

# Dynamics of copper uptake by three types of flax

## Dynamika pobierania miedzi przez trzy typy lnu

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Flax to obtain high yield and good quality fiber and oil needs balanced fertilization. In the early stages of development the plant takes up small amount of nutrients, but after reaching a height of 10 cm the intensity of the accumulation increased significantly until the flowering phase. According to the literature, the most appropriate NPK ratio in the feeding flax is 1: 2: 3 it is about 40 kg N/ha, 70 kg P/ha and approximately 120 kg K/ha. Apart from the basic nutrients for proper growth and development flax also need microelements such as copper, zinc and manganese. The aim of this study was to determine the dynamics accumulation of copper in the growing season and in the full maturity three types of flax. Field experiments were carried out during three years (2011–2013) in a slightly acidic soil (Haplic Luvisols) formed from light loam. Average monthly temperature in this period was higher than the long-term average and total precipitation close to the long-term average. Wheat was a forecrop and after its harvesting mineral fertilization with 30 kg N/ha, 60 kg P/ha and 120 kg K were used and sown three types of flax Type I – overproducing flavonoids, Type – II overproduction glucose, derivatives of phenylpropanoids Type III – with a higher content of omega-3 fatty acids. Samples of flax plant were collected five times during the growing season, and in the phase of full maturity separated into stems, seed and seed coats to evaluate the distribution of copper between them. The paper presents the average values of the three-year study period. The copper content was determined after the dilution of plant and nitric acid digestion using AAS method on the Varian Spectra AA 200. It was found that during the period of vegetation dry matter yield increased and depended on the yield and the type of flax. Most dry matter flax accumulated in the first year of the study, and at least a second. The largest capacity in this area has shown a flax Type I. During the growing season systematically changed the proportion of dry matter in the fresh matter, from the 7% at the beginning of vegetation to 73% at full maturity. In the maturity the most of dry matter had stems, seeds and then at least seed coats. Most effective in this respect was flax type III. It has been shown wide variation in copper content in the aboveground parts of flax, which averaged over three years, from 1.59 to 16.8 mg Cu/kg dry weight. Content of Cu increased during the growing season and in the full maturity stage was more than two times higher than at the beginning of the growing season. No significant differences in copper content between types of flax were determined. Accumulation of copper over three years of research ranged from 0.39 to 50.3 µg Cu for 1 plant. The smallest was in the beginning of growing and on the end of the growing season was more about ten times higher. Flax Type I had a greater ability to copper uptake from the soil than Type II and III which accumulated approximately 30% less.