1. Hoppe, Robert A. and MacDonald, James M., Updating the ERS Farm Typology (April 2013).
2. Census of agriculture [Электронный ресурс]. Режим доступа: hups:/vww.agcensus.usda.gov/
3. Farm typology [Электронный ресурс]. Режим доступа: hups:/vww.agcensus.usda.gov/
4. 2012 Census of agriculture: United States Summary and State Data Volume 1, Geographic Area Series, Part 51. Issued May 2014. – URL: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapte r_1_ US/usv1.pdf (дата обращения: 16.09.2020). – Текст: электронный
5. 2017 Census of agriculture: United States Summary and State Data Volume 1, Geographic Area Series, Part 51. Issued April 2019. – URL: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_ Chapt er_1_US/usv1.pdf (дата обращения: 14.09.2021) – Текст: электронный.

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QUINOA - A NEW AGRICULTURAL CROP FOR RUSSIA

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Abstract. *The article presents the results of studies on the effect of nitrogen nutrition on quinoa grain yield and quality.*

Keywords*: quinoa, nitrogen, yield, protein.*

Quinoa (*Chenopodium quinoa* Willd.) is a new crop, presently being tested in Northern Europe, where its close relative fat hen (C. *album*) is already a well-known weed species. Although it may seem trendy and fashionable quinoa is certainly not a new food. It was grown and eaten thousands of years ago by the ancient Incas and revered as the “mother of all grains.” In the Iron Age, the European fathen had the status of a secondary crop, either collected or cultivated [1].

Therefore, the present-day introduction of quinoa to Northern Europe is based on the utilization of a closely related species in ancient times. Quinoa is one of the oldest, existing crops, which was first detected by Europeans when Columbus discovered South America in 1492 [1, 2, 5].

According to the FAO, quinoa is regarded as a new world staple and predicted to spread fast across the globe (FAO 2013).

Quinoa is often referred to as a 'super food' and with good reason since quinoa is considered one of the world's most popular healthy foods.

Quinoa seeds are often used as substitute of rice, and the seeds are highly nutritious and have high percent of protein as compared to other cereals. Quinoa is gluten-free, and contains sufficient amount of all nine essential amino acids. It is also high on antioxidants, B vitamins, E vitamin, fiber, iron, calcium, potassium and phosphorus.

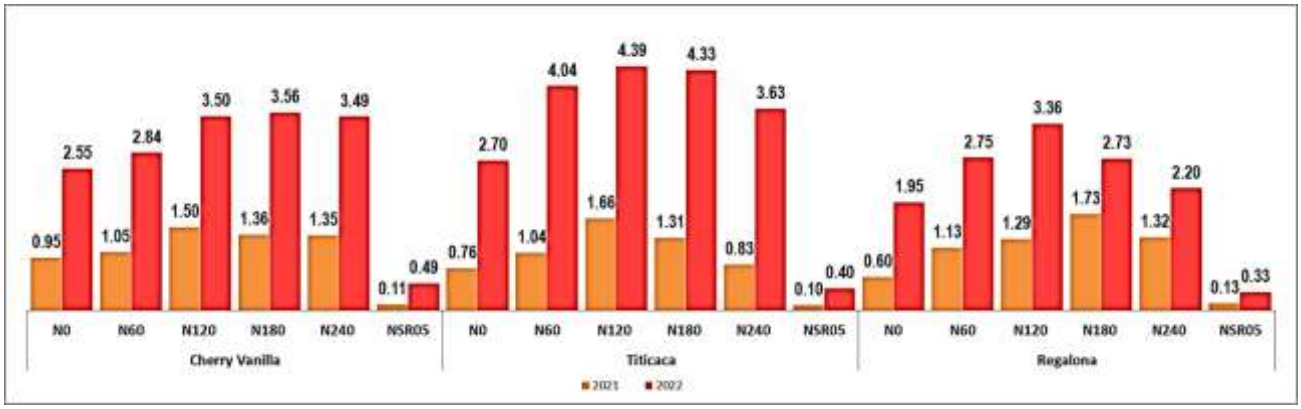
Cooked quinoa consists of 71.6% water, 21.3% carbohydrates, 4.4% protein, and 1.92% fat [1, 4].

The carbohydrates in quinoa consist mainly of starch, insoluble fibers, and small amount of sugar. Unusually for the plant world, quinoa grains are a complete protein with 2 grams of fat per 100g (3.5oz).

Quinoa seeds seem to have more nutrients than most other grains and are fairly high in quality protein [1].

For several years we have been doing research on quinoa. Research has been carried out under the agroecological conditions of the Central region of the Russian Federation at the Field Experimental Station of the Timiryazev Academy. In these experiments, the features of quinoa yield formation were studied depending on varietal characteristics, doses and timing of nitrogen fertilizer application, and seeding rates.

Productivity is the most important indicator of the agronomic efficiency of crop cultivation. Being not an easy crop to grow, Quinoa requires much attention to detail to ensure harvestable crop. The production cycle runs from spring to autumn. Crop quality is checked at all stages that allows obtaining healthy, delicious grain. Ideal temperature for quinoa farming is between 18°C and 20°C. Quinoa can be grown in different types of soil. But the most suitable soil for commercial quinoa farming is neutral sandy loam soils.



Picture 1. The yield of quinoa varieties Cherry Vanilla, Titicaca, Regalona, 2021-2022, t/ha

During the years of research, the yield varied within a fairly wide range - from 6 t/ha for the Regalona variety in 2021 to 4.4 t/ha for the Titicaca variety in 2022 (picture 1).

The highest yield was produced by the Titicaca variety in 2022, that is 2.7 t/ha in the control variant of the experiment, 3.6-4.4 t/ha when using nitrogen fertilizer, respectively. With the use of nitrogen fertilizers, the yield of quinoa increased in all variants of the experiment compared to the control. However, yield increases were the highest when nitrogen was applied at doses of 120 and 180 kg/ha.

The quality of the resulting crop is also important.

Table 1

Protein content in quinoa grain harvest 2021 and 2022, %

Experiment Variant	Cherry Vanilla		Titicaca		Regalona	
	2021	2022	2021	2022	2021	2022
N0	10.07±0.22	8.37±0.17	10.10±0.19	9.15±0.19	9.46±0.11	10.49±0.22
N60	10.30±0.28	11.22±0.27	10.24±0.21	9.66±0.21	10.20±0.32	13.20±0.37
N120	10.22±0.20	12.98±0.25	9.81±0.29	12.16±0.37	10.60±0.35	13.93±0.33
N180	11.17±0.39	13.56±0.31	10.53±0.36	13.86±0.33	10.56±0.29	14.33±0.36
N240	11.29±0.34	12.61±0.35	11.76±0.38	12.70±0.36	10.76±0.33	15.15±0.45

The protein content in quinoa grains harvested in 2021 ranged from 9.5 to 11.8%, depending on varietal characteristics and cultivation technology (nitrogen fertilization). Mineral fertilizers contributed to the accumulation of protein in the grain. On all variety samples, there is a tendency to increase the protein content with the introduction of increased doses of nitrogen fertilizer.

In 2022 the amount of protein in quinoa grain ranged from 8.4 to 15.2%. There was also a tendency to accumulate protein in the grain when using high doses of nitrogen fertilizer.

Our research shows that profitable production of quinoa is quite possible in our country.

References

1. What is Quinoa? - [Electronic resource]. - URL: https://www.quinoaquality.com/what-is-quinoa

2. Bazile D, Jacobsen S-E and Verniau A (2016) The Global Expansion of Quinoa: Trends and Limits. Front. Plant Sci. 7:622. https://doi.org/10.3389/fpls.2016.00622

3. Catalogue of commercial varieties of quinoa in Peru. A future planted thousands of years ago // Food and Agriculture Organization of the United Nations. Lima, 2015. – P.74.

4. Food and Agriculture Organization/World Health Organization of United Nations. 2010. Fats

5. Jacobsen, S.E, Mujica A, Ortiz R. 2003b. The global potential for quinoa and other Andean crops. Food Rev Int 19: - P.148.

6. Jacobsen, S.-E. (2017). Adaptation and scope for quinoa in Northern latitudes of Europe. J.Agro.Crop Sci. 203:603–613. https://doi.org/10.1111/jac.12228
7. Fomina T.N. English-Russian dictionary on agronomy and soil sciences: dictionary / T.N. Fomina ; Russian State Agrarian University - MAA named after K.A. Timiryazev (Moscow). - Moscow : RSAU-MTAA, 2014. - 76 pp.

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МОНИТОРИНГ ИЗМЕНЕНИЙ НАЗЕМНОГО ПОКРОВА СИРИЙСКОЙ АРАБСКОЙ РЕСПУБЛИКИ С ИСПОЛЬЗОВАНИЕМ СПУТНИКОВЫХ СНИМКОВ LANDSAT

Али, Махер Салид. *Doctor of the Ecology and Forestry Department, Faculty of Agriculture, Tishreen University, Lattakia, Syria. E-mail: maher.s.ali@tishreen.edu.sy*

Аннотация. *В работе был проведён мониторинг динамики наземного покрова Сирийской Арабской Республики (САР) по данным изображений Landsat-5 1993 г. и Landsat-8 2019 г. Для неуправляемой классификации спутниковых изображений был применён алгоритм ISODATA. Общая точность проведённой тематической классификации по алгоритму ISODATA составила более 80 %, а коэффициент Kappa – 0,76-0,78.*

Ключевые слова*: Landsat, Сирийская Арабская Республика, Тематическое картографирование, Растительный покров.*

Введение. Исследования земного покрова на основе данных спутниковых снимков имеют особое значение для лесного покрова в Средиземноморском регионе из-за пространственной и временной неоднородности, обусловленной особым климатом, разнообразием растений и топографическим разнообразием [1]. Дистанционный мониторинг растительного покрова является важным источником точной и своевременной информации, необходимой для анализа динамики его изменений и устойчивого управления территориями [2].

Спутниковые изображения системы Landsat обеспечивают периодические наблюдения за растительным покровом с начала 70-х годов прошлого столетия, что позволяет проводить оценку его динамики и состояния. Решению этих вопросов в значительной мере способствуют данные дистанционного зондирования Земли (ДЗЗ) и программные средства для обработки спутниковых данных [6]. Для решения вопросов дистанционного мониторинга растительного (лесного) покрова за более чем 20-летний период времени принято использовать изображения среднего пространственного разрешения системы спутников Landsat [5].