative technologies in agricultural production, in particular, pre-sowing stimulation of seeds (Hozayn & Qados, 2010; Shabin, Tyshkevich, & Ershova, 2017) allows to get a crop in less time with less effort and lower costs.

The first scientific results on the stimulation of crop yields by physical factors were obtained in 1746. Dr. Mimbre from Edinburgh discovered that the treatment of myrtle plants with an electrostatic field enhanced their growth and flowering. In 1748, French abbot Jean Nole established the acceleration of seed germination after treatment with an electric field. In 1885, Finn Lemstrem described the stimula-

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tion of growth of potatoes, carrots, and celery by 40% in eight weeks. Strawberries ripened twice as fast. Raspberry harvest doubled, that of carrots increased by 25%. Control plants of cabbage, turnip, and flax grew better than the treated ones (Briggs, 1926; Ross, 1844; Nelson, 2007).

In 1918-1921, about 500 British farmers in the acreage of about 2,000 acres studied the method of treating cotton seeds with a solution of fertilizer treated with an electric field (Nelson, 2007). It turned out that at the end of the growing season there were two or three times more boxes on the test plants than on the control plants. Positive results were obtained for sugar beets, tomatoes, and corn.

The experiments have been continuing successfully. There has been accumulated a significant scientific material on the use of physical and chemical factors to increase the yield of cultivated plants. It has been established that plant growth stimulators pose a complex effect on physiological and biochemical processes, accelerate the development of plants, and enable more rational use of agricultural lands and equipment (Wierzbowska, Cwalina-Ambroziak, Glosek, & Sienkiewicz, 2015). Their positive effect on yields and quality of agricultural products has been demonstrated in case of phytopathological state of crops in different soil and climate conditions (Kuzminykh & Pashkova, 2016; Petrichenko & Loginov, 2010).

In some of the cases, the use of stimulants allows reducing the dose of applied fertilizers and pesticides which has a positive effect on quality of agricultural and food products, as well as reduces production costs (Pigorev, Zasorina, Rodionov, & Katunin, 2011; Ponomareva & Zaharova, 2015; Demchenko, Shevchuk, & Yuzvenko, 2016). In the developed countries, application of stimulants allows increasing the productivity of particular crops by 20-30% (Danilov, 2017). Specifically, in vegetable and fruit production, as well as in ornamental horticulture, their use has become a mandatory agrotechnical technique which is employed in 50-80% of agricultural enterprises all over the world (Malevannaya, 2001; Ambroszczyk, Jedrszczyk, & Nowicka-Polec, 2016).

The use of plant growth stimulants is focused on solving a specific problem of obtaining a given volume and quality of agricultural products (Chekurov, Sergeeva, & Zhalieva, 2003). Special attention is paid to the use of environmentally friendly and non-toxic methods and substances (Colla, Rouphael, Canaguier, Svecova, & Cardarelli, 2014; Paradikovic, Vinkovic, Vinkovic Vrcek, & Tkalec, 2013; Ovcharenko, 2001; Tiwari & Dhuria, 2018). Internationally, growth and development of plants of natural and synthetic origin are used (Alexandrova, Shramko, & Knyazeva, 2010; Kocira, Kornas, & Kocira, 2013).

Natural stimulants (gibberellins, auxins, ethylene, kinins, etc.) consistently participate in the metabolism at all stages of plant life and affect budding, flowering, and fruiting. The activity of synthetic growth stimulants is similar to natural growth and is carried out by regulating the general hormonal status of plants (Roumeliotis et al., 2012). Stimulants increase plant resistance to adverse environmental conditions (drought, freezing temperature drops, etc.), damage by pests, and morbidity (Wierzbowska et al., 2015). In a number of cases, their use allow reducing the amount of applied fertilizers, herbicides, and pesticides (Kozlobaev, 2016).

However, along with a number of positive aspects, the application of plant growth stimulants has particular negative effects. These substances can accumulate in products and cause allergic reactions among employees who work directly with them, as well as among consumers. Most of the stimulants are rather expensive and difficult to prepare (Gordeeva, Shoeva, Yudina, Kukoeva, & Khlestkina, 2016). The above flaws necessitate the search for new effective, affordable, cheap, and environmentally friendly solutions, one of which is an activated water. The purpose of this study is to analyze the effectiveness of application of activated water in agriculture for the purposes of increasing the volume of crop production and solving food insecurity problem.