REDUCTION OF CHEMICAL LOAD OF AGRICULTURAL SOILS BY EFFECTIVE APPLICATION OF FERTILIZER SPRAYERS IN RELATION TO CULTIVATED CROPS

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Abstract

The aim of the scientific monograph was to measure and evaluate the time frames, to determine soil compaction using penetrometric measurement and to evaluate (on the basis of statistical indicators) the impact of fertilization on individual crops in a selected farm. According to the standard STN 47 0120 (Agricultural and forestry machines and tractors. Methods of measuring time and determination of operating indicators), we have measured the time frames and determined the calculation indicators of performance. From the obtained data, we have determined the performance of machines per unit time. After the application of fertilizers, we have evaluated the impact of the agricultural machine on the soil by penetrometric measurement, where we have recorded the highest penetrometric resistance in the years 2016 - 2019, up to 4.7 MPa. As regards the impact of fertilizers on crop yields, nitrogen fertilizers have been shown to have a statistically significant impact on winter wheat yields. In the other two monitored crops - spring barley, oilseed rape - the impact of fertilizers was not statistically proven, but in the case of spring barley we have proved that the height of the crop is influenced by weather conditions (mainly average daily temperature and annual precipitation).

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Author's preface

The present scientific monograph entitled Reduction of chemical load of agricultural soils by effective application of fertilizer sprayers in relation to cultivated crops, with its content offers the reader the opportunity to get in touch (in the first part) with the issue, possibilities and forms of fertilization within the Slovak Republic. At the same time, there are discussed the properties of industrial and organic fertilizers. We characterize the available techniques in the conditions of the EU. The second part is experimental, where we disassembled the time frames of the most used fertilization machines. The dose is determined exactly, depending on nutrient supply maps in chosen companies. At the same time, we evaluate the quality of used fertilizers and the quality of chosen agricultural machinery. Last but not least, we want to thank the sponsorship and advisory assistance of the company AGROSERVIS spol. s r.o.

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Introduction

The history of mankind is marked by man's constant struggle for food. Already in prehistoric times, individual tribes, as well as entire nations, moved from plundered areas to fertile steppes, often having to fight hard for this territory. The procurement of food was the subject of revenues and decrees of monarchs, but also of the laws of the modern world. Humanity and nutrition are a connected problem forever, and this problem still exists today. More than a third of the world's population is malnourished. In the fight against hunger, fertilizers as a means of plant nutrition are an important and inconceivable aid. The need for fertilization and tillage has been known to humans since ancient times. Pharaoh Amenemha III. ordered that gypsum has to be used for fertilization and not for flour mashing. The Incas in America punished with the death that person, who has beat one of the birds - the guano donors. The people of ancient China and the Far East were pioneers of fertilization. Farmers in these countries collected animal droppings and were the first to use it to maintain soil fertility. In ancient Rome, gardens and vineyards were fertilized with wastewater and ash. The remains of the extensive irrigation canals in Mesopotamia and Egypt can still be admired today. However, the experiences of ancient nations have now been almost completely forgotten. Extensive religious disputes and endless wars did not create good conditions for the development of crop production. Chemists of this period - alchemists - did not care about solving nutritional issues but saw the goal of their effort in the finding of the elixir of life and the preparation of gold. In Europe, during this period, the plants were first grown on virgin soil, which was rich enough in humus and minerals, and later, when such land was no longer available, setback took place. At the end of the 18th and the beginning of the 19th century, with the development of agrochemistry, people's attention began to turn to questions about how plants feed. Two years before his death, the French chemist Lavoisier (1743 - 1794) declared that the processes that take place in the plant and animal organisms are chemical reactions. However, systematic work focused on the study of issues related to plant nutrition did not begin until the 19th century. Only then, it was possible to arrive at such important findings that completely refuted the hitherto valid so-called humus theory. The student of Gay - Lussac, the German chemist J. Liebig (1803 - 1873), was responsible for the decisive turn in the views on plant nutrition. On the basis of numerous analyzes of soils before planting and after harvesting plants, he has clearly shown that by harvesting the soil is depleted of minerals and, as a result, soil fertility decreases rapidly. With his findings he laid the foundations of the mineral theory

of nutrition and definitively refuted the hitherto valid humus theory. Liebig proposed a process for the conversion of normal calcium phosphate to a soluble and more plant-friendly primary calcium phosphate by the action of sulfuric acid. Within agriculture, the development of crop production is a limiting factor influencing livestock production as well as food production. The successful development of this specific production activity presupposes a thorough knowledge and respect for the landscape, the laws of nature and the dynamic development of the agrobiological nature of this scientific discipline. The role of the agricultural department is to ensure average food security, including plant origin, based on biological principles. Agriculture is often under pressure from various requirements, mainly economic, environmental and ecological. Due to the high intensity of crop production, it is necessary to supply the missing nutrients through fertilizers. The use of industrial fertilizers is one of the basic intensifying factors of plant production. Important financial items include the cost of industrial fertilizers on agricultural holdings. From this point of view, it is good to know how to use these financially expensive raw materials correctly and economically with the highest possible efficiency. Today, the emphasis is on growing as many crops as possible to meet the demands of the worldwide market. Due to their properties and nutrient content, industrial fertilizers affect the fertility of the soil, the availability of nutrients for the growth of agricultural crops, and thus, last but not least, the size of the achieved production. Intensive crop production leads to a high loss of nutrients from the soil, which must be replenished and thus pay attention to the optimal ratio of mineral components in the soil. In the case of efficient use of inputs in the plant production system, it should be mentioned that the effective use of industrial fertilizers does not only involve the economic side, but it is primarily an effective application of mechanization means due to spatial differentiation of nutrients and soil properties on the land, as well as efficiency of access to these nutrients for plant growth and development. Conventionally offered mixed fertilizers often do not meet the criteria of plants and therefore the solution in this area is the use of one-component industrial fertilizers. Here, however, their uneven application can cause problems of non-fertilized or over-fertilized areas. One of the factors of uneven application is the different size of their fractions influenced either by poor storage conditions, segregation of particles during handling or by them etc. This scientific monograph is focused on solving these problems.