

EFFECT OF NITROGEN ON YIELD AND NITRATE CONTENT IN POTATO TUBERS

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Abstract

The production of potatoes, as a highly labor-intensive and profitable vegetable and field crop, requires fertilization, especially the use of nitrate fertilizers, as a major cultural operation. To determine the most favorable nitrogen application rate that would ensure high yields along with optimum nitrate accumulation in potato tubers, a field trial was established using different types (urea and CAN) and rates (50, 100 and 200 kgN/ha) of nitrogen fertilizers in two potato cultivars ('Lizeta' and 'Kondor'). The experiment was conducted on a leached soil under the agroenvironmental conditions of Mountain Radočelo (slopes of Mountain Golija) in Serbia. Results showed that, in both cultivars, average potato yields were higher under CAN treatment ('Lizeta' 32.511 kg/ha; 'Kondor' 32.952 kg/ha) than under urea treatment ('Lizeta' 31.877 kg/ha; 'Kondor' 29.142 kg/ha). Increasing rates of nitrogen and treatments with urea and CAN led to an increase in soil nitrate nitrogen after plant uptake, but its content was lower in all treatments than before trial establishment. Nitrate nitrogen levels in the soil were higher after urea fertilization (12.2 mg/kg) than after CAN treatment (7.6 mg/kg). Average nitrate accumulation was higher in potato tubers fertilized with CAN, particularly in 'Lizeta' ('Lizeta' 236.2 mg/kg; 'Kondor' 198.3 mg/kg), whereas the use of urea gave an average nitrate content of 208.4 mg/kg in 'Lizeta' and 174.7 mg/kg in 'Kondor'.

Keywords: *Potato, Nitrogen fertilizers, Yield, Nitrate content*

Introduction

Nitrogen (N) is one of the nutrients that exert the greatest influence on plant growth and development under diverse environments (Cao and Tibbitts, 1993). It is for this reason that the use of nitrogen fertilizers has been intensified in agricultural production. Crops can utilize different N forms, the main ones being nitrate (NO_3^-) and ammonium (NH_4^+) ions (Coraspe-Léon et al., 2009). Also, urea is an important N source, but experimental results have indicated that uptake capability and use of different N forms (NO_3^- , NH_4^+ or urea) vary depending on the plant species, developmental stage, soil pH, temperature, light intensity and root carbohydrate content (Cao and Tibbitts, 1993; Tan et al., 2000; Lea and Azevedo, 2007). Moreover, as different forms of nitrogen cause an uneven uptake and accumulation of harmful nitrates by crops, it is essential to properly determine the amount of nitrogen required to achieve high yields of good quality crops, particularly in view of the increasing importance given to nitrate content as a quality parameter of vegetables. Given that vegetable consumption accounts for the highest daily dietary intake of nitrates (about 72-94%, European Commission), and considering the important role of potatoes in the amount of vegetables consumed, some European Union countries have recommended limits for nitrate levels in tubers used in the human diet. In Germany, the maximum allowable nitrate concentration in tubers should not exceed 200 mg/kg; in Poland, nitrate limits are set at 183 mg/kg (Cieslik and Sikora, 1998).

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