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## Tuber quality parameters of potato varieties depend on potassium fertilizer rate and source

Ivan MANOLOV<sup>a\*</sup>, Nesho NESHEV<sup>a</sup>, Vesela CHALOVA<sup>b</sup>

<sup>a</sup>Agricultural University Plovdiv, 12 Mendeleev bul. 4000 Plovdiv, Bulgaria

<sup>b</sup>University of Food Technologies, 26 Maritsa Blvd, Plovdiv 4000, Bulgaria

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### Abstract

The influence of potassium fertilizer source ( $K_2SO_4$  and KCl) and fertilizer rates on potato tuber quality parameters under pot and field experimental conditions were studied. The pot experiment included high rate of potassium fertilizers providing 600 mg  $K_2O\ kg^{-1}$  soil from both sources, studied at four varieties.

The field experiment included two fertilizer rates - 100 and 200 kg  $K_2O\ ha^{-1}$ . The dry matter content in tubers from the plants of the pot experiment was the highest for the controls of the three studied varieties - 19.78 % for „Louisiana”; 17.16 for „Riviera” and 17.26 % for „Hussar”. The highest dry matter content (20.98 %) in field conditions was observed for variant  $K_{200}$  ( $K_2SO_4$ ). For all variants from the pot trail fertilized with KCl the starch content was decreased approximately with 2.2 to 2.4 % in comparison to controls. The highest tuber starch content was observed also for the control (15.24 %) from the field study.

The fertilization did not influence the reducing sugars content in tubers. The content was around 0.40 % independently of the trail conditions and cultivars. The application of KCl decreased the content of vitamin C in tubers for all variants from the pot trail compared to the controls (from 46% at variety „Louisiana” to 61 % to Agrida). In the field experiment the high rate of  $K_{200}$  KCl reduced vitamin C content with approximately 54 % (8.40 mg  $100\ g^{-1}$ ) in comparison to variant  $K_{100}$   $K_2SO_4$  (18.10 mg  $100\ g^{-1}$ ). Positive influence of KCl on crude protein content in tubers at all varieties from both trials was recorded.

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\*Corresponding author. Tel.: +359-899-653-354 ; fax: +359 32 564 345.

E-mail address: [manolov\\_ig@yahoo.com](mailto:manolov_ig@yahoo.com)

## 1. Introduction

Among all cultivated plants potatoes (*Solanum tuberosum* L.) have the highest botanical and biological diversity (Valchev, 2011). Used for food for more than 10 000 years, potatoes have high industrial and forage importance (Terziev and Karov, 2000; Donnelly and Kubow, 2011). According to Rytel et al. (2013), the quality of potato tubers and their chemical composition are influenced by genetics factors, soil fertility, weather conditions and chemical treatments that are applied. Potato tubers which have low nitrogen content more often have low dry matter content, as well as higher rates of reducing sugars (Zorb et al., 2014). According to the same authors, reducing sugars are critical precursors for acrylamide formation during frying which is considered carcinogenic and neurotoxic for humans. Nitrogen fertilization increases nitrogen content in potato plants (Neshev et al., 2014). The source of potassium (KCl or  $K_2SO_4$ ) affects yield and quality of potatoes (Manolov et al., 2015). Bansal and Trehan (2011) established reduction of dry matter content in tubers after fertilization with KCl. When compared to KCl,  $K_2SO_4$  improved the quality of tubers and is a preferred source of potassium for potatoes (Herlihy and Carroll, 1969; Manolov et al., 2015).

The aim of the study was to determine the influence of the source of the potassium fertilizer on some quality parameters of different potato varieties in a pot experiment. The second aim was to compare the effect of potassium source and its rates on tuber quality in field conditions.

## 2. Materials and Methods

The pot experiment was performed with four potato varieties: „Louisiana”, „Riviera”, „Hussar” and „Agria”. Potatoes were grown in 15-liter pots containing 15 kg soil with  $pH_{(H_2O)}$  5.67. The soil contained 24.4 mg  $N_{min}$   $kg^{-1}$ , 35.2 mg  $P_2O_5$   $100 g^{-1}$  and 43.9 mg  $K_2O$   $100 g^{-1}$  before the beginning of the study. The trial was designed to evaluate the cultivars responsiveness to zero potassium fertilization ( $K_0$ ) and high rate of potassium fertilizer  $K_{600}$  (600 mg  $K_2O$   $kg^{-1}$  soil) supplied either as  $K_2SO_4$  or KCl. Ammonium nitrate and triple superphosphate were added to all variants to provide 200 mg N  $kg^{-1}$  and 150 mg  $P_2O_5$   $100 g^{-1}$  soil, respectively. The field experiment was conducted on shallow brown forest soil (Cambisols–coarse) in mountainous region under non irrigated conditions with the variety „Agria” by the randomized block design in 4 replications in 2015. The experiment included control and two rates of the potassium fertilizers  $K_{100}$  and  $K_{200}$  providing 100 and 200 kg  $K_2O$   $ha^{-1}$  as  $K_2SO_4$  or KCl. The same rates of nitrogen (as  $NH_4NO_3$ ) and phosphorus (as triple superphosphate) fertilizers were applied to provide 140 kg N and 80 kg  $P_2O_5$   $ha^{-1}$ , respectively to all the variants including the control. The size of the harvesting plot was 16  $m^2$ . Potato planting distance was 25 x 70 cm. The soil  $pH_{(H_2O)}$  was 5.44 and it contained 33.9 mg  $N_{min}$   $kg^{-1}$ , 32.9 mg  $P_2O_5$   $100 g^{-1}$  and 23.5 mg  $K_2O$   $100 g^{-1}$  before the beginning of the study.

Total dry matter content was determined by oven drying at 70°C for 24 h. The amount of starch was determined by using a polarimetric method (Liutskanov et al., 1994). The method of Hagedorn and Jensen was followed to establish the content of reducing sugars (Ivanov and Popov, 1994). Vitamin C was evaluated by dichlorophenolindophenol titration method (Ivanov and Popov, 1994). Total nitrogen was determined by Kjeldal’s method and multiplied by 6.25 to convert to crude protein (Tomov et al., 2009).

Statistical analysis of collected data was performed by using Duncan’s multiple range test (1955) of SPSS program. Statistical differences were considered significant at  $p < 0.05$ .

## 3. Results and Discussions

The highest dry matter content in tubers from the plants of the pot experiment was observed in the controls of the three studied varieties - 19.78 % for „Louisiana”; 17.16 for „Riviera”; 17.26 % for „Hussar” (Table 1). The results correspond with the data of our previous pot trial conducted with variety „Picasso” where the highest dry matter content was also found in the control (Manolov et al., 2015). Similar tendency was not observed for the variety „Agria”. The highest dry matter content (19.37 %) for this variety was found in the tubers fertilized with  $K_2SO_4$ . The KCl fertilization decreased dry matter content in all varieties compared to controls (Table 1).

The content of dry matter of the tubers produced under field conditions was the highest (20.98 %) after fertilization with  $K_{200}$  ( $K_2SO_4$ ). At variant  $K_{200}$  KCl, tuber dry matter content was the lowest - 18.40 % (Table 2). Kumar et al. (2007) also found that the fertilization with KCl decreased dry matter content in potato tubers (21.8 %), compared to fertilization with  $KNO_3$  (22.5 %) and  $K_2SO_4$  (22.3 %).

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