



Crop quality aspects of potato varieties and breeding clones in organic farming systems

Lidija Vojevoda, Ilze Skrabule

Institute of Agricultural Resources and Economics, Latvia

Introduction

When developing potato varieties, not only the yield potential of the genotype, disease resistance, but also the quality aspects of the tubers are always taken into account. One of the indicators of quality is the starch content in the tubers. Starch from potato tubers is one of the most important ingredients as it is used as a raw material in many industrial processes. In Latvia, a potato starch processing company expands starch production each year. In 2020, a total of 1,853 tons of potato starch was produced, including 100 tons of organic starch. It is planned to increase the production of organic starch in the future, as it is in demanded both in Latvia and abroad. **The aim** of the study was to evaluate and select potato varieties and clones with high starch content in the organic farming system.

Methodology

In order to evaluate the starch content for each genotype, the Institute of Agricultural Resources and Economics had set up a field trial in organic crop production system with 10 potato varieties: 'Monta', 'Rigonda', 'Lenora', 'Prelma', 'Brasla', 'Jogla', 'Imanta', 'Magdalena', 'Kuras' and 10 breeding clones: S 07169-35; 2008-6.5; S 07131-15; S 10063-128; S 10063-48; 19922.29; 2001-33.17; S 09035-22; 19694.5; S 07156-22. A field trial was carried out in 2018-2020. The field plots were arranged in 4 replicates, randomized. The potatoes were planted in the third decade of May, by hand and within a distance of 0.3 m between the tubers and 0.70 m between rows in the organic field. The potato plots were harrowed each week after planting. As treatment against the Colorado potato beetle (*Leptinotarsa decemlineata*) was used permitted at the organic system insecticide Neemazal, at a dose of 1L per hektar. The starch content was determined as soon as possible after harvest for all genotype samples at same time. The starch content was determined using underwater weight. The starch yield ($t\ ha^{-1}$) was determined using equation (Equation 1).

$$C = RxBx100$$

C-starch yield, $t\ ha^{-1}$;
R-potato tuber yield, $t\ ha^{-1}$;
B - starch content, %.

(Equation I. Determination of starch yield, $t\ ha^{-1}$)

Results

The results proved impact of meteorological conditions on the starch content in the potato tubers. Starch content of varieties and clones varied from 12.68% to 20.63% on average in 3 years, significant impacts of genotypes and years were observed ($p < 0.05$). The correlation coefficient on average over 3 years was $r = 0.76033$, it indicated that there was a positive linear relationship between tuber yield and starch yield: with increasing tuber yield, starch yield increased, but the coefficient $r = 0.38864$ indicated that there is a positive linear relationship between starch content and starch yield: with increasing starch content, starch yield increased. Starch yield for potato varieties and clones differed significantly between growing years. The highest starch yield was for cultivars 'Kuras' - $7.5\ t\ ha^{-1}$ and 'Jogla' - $7.1\ t\ ha^{-1}$ in 2019, and for clones 19922-29 - $6.5\ t\ ha^{-1}$ and 2008-6.5 - $5.6\ t\ ha^{-1}$ which can be explained by higher tuber yields for these varieties and clones and high starch content - above 20%.

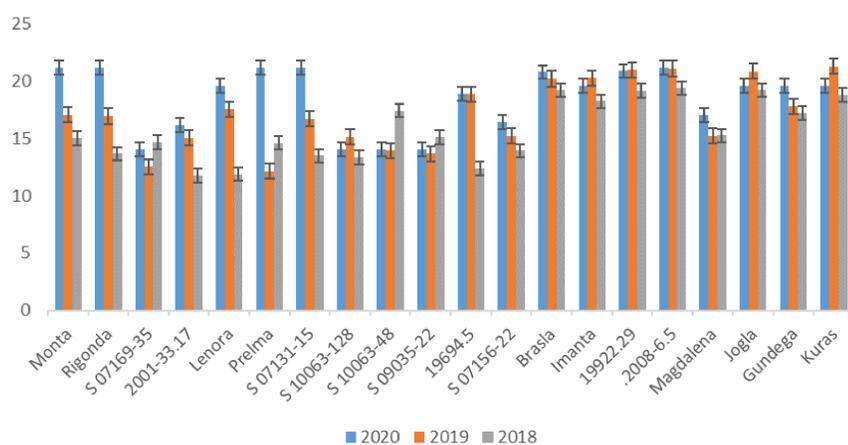


Figure 1. Starch content of potato varieties and clones in tubers in 2018-2020, %.

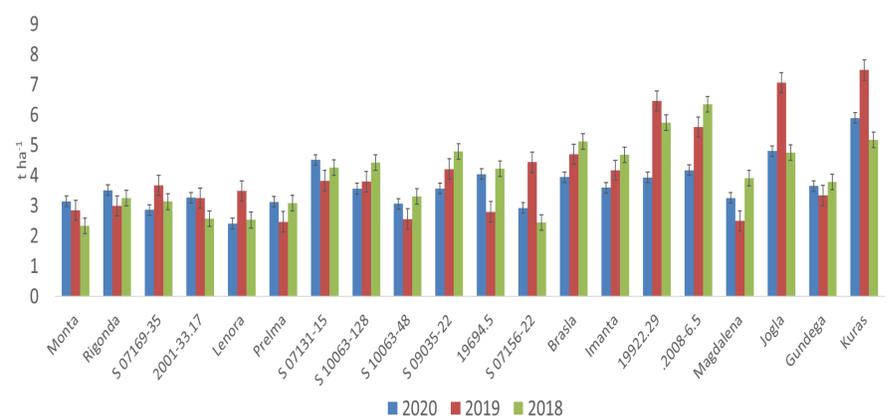


Figure 2. Starch yield of potato genotypes, $t\ ha^{-1}$

The highest starch content was found in 2019 for the variety 'Kuras' (21.32%) and for clones 19922.29 (21.0%) and 2008-6.5 (21.11%), also the following year these clones had a high starch content of (20.9%) and (21.17%), respectively. The high starch content in 2020 was also for the early varieties 'Monta' and 'Rigonda', 'Prelma' (21.17%), which can be explained by the warm and sunny August and plant foliage were not infected by late blight (*Phytophthora infestans*), resulting in more starch accumulating in the tubers. In 2018, many varieties and clones had a significantly lower starch content compared to 2019 and 2020 ($p < 0.05$).

Main conclusions

The highest starch yields were obtained in 2019 at for potato varieties «Kuras» - $7.5\ t\ ha^{-1}$, «Jogla» - $7.1\ t\ ha^{-1}$ and at for clones No.19922-29 - $6.5\ t\ ha^{-1}$; 2008-6.5 - $5.6\ t\ ha^{-1}$. In 2018, many varieties and clones had a significantly lower starch content compared to 2019 and 2020 ($p < 0.05$). It can be unequivocally concluded that the starch content in tubers depends on the annual climatic weather conditions and on the genotypes.

Acknowledgments

The research was executed in frame of Crop Breeding Programme, supported by Ministry of Agriculture, the research presentation was funded by the Latvian Council of Science, project "Potato breeding for low input and organic farming systems: nitrogen use efficiency and quality aspects of potato protein", No. lzp-2019/1-0371.