

STUDIES REGARDING THE POSSIBILITY OF INTRODUCING BUCKWHEAT CROPS IN DOBROGEA, WITHIN THE CONTEXT OF SUSTAINABLE AGRICULTURE

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Keywords: *buckwheat*

Abstract

Buckwheat (Fagopyrum esculentum var. sagittatum), family Polygonaceae, is an old crop originated from Tibet, where a large variety of wild and cultivated forms can be encountered up to an altitude of 3,600 m or even more. It was brought in Europe much later and it spread in Denmark, Germany and France. Its importance diminished in the 19th century. The surface cultivated with this plant was considerably reduced after the First World War. From 3.9 million ha cultivated between 1922-1925, the surface was reduced to 3.1 million ha in 1940. The crops are concentrated especially in Europe (1.4 million ha, among which 0.87 million ha in the Russian Federation and 0.37 million ha in Ukraine) and China (1 million ha). Among the countries that cultivate buckwheat, the following can also be mentioned: The USA (65 thousand ha), Poland (74 thousand ha), Brazil (45 thousand ha), Japan (43 thousand ha), France (31 thousand ha), Belarus and Lithuania. The world trade sums up to 180 thousand tones yearly, the major exporters being China and the USA. The culture area extends up to 70 degrees northern latitude and an altitude of 800 m. In Romania, it could be extended in crop, especially in ecological farming. Buckwheat can be cultivated in Dobrogea as this region has the appropriate soil and climate conditions. This paper proposes possible technological versions that can be applied to this culture in order to extend it in Dobrogea.

INTRODUCTION

Buckwheat, a sweet-flavored food type, has recently been focused on again by the consumers, firstly because of the dietary qualities of the seeds (with a calorie count of only 128 kcal/100 g, compared to the average of 350 kcal/100g in the usual cereals). Buckwheat crop is promoted by those that practice ecological agriculture as an alternative to the basic crops, being frequently sold in shops specialized in ecological products. For these reasons, specialists have begun to pay attention to buckwheat lately, in what regards the improvement of the existing types. The farmers are also interested, but in terms of profitable alternative to the current structure of crops.

MATERIAL AND METHODS

For this paper, we studied the possibility of introducing buckwheat crops in the crop structure of Dobrogea by means of an opinion poll accomplished among the local farmers, who were interested in this culture. First there were meetings with the farmers, where the advantages of using this plant in alimentation and agriculture were presented to them. As a result of the poll, farmers were interested in this topic. The location of the experiments was a farm around the locality of Stupina, Constanta County. In this regard, a buckwheat crop was set up and it was followed during the vegetation period and the results are presented in this paper. The soil type on which the crop was placed was calcaric chernozem.

RESULTS AND DISCUSSION

Description of the experimental zone: Dobrogea is located in the south-east of the country (the town of Sulina, located on 29°41'24" eastern longitude, is the easternmost locality of Romania), between the Danube and the Black Sea, surrounded from three sides by water. In spite of its Ponto-Danubian location, Dobrogea generally has a pronounced continental climate with hot and dry summers and winters with strong winds which influence the production. It can be said that the land of Dobrogea is a geological, morpho-hydrographic, climatic and biogeographical mosaic. It has a low potential for running waters, the region being dominated by natural lakes, but mostly anthropogenic lakes which are very important in modifying the structure of the hydrographic and physico-geographic landscape as a whole. Underground waters are found in differential hydrostructures, especially due to the lithological and tectonic elements, and they register a pH between 6.98 and 8.04. The fact that Dobrogea is framed by the Black Sea and the Danube on three sides determines the weakening of extreme values, especially thermal ones and the generation of local movements of air masses such as breezes. The annual precipitations, by the quantities registered (350-510 mm) locate Dobrogea between the regions with the lowest values in Romania. Regarding the soil, the loess and loess deposits have the widest distribution, covering practically the entire Dobrogea Plateau. This, at the level of the parent rock (the solification rock), gives the soil a high degree of homogeneity.

Description of the plant. Buckwheat is grouped, from the phytotechnical point of view, among cereals, because of its use. However, from a botanical point of view, it is a dicotyledonate plant, of the family Polygonaceae. The plant has a 20-40 cm tap root with numerous fibrous ramifications, distributed especially in the arable layer. The root hairs are very long, reaching 3-5 mm. This means that the root has a high capability to solubilize and absorb. The stem is erect, ramified from the basis, juicy and hollow inside. Its surface is slightly striated, green or reddish-green. Its height varies between 30-60 cm, but in good fertilization conditions, it can reach 130 m.

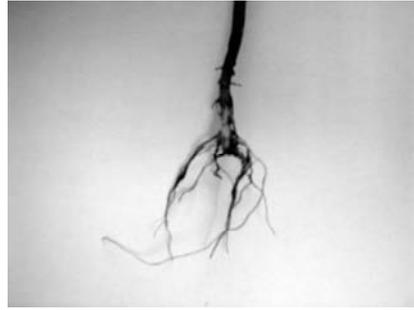


Fig. 1. Root of buckwheat



Fig. 2. Indefinite ramification in buckwheat

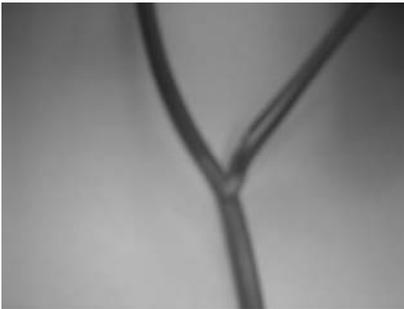


Fig. 3. Ramification and growth node in buckwheat

The leaves are triangular or sagittate-cordate, smooth and green; the ones from the base have long petioles, while those towards the top are almost sessile. The blade has a length of 2-5 cm and a width 1.5-5 cm, with slightly hairy nervures, green or reddish. The stipules are small and green. The stem and leaves juice is very acid; there are many calcium oxalate crystals in the cells. The flowers are frequently united in an inflorescence looking like an elongated raceme. The shapes of corymb and semiumbel are also encountered. The inflorescence has a long peduncle inserted at the pit of superior leaves and comprises a large number of flowers, sometimes 3000, but the average is approx 500. These are small (2-3 mm), made

up of a perigone with 5 petal-like sepals, pinkish-white or red, with strong fragrance.

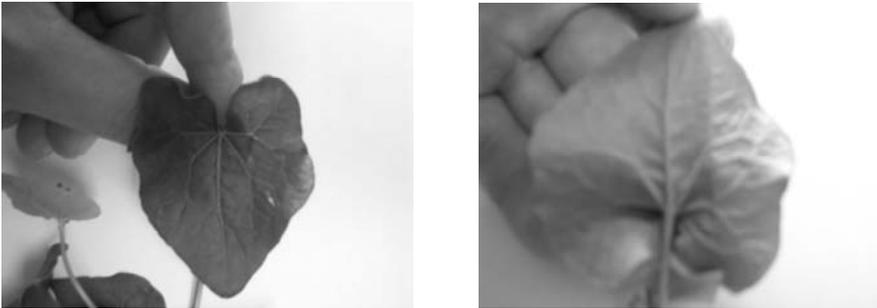


Fig. 4. The ventral and dorsal part of buckwheat leaf

There are eight stamens placed on two circles: five on the outside and three on the inside. Characteristic to the flowers is the sexual dimorphism studied by Darwin; some flowers have the style longer than the stamens, others, shorter. The ovary has a single chamber, one pistil and three stigmas (rarely two or four).

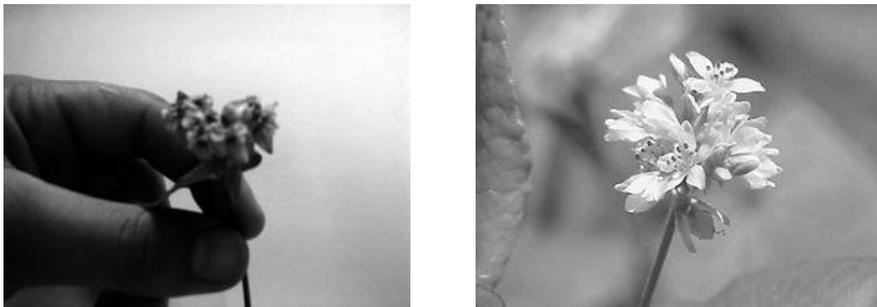


Fig. 5. The inflorescence of buckwheat

The fruit is a nut with three edges (length = 4-6 mm; width = 2.8-3.7 mm; thickness = 2.4-3.4 mm). Its color is chestnut-brown or silver-grey, glossy after harvesting and dull later. The MMB is 19-27 g, MH 55-70 kg. The springing is epigeous and the cotyledons emerge shrouded in the fruit covering, which it removes the following day. The little plant is pink or reddish when it springs, but turns green in the presence of light. For the entire vegetation period, buckwheat requires 60-160 days, depending on type and environment.

Cultivation technology. Rotation. The autumn barley was chosen as previous plant and after buckwheat followed mustard. *Fertilization.* For a production of 2000 kg/ha of seeds and 3400 kg/ha of straw, buckwheat extracts from the soil 64 kg N, 42.5 kg P₂O₅, 97 kg K₂O, (Bâlteanu, 2000), but it has a strong power of solubilization and use of the soil nutrients (in a form that is difficult to make soluble). Thus, only organic fertilizers were used, namely 20 tons/ha of manure. It was noticed that manure administered in autumn is very favorable on the seeds and

straw production, but also on the production of nectar and thus honey. *Soil tilling.* Considering the high demands for humidity and warmth buckwheat has, soil tilling was accomplished by a good mobilization of soil, which contributed to the increased capacity for water and its warming. The plowing was done immediately after the harvesting of barley, at a depth of 25 cm. Until sowing, the ploughed field was tilled by cultivator and harrow for the breaking up of the soil and destruction of weeds. The first spring tilling was done as the weeds emerged while the second was accomplished at 6 cm, around sowing time. *Seed and sowing.* As the seeds harvest resulted after threshing contained impurities consisting of weed seeds and dry seeds, the seed was prepared carefully in order to increase purity to 97% and germination to 90%. Thus, the biggest seeds were chosen in order to ensure vigorous and productive plants. In order to increase the germinative capacity, especially the germinative energy, the air-thermal treatment was employed by exposing the seeds to open air and sunny weather for 2-3 days. The sowing date was established according to soil temperature, the danger of late frost and weather around lowering time. Sowing was begun when the soil temperature (10 m deep) was maintained at 9-10 degrees Celsius and the danger of frost passed. It was also considered that flowering time should occur in a wet period. The distance between the rows was chosen at 15 cm. The quantity of seeds per ha, calculated according to the useful value and MMB, with a target density of 400-500 germinable seeds/square meter, was 90 kg. The row orientation influences considerably the production in the forest zone, with more nebulosity and more fertile soils. In this regard, the row orientation was north-south. The sowing depth was 6 cm. *Maintenance works.* Flattening out the buckwheat culture is indicated on all the dry and light soils, as well as in dry springs. The capillarity resulted helps water rise to the seeds level which germinate faster. By advancing the growing plants, a harvest growth of 10-20% is ensured. In order to control crust and weeds, a light harrow was used. The weeds that were not destroyed by harrow were weeded so that the young plants should not be suffocated during the early vegetation period. In order to facilitate pollination and fecundation, bee colonies were brought around the field (one hive/ha). *Harvesting.* Due to the long flowering period, buckwheat ripens very non-uniformly; on the other hand, the danger of shaking off is very high. This is why it is very important to choose the harvest day very carefully. If the threshing occurs too early, many seeds remain dry; if all the seeds are left to ripen, the most valuable ones are lost. Considering these aspects, threshing was begun when 90% of the fruits ripened, even though some plants still had a few flowers left. The losses by shaking off increase as threshing is delayed, reaching full ripening at 20-30% (Bâlțeanu, 2000). The harvesting took place on September 6 (in the evening), by cereal combine, with specific modifications for buckwheat. The seeds must be deposited carefully as the high content in water at harvest in high, especially when there are many green seeds left. Immediately after harvesting, the seeds were

scattered, spread in a thin layer on a concrete platform and then spaded several times a day. *Productions*. The production obtained was 1800 kg/ha.

CONCLUSIONS

1. The climatic conditions of Dobrogea are favorable to buckwheat crop.
2. Autumn barley is a good previous plant for buckwheat.
3. Ploughing performed immediately after the harvesting of barley, at 25 cm and a germinative bed at 6 cm around sowing time, fertilization only with organic fertilizers (20 tons/ha of manure), sowing at a distance of 15 cm between the rows, 90 kg of seeds per ha, row orientation on north-south, sowing at 6 cm, culture flattening out, all these provided favorable conditions for the development of buckwheat plants.
4. The bee colonies (one hive/ha) facilitate pollination and fecundation.
5. The production of buckwheat per ha (in the conditions of Stupina, Constanta County) was 1800 kg/ha.

ACKNOWLEDGEMENTS

The research was supported by the project „The possibility of introducing of new plants into culture, which are capable of exploiting the agro-productive potential of Dobrogea, considering the climatic modifications, in the context of sustainable agriculture” - 2008-2009, research contract no. 9140/2008, between Ovidius University Constanța and S.C. Ostrovit S.A. Constanța.

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