

STUDY ON THE ACCLIMATIZATION OF AMELANCHIER ALNIFOLIA NUT. SEMINAL DESCENDANTS IN THE HILLY AREA OF CODRU MOMA MOUNTAINS FROM ROMANIA

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Abstract

This paper presents the results recorded during the five years in which the development of Amelanchier alnifolia Nut. Species by three cultivars have been monitored. Due to the desire to obtain valuable species both by their capacity to develop the areas in which they are cultivated, but especially by the fruit production, thousands of new varieties have been created by amelioratio. However, these varieties are also important because of their capacity to adapt themselves to the pedo-climatic conditions of the species mentioned above. This aspect of the adaptation capacity to the pedo-climatic conditions of the species under study have been had in view in this study.

The present study is the first stage of the research on the introduction of some new species of fruit shrubs in Romania, more exactly in the hilly region of Codru Moma Mountains. The research in this paper presents the results on the acclimatization and development of Amelanchier shrub known also under the common name of Saskatoon.

Key words: seminal descendants, amelanchier alnifolia, saskatoon berry, species acclimatization, farm, Codru Moma Mountains

INTRODUCTION

If a few decades ago, the consumption of fresh fruits could be performed only during their ripening season, today due to the modern cultivation methods and the imports, the fruits can be consumed fresh during the whole year.

As regards the fruit shrubs, the farmers look for those varieties that are capable to render a maximum value to the respective exploitation, obviously through the fruit quality and production while the consumer is always interested in extra quality and acceptable prices as well as in a new product that is different from others.

Species key information: Family: Rosaceae, Sub-Family: Pomoide, Genus: Amelanchier – Medium size shrub or small tree – Flowers in racemes, bright white – Fruit is round, dark blue and resembles blueberries – no relation at all (sometimes white fruit); can be mechanically harvested – Cultivation on wide range of soils – Winter hardiness up to Zone 2 (-30°C) (<http://www.nwplants.com>).

The following species of Amelanchier genus have been identified in the Dendrological Park *Arboretumul Sylva* from Gurahonț, Romania in

1983: *bartramia* (Tausch) Roem 1972, *canadensis* (L) Med 1973, *cusickii* Fern 1976, *intermedia* Spach 1975, *laevis* Wieg 1975, *ovalis* Med 1972, *sanguinea* (Punsh) DC 1975, *spicata* (Lam) K.Koch 1972, *stolonifera* Wieg 1977 by engineer Eusebiu Ștefan, but *alnifolia* species doesn't appear in this paper; Preda M. mentions this Genus in 1989 that it includes 24 species of shrubs or small trees.

Production of saskatoon berries as a commercial crop has gained importance in North America and is being exported to other countries for consumption and processing because of its nutraceutical value and consumer acceptance. This also calls for new post-harvest techniques for shelf life extension and processing in the manufacture of new saskatoon berry products. Freezing is the only post-harvest technique reported till date to preserve the berries for year-long consumption (Lakshminarayana R. 2006), this shrub being popular also in Canada where it is cultivated in commercial plantations or it can be found spontaneously in the wild flora.

MATERIAL AND METHODS

All the development stages from seed germination to the fruit production have been monitored in Bărzani Farm during the period 2012-2016.

The seed material originated from Alberta area, Canada, this shrub species being remarkable due to its capacities, such as resistance to very low temperatures or high resistance to draught during the summer season.

The plants of *Amelanchier alnifolia* can be obtained according to Wolfgang and Marco K. 2013 by sowing, sucker division, seedlings or root sections and for their production Bălășcuță N. 1986 recommends and describes the mother plantations, that are special plantations, without a fruit plan, intended only to provide the biological material necessary for multiplication.



Fig.1 Location of study. (source: Google maps)

The plants obtained generatively from three seed sources have been considered in the present study. Two of them were coming from two cultivars Smoky and Thiessen and the third source was represented by the seeds collected from the spontaneous flora (for which the name of Canadian blueberry has been used).

In the first two years of vegetation, the plants obtained from the three known sources of seeds have been kept in a nursery regime, where they benefited from specific works during the vegetation period such as: soil mechanical tillage and weed control works, fertilization and diseases and pest control treatments.



Fig.2 Saskatoon plants in the nursery, year 2, Bărzani Farm 2013

In the third year, the plants obtained in the nursery have been cultivated in a regime of experimental plantation. Those plants that presented well-developed roots, wooden well-formed stems have been considered.

The planting scheme in the three cases was 3x1 m (3 metres between the plant rows and 1m between the plants on the row).

To initiate the experimental plots, the land was well-prepared by soil ploughing at a depth of 0.4m on the whole surface and then the soil was shredded by a disc harrow.

A deep loosening provides the soil aeration, fact that facilitates the gas exchange necessary to the roots (Himmelhuber P.2013). The research undertaken especially in the last two centuries allowed the more profound

knowledge of the soil biology and especially the percolation by the help of technical means that are more are more developed in the world of micro-organisms that populate the earth's crust (Mateescu Fl., 2008). A quantity of 25 t/ha of manure was also applied.

The planting process was made by complying with the general planting rules, that is mulching, wetting and careful soil compaction around the plants. This operation was applied in autumn according to the literature recommendation and the plant taking roots was accomplished in an average percent of 97%. During planting, the soil temperature was of 10⁰C. Before planting, the branches are shorten a little, the possible fruit-bearing buds are removed and the roots are shaped. The planting is made with 2-3 cm deeper than the plant has grown in the seedbed or nursery; after planting, the mulching with saw dust, straws, leaves or other vegetal materials of the surface around the plant is recommended, at about 50 cm around it, (Hoza et.al. 2008).

In the years following the planting stage, some well-known agro-technical works have been applied:

- soil maintenance by its hoeing (year 3 and 4)
- fertilization (annually)
- maintenance of weedy soil (the vegetal layer among plants was turned into mulch with the help of a device pulled by the tractor);
- prognosis treatments against diseases and pests; it is also important to mention that these plots didn't benefit from an irrigation system during this period (annually)



Fig. 3. Experimental plot from Barzani Farm, year 3.

The significant planting distances can be exploited more efficiently by interbedded crops (Heinz E.2012), but due to the land configuration that presents a gradient of about 12%, it was preferred the grassing of these

intervals which is a maintenance system very recommended in the blueberry plantations in the areas rich in precipitations, of more than 700 mm annually (Chira, 2009).

This aspect for the demonstrative plots were performed starting with the fourth year, the vegetal layer among plants was turned into mulch with the help of a device pulled by a tractor, and the plants that has got into the soil again enrich the soil in nutrients (Krumpach E. 2015).

Measurements of the following characteristics have been monitored and performed:

- vigour of the obtained plants;
- acclimatization to the pedo-climatic conditions;
- blooming period;
- fruit production.

RESULTS AND DISCUSSION

The results obtained after the performance of the biometric determinations upon the mentioned characteristics for the three saskatoon varieties under study, were statistically processed by variation analysis specific to the monofactorial experiments performed in measurement arrays (Ardelean., 2008).

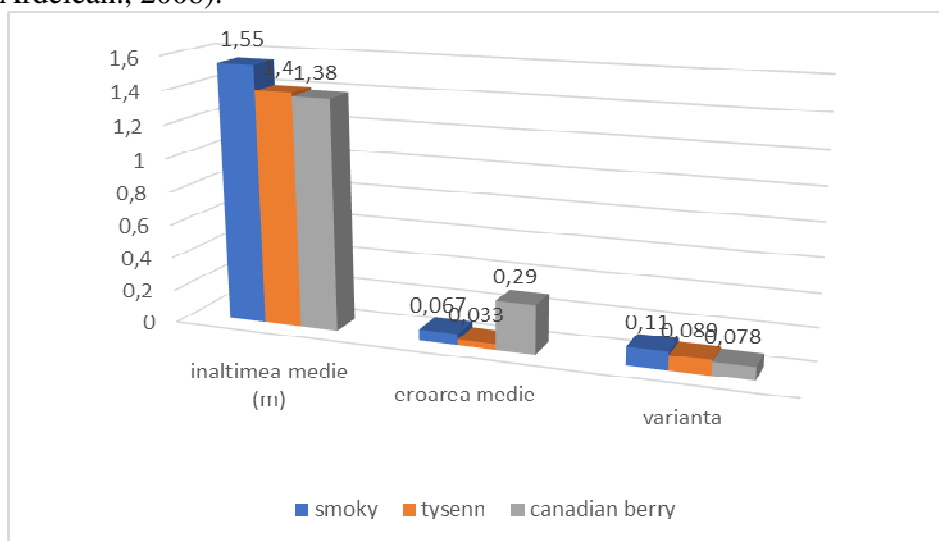


Fig. 4 Influence of saskatoon variety upon the height of the plants at the end of the fifth year of vegetation, Bărzani Farm, 2016.

After the fifth year of vegetation, the saskatoon Smoky variety presents a growth difference of the average plant height of 0.15m in comparison with Thiessen variety, and of 0.17m in comparison with the

Canadian berry. This difference proved to be less significant, fact that makes as the obtained results regarding the average plant heights for the three varieties to be credible without significant growth differences among them. This conclusion confirms the fact that the height of the plants from different varieties from Bărzani Farm, Romania, meaning the saskatoon varieties under study have a relatively similar growth and vigour.

As regards the blooming period, Preda M. 1989 states that *Amelanchier alnifolia* blooms in the middle of spring, this period being reconfirmed also at Bârzești by the periods recorded in Table no. 1.

Table.1

| Average values of the blooming periods. | | |
|---|-----------------------|-----------------|
| Variety | Beginning of blooming | End of blooming |
| Smoky | 20.Apr | 05.May |
| Thiessen | 15.Apr | 01.May |
| Canadian berry | 20.Apr | 05.May |

It is important to notice the resistance of *Amelanchier* species to low temperatures because during year 4 and 5 under study, more exactly during the blooming period, the experimental plots were exposed to low temperatures ranging between 0⁰C and -3⁰C, followed by late frost for 3-5 days but without losses of fruits or other problems caused by weather conditions.



Fig. 5. Saskatoon specimen during the blooming period, Bărzani Farm, Romania 2016

According to Köppen on the adaptation to the pedo-climatic conditions, the experimental plot can be included in C.f.b.x region (western piedmont climate):

- (C) represents the temperate climate,
- (f) sufficient precipitations during the whole year,
- (b) the average temperature of the warmest month under 22 degrees Celsius (but it exceeds 10⁰C for at least 4 months),
- (x) pluviometric maximum is recorded at the beginning of summer and the minimum at the end of winter.

Year 2012 had annual average temperatures undifferentiated from the normal ones and significant extra rainfalls, thus it can be considered as a *favourable environment* for saskatoon;

Years 2013 and 2016 with annual average temperatures undifferentiated from the normal ones and significantly distinctive less rainfalls can be considered as *favourable* for saskatoon;

Years 2014 and 2015 with annual average temperatures that were significantly over the normal ones and annual rainfall levels very close (2012) or significantly higher (2013) than normal ones can be considered *very favourable* for the saskatoon crop.

The first berries occurred in the third year for the Canadian berry and in the fourth year for Thiessen and Smoky varieties. Thiessen cultivar had a different, more flavoured aroma in comparison with the other two cultivars and regarding their size, it can be stated that they are in accordance with the information included in the literature (Richard G. St-Pierre 2005). Table 2 includes the average values recorded for their diameters.

Table 2.

| Average diameter of berries. | | |
|------------------------------|-------|----------------|
| Thiessen | Smoky | Canadian berry |
| 17 mm | 14 mm | 14 mm |

The berries are round and fleshy, with more seeds (Robert S, et. al 2013), being purple during the yellow ripening period and dark blue during the full ripening season, being grouped in bunches.

Pruning of established stands may also include 1) removal of low spreading branches to encourage air circulation and more upright form, 2) removal of diseased shoots, and 3) heading back shoots to six feet 4 for more efficient harvest (***)



Fig. 6. Saskatoon berries produced in Bărzani Farm, year 5.

The berries of the fruit shrubs represent in the same time an important source of raw material, extremely valuable to obtain some natural products (Botez M. et. all 1984). The average values of the physical and chemical analyses for *Amelanchier* berries are presented in Table no. 3.

Table 3.
Physical-chemical assessment of *Amelanchier alnifolia* berries obtained in Bărzani Farm.

| Performed determination | Obtained values | Performed determination | Obtained values |
|-------------------------|-----------------|--------------------------------------|-----------------|
| s.u. (%) | 22.81 | Vitamin C (mg/%) | 4.92 |
| Nt (%) s.u. | 0.39 | Gross protein(mg/%) | 2.31 |
| P (mg/%) s.u. | 23.4 | Total Glucides (mg/%) | 12.1 |
| K (mg/%) s.u. | 155.0 | Fe (mg/%) | 0.91 |
| Ca (mg/%) s.u. | 40.8 | Na (mg/%) | 0.43 |
| Mg (mg/%) s.u. | 21.9 | Titrateable acidity (% ac.citric) | 0.59 |
| Ash (%) | 0.89 | Polyphenols (mg/%) | 251 |

Fruits are the vegetal origin elements that contain almost all the substances necessary to the human body (Bădescu et. al 1984) that contain beneficial elements for the human diet (Jocelyn et.al 2005). In this case, it is important to notice the presence of a significant quantity of polyphenols in the berries, as well as, of K, P, Ca, Mg, Fe substances or Vitamin C.

Amelanchier shrub, also known under the common name saskatoon berry, presented a very easy and fast acclimatization to the pedo-climatic conditions from Bărzani Farm located in a hilly region of Codru Moma Mountains, Romania.

As in trees, the origin, quality and both fruit and seed development stage have a significantly high influence upon germination (in *Quercus robur*, *Q. frainetto* – Timofte et al., 2011), in the case of *Amelanchier alnifolia* shrub, the quality of seeds is a characteristic that determines the success of crops and plantations, being closely correlated with obtaining a high qualitative and quantitative production (Neagu M. 1975). But from the very beginning, man got involved in the evolution of plants and their introduction into crops because he chose, multiplied and cultivated only those specimen that corresponded to his requirements (Gosch T. 2014). Thus, it can be said that *Amelanchier alnifolia* shrub corresponds to the requirements for which it was introduced in this area.

As regards the rate of plant taking roots when transplanting them during the third year, the capacity of transplanted seedlings to form new roots in a plantation environment is essential for their further growth and development (Mary I and others 2004), and the plant resistance to other factors such as frost during the blooming period or pedological draught during the summer season, there are no significant differences of acclimatization among the three cultivars under study, all of them having considerable and very favourable results.

Concerning the soil conditions, it is also important to mention that the region where the study was placed is characterised by a clayey soil, it is poor in nutrients, and the average value of its pH is of 6.5.

Other important aspect is the early ripening of the berries, at the beginning of summer, fact that favours their successful valorisation due to the competition with other seasonal fruits, such as cherries and strawberries.

In the spring of the fourth year it was encountered the bacterian fireblight (*Erwinia amylovora*) in all the three cultivars, being the most damaging disease in fruit growing, capable to destroy the whole plant in three months as stated by Csep N. and Timofte A. 2006. This disease affects the young sprouts at the beginning of their growth when they are of 7-10 cm (Tomşa M. and Tomşa E. 2003). The tip of the sprouts dries and bends under the form of crutch (Vetek G. Geza N. 2014).

Saskatoon plants are cultivated at present in many places around the world to be suitable for different food products and for their high content in nutrients and polyphenols (Anu L. et al. 2012). Those obtained in Bărzani Farm proved a very high resistance to the pedological drought in years four

and five, but this is because of the well-formed root system after the application of fertilizers.

Both the form of plants and berries is very similar to that of blueberries, therefore we can use the term Canadian (blue)berry.

At present, Amelanchier shrub represents a new crop for the commercial cultivation in Europe and it definitely presents a real interest for its cultivation in the commercial farms from Romania.

CONCLUSIONS

After the research undertaken in Bărzani Farm, it can be definitely stated that there are favourable conditions for the development of Amelanchier varieties both in this hilly area but also in less similar regions from Romania.

This shrub has a very high ecological plasticity being capable to exploit hilly areas poor in rainfalls, or areas where late frosts and pedological draught appear frequently during the summer season.

A well-organized crop system that can provide a suitable development of Amelanchier plants, can obviously have a considerable contribution in obtaining the berries that seem to be very appreciated on the market in Romania, even if this market is still in its initial phase when it is about this type of berries.

The ripening period of the berries was influenced each time by the climatic conditions of the agricultural year, but it must be state that for the pedo-climatic conditions from Codru Moma Mountain region from Romania, the ripening time framework of saskatoon berries ranges from the 25th of May to the 25th of June.

The average fruit production in the fourth year was of about 0.9 tons/ha for Thyessen cultivar and 0.85 tons/ha for Smoky and Canadian berry. It is important to notice that from one year to another the fruit production doubled, and this statement is supported by the results of the fifth year. Their energetic value presented in Table no. 3 confirms the fact that this shrub has a real future.

The green fence can serve not only to border the land but it can also provide a spectacular blooming in spring (Rene A, 2014). The same thing can be stated also for the saskatoon that can be successfully used as a fruit-bearing or even as an ornamental fence.

The results confirm the fact that saskatoon adapts itself easily to the pedo-climatic conditions from this region and the berry production, as well as, their value on the market from Romania encourage further studies.

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