CULTIVATION PERSPECTIVE AND IMPORTANCE OF QUINOA FOR LEAVES IN ROMANIA

PERSPECTIVE DE CULTIVARE ŞI IMPORTANŢA SPECIEI *CHENOPODIUM QUINOA*, WILLD., CA LEGUMĂ PENTRU FRUNZE ÎN ROMÂNIA

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Abstract. *In recent decades, climate change is rapidly deteriorating crop production conditions. The phenomena of salinization and drought are constantly increasing in all areas of the world, as well as in Romania. On the other hand, there is a constant population growth worldwide, which means that new species and genotypes tolerant to these factors can be identified and used for modern-future agriculture. The species tolerant to stress and salinity exist, they have an ecological plasticity and a very high value of biodiversity, due to the different climatic conditions in their area of origin, but at the moment they are unused and neglected. One such species is quinoa Chenopodium quinoa, Willd., which we have focused on in this paper, in particular emphasis is placed on the ecological plasticity of the plant, respectively resistance to drought and salinity.*

Key words: climate changes, tolerant species, salinity, ecological plasticity

Rezumat. *Schimbările climatice degradează în ritm accelerat condiţiile de producţie ale culturilor, în ultimele decenii. Fenomenele de salinizare şi de secetă sunt în continuă creştere în toate zonele lumii, cât şi în România. Pe de altă parte, se înregistrează o continuă creştere demografică la nivel mondial, ceea ce face ca noi specii şi genotipuri tolerante la aceşti factori, sa fie identificate şi folosite pentru agricultura modernă-viitoare. Speciile tolerante la secetă şi salinitate există, ele având o plasticitate ecologică şi o valoare a biodiversităţii mare, datorate diferitelor condiţii climatice din zona lor de origine, dar, momentan, sunt neutilizate şi neglijate. O astfel de specie este şi quinoa, Chenopodium quinoa Willd., asupra careia ne-am îndreptat atenţia în această lucrare, în mod deosebit se are în vedere plasticitatea ecologică a plantei, respectiv rezistenta la secetă şi sărăturare.*

Cuvinte cheie: schimbări climatice, speciI tolerante, salinitate, plasticitate ecologică

CIRCUMSTANCES

Quinoa *(Chenopodium quinoa* Willd.) is considered a pseudo-cereal, originating from Latin America. The species still has a strong traditional imprint, even if new modern practices appear, due to studies conducted at the University of Colorado (USA) and in Europe.

The cultivation of the species was largely abandoned with the arrival of the Spanish conquerors, who replaced the quinoa plant with cereals brought from

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Europe (wheat and barley), much more productive at that time. The quinoa plant is currently grown throughout the Andean region, in the USA, in Europe, Asia and Africa.

Quinoa is a plant grown mainly for its edible seeds, with a high degree of digestibility. Also, the leaves can be eaten as a substitute for spinach, in various dishes, well known in the area of origin (Vitănescu, 2020). The nutritional value of quinoa leaves is special, quinoa is a very interesting food, being a precious source of protein, vitamins and minerals.

In 1996, the quinoa plant was classified by the FAO as one of the most promising crops for humanity, not only for its beneficial properties on health, but also for its multiple uses, being considered an alternative solution to eradicate world hunger.

FOOD PERSPECTIVES

The *Chenopodium quinoa* Willd. species has been studied due to its good adaptability to different environmental conditions, its high nutritional value and the interest it has shown lately, both globally and nationally. From a food, therapeutic, agrotechnical, economic and social point of view, the quinoa species has aroused interest in our country, although it is not yet widely cultivated in Romania.

In this respect, the efforts of researchers are mainly focused on the following research directions, namely:

- increasing the resistance of plants to manna - *Peronospora variabilis*,
- elimination of saponin / creation of sweet varieties,
- nutritional value in the diet / nutraceutical properties of the species,
- precocity,
- drought resistance and salinity
- the defense mechanisms of the quinoa species against abiotic stressors - drought and salinity

As a food, quinoa is considered a pseudo-cereal, with a special nutritional value, which is why we turned our attention to its benefits. Quinoa leaves can be eaten raw or steamed, retaining most of their vitamins and minerals. Based on the nutritional profile and the total content of polyphenols and flavonoids, quinoa leaves can be considered an alternative for human consumption, because they have an interesting nutritional potential and a special antioxidant capacity, which is a dietary requirement. They have a better nutritional profile than cereals, do not contain gluten, with a higher protein content in fresh leaves than spinach (2.86%) or broccoli (2.98%) (Alma Vazquez-Luna, 2019). Quinoa leaves also excel in glutamic acid (4.49 g / 100g protein), aspartic acid (2.98g / 100g protein), alanine (2.9 g / 100g protein) and glycine (2.48 g / 100g protein). Quinoa is an important source of essential amino acids: lysine, methionine and tryptophan, usually absent or found in small amounts in other foods of plant origin. This makes quinoa a

basic component in the vegan and ro-vegan diet, being an important source of calcium and phosphorus, considered a good substitute for animal protein.

ANTINUTRITIVE PERSPECTIVES

Antinutrient substances (saponin) are also present in quinoa leaves, as well as in seeds (sweet varieties-0.2-0.4 g / kg su; bitter varieties 4.7-11.3 g / kg su), which makes them practically impossible to be consumed without applying a series of treatments beforehand. Saponin inhibits the absorption of Ca in the human body, on the one hand, and on the other hand has anti-inflammatory properties, contained in the leaves in amounts less than 0.13-0.17 g / kg s.u.

The nutraceutical potential of quinoa for leaves was evaluated by analyzing the phenol content, elucidating the effect of phenolic compounds in quinoa on the properties of cancer cells and estimating their antioxidant activity, bioavailability and bioavailability. These observations indicate that the phenols contained in quinoa may exert chemopreventive and anticancer effects on oxidative stress and intra-cellular dependence signaled by synergistic effects. The relative bioavailability and bioavailability potential of the components, probably responsible for these effects, demonstrates the versatility of quinoa species for dietary supplementation (Gawlik-Dziki, 2013). A study conducted at Harvard says that daily consumption of quinoa can reduce the risk of premature death caused by cancer, being rich in antioxidants with a role in fighting free radicals.

FAO considers quinoa to be a "perfect food" and is not only used in common diets, but can be a staple in vegetarian diets or for the diet of high-performance athletes, as well as in the diet of those suffering from celiac disease and diabetes.

TEHNOLOGICAL PERSPECTIVES

Given the climate change and the phenomena of drought and salinization, which are constantly growing in all parts of the world, as well as in Romania, the aim is to identify and use in agriculture some species and genotypes tolerant to these factors.

In the face of declining water resources and declining crop productivity, it is relevant to assess the potential of halophyte plant species. This feature has aroused interest in this species and a large number of studies have been done in order to elucidate the mechanisms used by quinoa to cope with high salt levels in the soil at different stages of plant development (Adolf, 2013). Tolerances of the quinoa plant to abiotic stress (drought, salinity, low soil fertility, frost, etc.) have led to the creation of programs focused on increasing productive potential. The introduction of salinization-resistant crops is considered one of the best alternatives to meet these changes in nature. In this regard, quinoa cultivation is one of the species with an important potential in maintaining food security in countries suffering from arid environmental conditions.

From the point of view of the agrotechnical value, the quinoa species can offer new solutions to the agricultural ecosystems, reducing the costs with the maintenance and restoration works of the lands, which are in different stages of degradation. It also contributes significantly to increasing soil fertility. The microbial composition is strongly affected, among other factors, by the extreme effects of climate, caused by changing rainfall, diminishing water resources. Farmers need new tools to adapt to these changes.

ECONOMIC PERSPECTIVES

Quinoa is a food of South American origin, which is grown mainly in Peru and Bolivia (92%), states that, from an economic point of view, have experienced an economic boom, production doubling in recent years. (Pedersen *et al.,* 2016). More than half of quinoa production is destined for export. In the area of origin, the territories cultivated with quinoa are expanding, to the detriment of the other crops. Production and price are constantly increasing (ranging from 3000-8000 USD per tonne), and constantly increasing requirements create natural and social imbalances. Emphasis is also placed on quantity at the expense of quality. In Europe, Italy has become the main exporter of quinoa. Quinoa culture has crossed both cultural and territorial borders, reaching France, England, Sweden, Denmark, the Netherlands, Italy, USA, etc., being spread in over 70 countries. The most important European importers of quinoa are: France, Olada and Germany (Bazile *et al.,* 2016).

Scientific research in agriculture is more necessary, the more advanced the production process and the factors that influence it are. The results that will be obtained through thorough and complex research will be used by specialists working in production as a means of guidance on the applicability of new results. As in all fields, there is a close correlation between the level of research and technical progress in agriculture, as production accurately reflects the level reached by agricultural research.

As a consequence of climate change in Europe, various effects of some causes are foreseen, depending on the territorial areas: extreme climatic conditions - drought, increasing soil salinity, increasing erosion, etc. (Pachauri and Reisinger, 2007). To solve this problem, greater flexibility of agricultural activity is needed, which must be based on a wide range of crops and an improvement in cultivation techniques. Thus, the need to introduce in the traditional crop rotation plan a series of crops increases, which is distinguished by a greater efficiency of water use in the soil.

Quinoa is a rustic plant, resistant to drought and salinity, adaptable to less favorable conditions. It prefers medium-textured, well-drained soils rich in organic matter with a medium nutrient content. The vegetation period varies depending on the genotype and environmental conditions, between 110-240 days. This recommends it as an alternative crop to climate change and highlights the contribution it can make to global food security.

In fact, hard research has led to the introduction, development and promotion of quinoa crops around the world. The number of countries cultivating this basic crop has grown rapidly, from 8 countries in 1980 to more than 120 countries in 2018 (Sifeddine Rafik *et al,* 2021). Today, quinoa is grown in countries like Bolivia, Peru, Uruguay and is highly valued in Asia, Europe, North America, etc.

CONCLUSIONS

The prospects for the cultivation of the quinoa species (*Chenopodium quinoa* Willd.), as a leafy vegetable, take into account the following:

1. Cultivation of varieties that are adapted to the climatic conditions in our country or that have a high ecological plasticity, as well as a mechanism of resistance to stress and salting conditions.

2. Improving cultivation techniques and introducing the crop into the traditional cultivation plan, for a better use of nutrients and soil water.

3. Technological optimization of certain cultivation measures for the Chinese species, as a leafy vegetable plant.

4. Implementation of a cultivation technology for the Chinese species, as a vegetable for leaves.

5. The need to introduce in the diet of the agricultural product with a high nutritional level, as an alternative in the vegan and raw-vegan diet, cultivated as an organic vegetable plant for leaves.

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