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FOREWORD

A Word from the Editor-in-Chief

Dear colleagues,

In your hands is the Book of Proceedings of the X International Scientific Agricultural Symposium "AGROSYM 2019", which I hope you will find useful in your work. As many as 900 contributions, from 82 countries, have been accepted for oral or poster presentations. Symposium themes cover all branches of agriculture and are divided into 7 sessions: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environmental protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, 7) Forestry and agroforestry. Papers dealing with agricultural engineering and technology were included into one of the seven sessions depending on their focus.

In the plenary lectures were addressed interesting topics; one keynote was on biotechnology and two others dealt with organic farming in Australia and Europe. This confirms the role of AGROSYM as a forum for open discussions and exchanges on agriculture, food, the environment and rural development in the Balkans and beyond. Many of the papers identify a number of approaches and market-based incentives to encourage producers to achieve higher levels of performance (from both economic and environmental points of view) and as a result to meet the expectations of governments and consumers.

The successful management of agricultural resources to satisfy changing human needs, while maintaining or enhancing the quality of the environment and conserving natural resources, indicate a long-term agricultural development imperative. Advances in productivity, profitability and stability of modern cropping, animal and forestry systems will have to be achieved globally on an ecologically sustainable basis. Today, it is obvious that conventional methods of agricultural production, while providing sufficient food and various products to humanity, have led to a number of negative impacts, including the transgression of many planetary boundaries. These negative impacts raise serious questions about the long-term sustainability of high-input agriculture and call for a genuine transition towards sustainable agro-food systems, which achieve food and nutrition security for present and future generations within the safe operating space for humanity.

Full texts of the submitted communications will be available on the website of AGROSYM (http://agrosym.ues.rs.ba). Each paper included in the present Book of Proceedings was positively reviewed.

Much appreciation is due to the authors of all papers submitted and presented at the symposium as well as to all symposium participants whose ideas and contributions allowed rich and lively discussions during the various sessions. Many thanks to all reviewers, session moderators and colleagues for their help in editing the Book of Proceedings. Special thanks go to all co-organizers, partners and sponsors for their unselfish collaboration and comprehensive support.

Editor-in-Chief

Dusan Kovacevic, PhD
East Sarajevo, 12 October 2019

CONTENT

YIELD AND CONTENT OF STARCH AND PROTEIN IN THE SEED OF THE QUINOA GENOTYPES PUNO AND TITICACA

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Abstract

Quinoa (*Chenopodium quinoa* Willd.) is considered as a very important agricultural crop due to its nutritional value and tolerance to different stress factors. The aim of this study was to investigate the differences in yield, the content of starch and protein in the seed of two introduced genotypes of quinoa (Puno and Titicaca) and the possibility of their cultivation in Serbian agroecological conditions. The experiment was carried out during the 2017 growing season in the rain-fed condition in Subotica, Republic of Serbia. The seeds were sowed in the first part of April. Sowing was done at a depth of 2 centimeters, the distance between the rows was 50 cm and between the plants in the row 5 cm. The crops were harvested in the first half of August when quinoa seeds were mature and the amount of moisture in seed was 12%. The harvest of Puno and Titicaca seeds was made by hand. The content of crude proteins was determined according to the Kjeldahl method, while for starch measurement the Ewers polarimetric method was used. Obtained results showed that the yield of plants Titicaca genotype (24.4 g/plant) was higher compared to the yield of plants Puno genotype (21.3 g/plant). Our results did not show significantly different values in protein content between the seeds of Puno (14.1%) and Titicaca (14.0%). Also, the seeds of Titicaca and Puno contained similar starch content (54.1 and 55.6%, respectively). These results indicate that both investigation genotypes can be grown in Serbian agroecological conditions.

Keywords: *Quinoa, yield, seed, starch, protein*

Introduction

Quinoa (*Chenopodium quinoa* Willd.) is a pseudocereal plant, belonging to the family Amaranthaceae, native to the Andean regions of South America. Quinoa being adaptable to different types of soil and climatic conditions and to adapt to different abiotic stress conditions including frost, drought, salinity (Jacobsen and Muica, 2002; Jacobsen, 2017). Furthermore, the crop has a remarkable adaptability to different agro-ecological regions. It can grow at relative humidity from 40% to 88%, and withstands temperatures from -4 °C to 38 °C. It is a highly water efficient plant, is tolerant and resistant to lack of soil moisture, and produces acceptable yields with rainfall of 100 to 200 mm (Valencia-Chamorro, 2003). In comparison to most cereals, quinoa seeds have a higher nutritional value (Matiacevich *et al*., 2006). The nutritional values of quinoa are the result of high content of minerals, vitamins, proteins and essential amino acids, high quality fatty acids, antioxidants and other important multiple bioactive compounds (Vilcacundo and Hernández-Ledesma, 2017). The nutritional value of quinoa seeds is reported to meet, and even surpass, that recommended by the World Health Organization (Hirose *et al*., 2010). It is known that quinoa has considerably positive effects on metabolic, cardiovascular, and gastrointestinal health in humans. The protein content of quinoa seeds varies from 8% to 22%, which is higher on average than that in common cereals such as rice, wheat, and barley. The storage reserves of proteins in the seeds are mainly located in the reduced endosperm and the cotyledons (Valencia-Chamorro, 2003), while carbohydrate reserves are found in the perisperm, nominated as seed storage tissues

(Prego *et al*., 1998). Agronomic research, including the plant density, potential ultivation, phenology, morphology, physiological maturity, yield, and weeds control, should be performed. Production of quinoa has been prevalently conducted in Bolivia and Peru and still is with small productions in other Andean countries like Ecuador, Chile, Argentina, and Colombia. Jacobsen (2003) and Pulvento *et al*. (2010) has been investigated quinoa adaptability to both northern and southern European conditions. Many other countries are performing tests on quinoa with very promising results. Growing period of quinoa varied between 70 to 200 days (Kenya 65-98 days, Denmark and Sweden 120-160 days, Greece 110-160 days) (Ramesh *et al*., 2017). The highest yield of 7.500 tons/ha was recorded in Lebanon closely followed by Egypt 3.872 tons/ha, while lowest yield was recorded in Mauritania 0.230 tons/ha.
The aim of this paper is present the possibility of cultivating quinoa and achieving satisfactory yields and quality (protein and starch content in the grain) in the agroecological conditions of Serbia.

Material and Methods

The experiment was carried out during the 2017 growing season in rain-fed conditions, using two introduced genotypes of quinoa adapted to the European climate, Puno and Titicaca. Used genotypes selected at the University of Life Sciences in Copenhagen, Denmark (Jacobsen and Muica, 2002). The quinoa was grown on Serbian farm near Subotica, located in Vojvodina, northern Serbia. The soil type was chernozem, medium rich in nitrogen (0.24%) and hummus (3,19%), highly rich in phosphorus (34.68 mg P_2O_5 per 100 g of soil) and rich in potassium (29.42 mg K_2O per 100 g of soil), slightly alkaline (pH 7.6). The analysis showed that the nutrient content of the soil was satisfactory and fertilizer wasn't applied during the vegetative season. The seeds were sowed in the first part of April. The experiment was laid out in a split-split plot system, with four replications. The size of the main plot was 12 m^2. The distance between the rows was 50 cm and between the plants in the row 5 cm (approximately 400 000 seeds per hectare). The seeds were sown at a depth of 2 centimeters. The crops were harvested in the second half of August when quinoa seeds were ripeness, the moisture content was 12%. The height of plants, plant fresh weight, number of flower branches and yield was measured. All investigated parameters were calculated on the basis of 120 plants. The seeds were ground by using a laboratory mill (model Cemotek Sample Mill Foss, Sweden) and then the contents of proteins and starch were analyzed. The content of crude proteins was determined according to Kjeldahl method (Stikić *et al*., 2012), while for starch measurement the Ewers polarimetric method was used (ISO 10520: 1997). The temperature data was obtained from the automatic meteorological station located in the center of Subotica (4-km from the experimental field). The measurements were collected using "Nexus" instruments and "Weather Display" software (http://www.sumeteo.info). The amount of precipitation was measured on site, at the experimental field.
Monthly reviews of average air temperature and total precipitation are represented in Table 1.

Table 1. Climate conditions during the 2017 growing season.

	Average temperature (°C)	Total precipitation (mm)
April	11.2	35
May	17.1	38
June	22.1	35
July	22.8	44
August	23.3	33

Results and Discussion

In the territory of Serbia, there is a tendency to increase the air temperature as well as the number of tropical days (Ruml *et al*., 2017). Growing period of quinoa in Serbia is from beginning of April to the second half of August (about 140 days). The growing season 2017 in the Palić (Subotica) area features a temperatura mean of 18.9 ºC and a total rainfall of 245 mm. A comparison with the perennial average (1971-2000) shows that the growing seasons of 2017 were warmer, which was most pronounced during July and August (Table 1). Regarding the amount of precipitation, the growing season 2017 has been very dry. August was the warmest (23.3ºC), with the least rainfall (33 mm). Growing season 2017 is characterized by a pronounced deficit, higher than the average in the area of Serbia, which is 286 mm (Matović *et al*, 2013). The quinoa's need was as much as 534 mm higher than the incoming rainfall.
Results of plant height, plant fresh weight, number of flover branches and yield two genotypes (Titicaca and Puno) are presented in Table 2.

Table 2. Plant height, plant FW, number of flover brances and yield of two investigation genotypes (Titicaca and Puno)

Genotype	Plant height (cm)	Plant fresh weight (g)	Number of flower branches	Yield (g/plant)
Titicaca	139.43	134	13	24.35
Puno	122.78	96.6	16	21.33

Our results did not showed the big variation between Titicaca and Puno plants in investigation parameters: plant hight, plant FW, number of flower branches and yield (as the most important parameter). Average yield of Titicaca plants was 24.35 g/plant (4.9 tons/ha), while the average yield of Puno plants was 21.33 g/plant (4.3 tons/ha) (table 2). If we compare the yield obtained in our agro-ecological conditions to other countries (Kenya 4 tons/ha, Greece 2 tons/ha) (Ramesh *et al*., 2017), it can be considered a high yield. Compared to the conventional cultures involved, quinoa production could be more cost-effective in existing agro-agroecological conditions. For example, corn and quinoa record a similar yield per ha. Higher economic cost-effectiveness of quinoa production lies in the cost of cost. In Serbia, in 2017, the same price of corn was recorded, and in 2010 it was 0.13 eur/kg, which is approximately 35 times lower than the quinoa price. Between 2006 and early 2013, quinoa crop prices have tripled. In 2011, the average of quinoa crop price was 3,115 USD per ton with some varieties selling as high as 8,000 USD per ton (Ruiz *et al*., 2014).
We have compared Puno and Titicaca cultivars and found similar percentages of proteins (14.1 and 14.0%, respectively) (Czekus *et al*., 2019). Similar protein content in grain Puno and Titicaca quinoa genotypes (14.7 and 14.4%, respectively) was found Aluwi *et al*. (2017) The main carbohydrate component of quinoa is a starch and in our research the seeds of Titicaca and Puno contained similar starch content (54.1 and 55.6%, respectively) (Czekus *et al*., 2019). According to Aluwi *et al*. (2017), a higher percentage of quinoa seed starches was detected in Puno (62.6%) than in Titicaca (56.4%). In general, as for the Titicaca cultivar, the total carbohydrate represents the main seed component at approximately 54-57%, according to the study of Pulvento *et al*. (2012).

Conclusions

In conclusion, our study demonstrated that quinoa cultivars Puno and Titicaca has grown in Serbia (Southeastern European agro-ecological conditions), gave a very satisfactory yield, as well as the starch and protein content in the seed, in the year with a high precipitation deficit. With their introduction in production, given the current prices of quinoa seed, high profits could be achieved. Quinoa is a plant species extremely tolerant to drought and its cultivation could contribute to overcoming the increasingly negative effects of drought on agricultural production in Serbia.

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References

Aluwi N.A., Murphy K.M., Ganjyal G.M. (2017). Physicochemical characterization of 28 different varieties of Quinoa. Cereal Chemistry, 94 (5), pp. 847-856.

Czekus B., Pećinar I., Ivana P., Paunović N., Savić S., Jovanović Z., Stikić R. (2019). Raman and Fourier transform infrared spectroscopy application to the Puno and Titicaca cvs. of quinoa seed microstructure and perisperm characterization. Journal of ceraal sciences, 87, pp. 25-30.

Hirose Y., Fujita T., Ishii T., Ueno N. (2010). Antioxidative properties and flavonoid composition of *Chenopodium quinoa* seeds cultivated in Japan. Food Chem, 119, pp. 1300-1306.

ISO (International Organization for Standardization) 10520: 1997(en): Native starch - Determination of starch content - Ewers polarimetric method.

Jacobsen S.E. (2003). The worldwide potential for quinoa (*Chenopodium quinoa* Willd.). Food Rev Int, 19, pp.167-177.

Jacobsen S-E. (2017). The scope for adaptation of quinoa in Northern Latitudes of Europe. Journal of Agronomy and Crop Science, 203(6), pp. 603-613.

Jacobsen S-E., Muica A. (2002). Genetic resources and breeding of the Andean grain crop quinoa (*Chenopodium quinoa* Willd.). Plant Genetic Resources Newsletter, 130, pp. 54-61.

Matović G., Gregorić E., Glamočlija Đ. (2013). Crop Production and Drought in Serbia in Light of Climate Change. Agriculture in Serbia and Portugal: Recent Developments and Economic Policy Implications. Ed. Faculty of Economics of the University of Coimbra, Portugal. pp. 264-286, ISBN: 978-972-9344-07-7.

Matiacevich S.B., Castellión M.L., Maldonado S.B., Buera M.P. (2006). Water-dependent thermal transitions in quinoa embryos. Thermochimica Acta, 448, pp. 117-122.

Ramesh K., Suneetha Devi K.B., Gopinath K.A., Uma Devi M. (2017). Physiological Indices, Yield and Yield Attributes of Quinoa (*Chenopodium quinoa* Willd.) as Influenced by Dates of Sowing and Varied Crop Geometry. Int. J. Curr. Microbiol. App. Sci., 6 (7), pp. 1023-1034.

Ruiz K.B., Biondi S., Oses, R., Acuña-Rodríguez I.S., Antognoni F., Martinez-Mosqueira E.A., Coulibaly A., Canahua-Murillo, A., Pinto M., Zurita-Silva, A., Bazile D., Jacobsen, S.E., Molina-Montenegro, M.A. (2014). Quinoa biodiversity and sustainability for food security under climate change. A review. Agron. Sustain. Dev., 34, pp. 349-359.

Ruml M., Gregorić E., Vujadinović M., Radovanović S., Matović G., Vuković A., Počuča V., Stojičić, Dj. (2017). Observed changes of temperature extremes in Serbia over the period 1961 - 2010. Atmos. Res., 183, pp. 26-41.

Prego I., Maldonado S., Otegui M., (1998). Seed Structure and Localization of Reserves in *Chenopodium quinoa*. Annals of Botany, 82, pp. 481-488.

Pulvento C., Riccardi M., Lavini A., d'Andria R., Iafelice G., Marconi E. (2010). Field trial evaluation of two *Chenopodium quinoa* genotypes grown under rain-fed conditions in a typical Mediterranean environment in south Italy. J Agro Crop Sci, 196, pp.407-411.

Stikić R., Glamoclija Đ., Demin M., Vucelić-Radović B., Jovanović Z., Milojković-Opsenica D., Jacobsen S.E., Milovanović M. (2012). Agronomical and nutritional evaluation of quinoa seeds (*Chenopodium quinoa* Willd.) as an ingredient in bread formulations. Journal of Cereal Science, 55, pp. 132-138.

Valencia-Chamorro S.A., (2003). Quinoa. In: Caballero, B.: Encyclopedia of Food Science and Nutrition 8, Academic Press, Amsterdam, pp. 4895-4902.

Vilcacundo R., Hernández-Ledesma, B. (2017). Nutritional and biological value of quinoa (*Chenopodium quinoa* Willd.). Current Opinion in Food Science, 14, pp. 1-6.