Chapter 1
Changes in the Technology of Soybean Production

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ABSTRACT

Nitrogen is the key element of yield and the most limiting factor in achieving high yields. Nitrogen fertilization is specific because mineral nitrogen, the available form of nitrogen for the plant in the soil, is on one hand subject to leaching losses due to its mobility in the soil and denitrification, and on the other hand to the content increase due to mineralization of soil organic matter. To encourage more intensive adoption of atmospheric nitrogen in nitrogen-fixing, the presence of cobalt and molybdenum is necessary. Molybdenum is required for the binding of atmospheric nitrogen by Azotobacter and plays an important role in the fixation of N₂. Legumes treated with molybdenum have a larger amount of fixed nitrogen. Cobalt is relevant to the process of biological fixation of molecular nitrogen. The role of cobalt in biological fixation of molecular nitrogen is specific, and it cannot be replaced in the process by other trace elements. Inoculation of soybean seed with microbiological fertilizer and seed treatment with cobalt and molybdenum, as well as the use of corn crop fertilization with different doses of nitrogen, has a different impact on the yield and properties of soybeans.

INTRODUCTION

In Serbia, corn is a common crop-preceding soybean. High soybean yield can be provided by growing soybean after corn, as well as other preceding crops. However, when the herbicides used for combating weeds in corn are not applied correctly, and in the years with a small amount of precipitations during the fall and winter, corn-soybean rotation does not give good results. In Serbia, soybean use to separate our field system: corn-wheat. If soybean would be planted after corn, and followed by winter wheat, a great contribution would be made to the improvement of
agricultural production as a whole. Winter wheat could be sown early, due to earlier maturing of soybean compared to corn. Corn would be used less as preceding crop to wheat, so late hybrids with higher yielding than the early hybrids could be sown on those surfaces (Nenadić, 1995). The same author recommends corn-soybean-wheat rotation. In Minnesota, an increase in yield by 11% was measured in soybean cultivation in crop rotation (corn-soybean) compared to monoculture (Hicks & Peterson, 1981). Soybean in rotation with corn had significantly higher yields than when grown in monoculture (Dabney et al., 1988). The same conclusion in favor of corn-soybean rotation was also reached by Meese et al. (1991). Amounts of fertilizer applied to corn fertilizing depend on a number of factors, primarily on the amount of planned yield and the supply of nutrients in the soil. Depending on the planned yield (6-10 t ha⁻¹), the need for nitrogen varies between 160 and 300 kg ha⁻¹. The preceding crops favorable for soybean are winter wheat and other small grains. However, according to the three-year period research conducted by the same authors, there were no statistically significant differences in soybean yield when grown after corn and after wheat (Molnar et al., 1983).

Unlike the natural soils, a part of plant nutrients in anthropogenic soils is taken from the present field along with agricultural yield. Thus the circulation of minerals stops. The result is continuous depletion of anthropogenic soils in accessible nutrients. To prevent soil depletion, nutrients should be restored by fertilization. Nitrogen fertilization has an important role in most habitats, due to the lack in the amount of nitrogen needed for intensive production, and its effect on yield which is usually very strong. Phosphorus and potassium fertilizers are “soil fertilizers”, and plants are fertilized (fed) with nitrogen fertilizers. Therefore, the choice of nitrogen fertilizers and the time and manner of their application is specific and has significant effects on the yield (Molnar, 1995). The same author believes that the amount of mineral nitrogen in the soil depends on the preceding crop, fertilization with organic and mineral fertilizers (especially nitrogen fertilizers for the preceding crop), the mode of crop residues use, the weather, etc… A number of authors point out the importance of rationalizing the use of nitrogen, as the rational application of nitrogen in agricultural production should be a priority so that its irrational use would not affect the ground water pollution with nitrates (Kessebalou et al., 1996; Hojka et al., 2006). The time of nitrogen application as fertilizer depends on the degree of nitrogen deficiency, which is associated with the available forms of nitrogen in soil and plant needs for this element (Binder et al., 2000). When planting soybean with the application of microbial preparation based on nitrogen-fixing bacterium (Azotobacter) - NITRAGIN, the highest grain yield per plant was achieved with the application of 60 kg N ha⁻¹, but the value was similar to the amount of 30 kg N ha⁻¹, so no significant differences were identified. Further increase in the amount of nitrogen at 90 kg N ha⁻¹ had a decreasing effect and reduced grain yield per plant. The amount of nitrogen without the application of NITRAGIN has a significant effect on the grain yield per plant, and the highest grain yield per soybean plant was formed at the highest dose tested (90 kg N ha⁻¹). Nitrogen fertilization of soybean has a strong influence on grain yield, including other favorable conditions, especially humidity. Nitrogen fertilization of soybean significantly affects grain yield per hectare (Weber 1966). A number of authors also note a favorable response of soybean to nitrogen fertilization (Al-Ithawi et al., 1980; Wood et al., 1993; Osborne & Riedell, 2006). Similar results were obtained for the effects of nitrogen fertilization of corn and mineral nitrogen content in soil (Welch et al., 1971; Starčević et al., 2003). In the fertility research of six corn self-bred lines, depending on five different nitrogen fertilizers, the recorded results showed that the effect of nitrogen is distinctive at a very strong dose of 100 kg ha⁻¹. Higher doses of nitrogen did not