ARONIA
PLANTER’S GUIDE

Edited by: Piotr Michalak
We present you with a comprehensive guide for establishment and taking care of aronia plantations. This guide is based on the authors’ over 20 years of experience in cultivation of fruit plants (mainly aronia) and running aronia nursery. This long experience resulted in almost perfect expertise in techniques of cutting multiplication and cultivation of aronia bushes. Today we would like to share this experience with you. This guide is the answer to the questions most frequently asked by beginning planters. However, while reading, one has to bear in mind that very often there is no one simple answer to a question concerning plantation and many issues must be addressed on a case by case basis.

We wish you a pleasant reading and fruitful harvest.

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Barbara and Tomasz Michalak’s orchard farm called Świat Aronii (The World of Aronia) was established in the ‘90s. It is located in its entirety in Łuków County in Lubelszczyzna. The total area of the farm exceeds 40 hectares, 35 hectares of which are at the moment devoted to a fruitful and ecological plantation of aronia. Świat Aronii Orchard farm, as suggested by the name, specializes in production of goods connected with aronia, i.e. aronia fruits, aronia cuttings, organic aronia juices, concentrated fruit juices, frozen fruits, dried aronia berries, aronia extract and many others. We also provide complex advice on growing and cultivating of aronia, as well as undertake activities aimed at the selection of the best quality and the most fertile aronia variety.

We have been producing aronia plants (cuttings) for over 20 years. Thanks to a carefully selected nursery stock we offer our clients only the best cuttings which guarantee optimal growth of bushes as well as abundant fruiting. Unquestionably, our nursery is one of the best nurseries both in Poland and Europe. We build competitive advantage over our competitors by possessing our own aronia plantations, which are established by using home-grown nursery stock. Currently the plantations exceed 35 ha (fully fruitful) and are completely ecological! It should be mentioned here that only the strongest bushes, grown from the best quality cuttings, can also bear a lot of fruit in organic farming. In our case the average yield of fully mature plantation per hectare comes down to 9-10 tones when cultivated on 4, 5, and 6 class soils. This not only proves the superb skill of taking care of the plantations but also shows the best quality of our cuttings, as the yield obtained by us is only slightly smaller than in the case of conventional plantations.
Briefly about aronia

Aronia (black chokeberry) is a perennial bush that is native to the North America. Adult fruit shrubs, when properly tended, can reach the height of 2-2.5 m. Aronia fruits have navy-blue, almost black color as well as a tart-sweet taste and aromatic flesh.

Aronia plantation can be established almost in any climate condition. It can survive both on wetlands and arid lands. Although it grows well on moderate acid soils, it can be also grown, without major difficulties, on slightly alkaline soils. It is a perfect plant for organic farming due to the fact that this high bush chokes weeds up on its own and the plant itself is resistant to vermin and illnesses. Aronia also has different advantages when it comes to soil requirements: thanks to its shallow roots it can be planted on areas with high level of ground waters. It is also resistant to major falls in temperature during winter; blooms late and irregularly, which in turn reduces the negative effects of spring frost.

The black chokeberry (Aronia melanocarpa) is the only species of aronia which is cultivated in our country. The best available cuttings are the ones from NERO variety, which were selected by a Russian biologist Michurin, thanks to whom the bush was “imported” to Europe – and these are the very same plants (cuttings) we produce at our organic farm in East part of Poland.
Aronia is considered by many specialists to be the healthiest berry in the world – it is called a super fruit and it is a kind of a vitamin bomb. Aronia juice is worth having at home during all seasons. Its fruits are rich in vitamins (C, B1, B2, B6, E, PP, among others) and plant compounds, which have a beneficial effect on our health as they protect us from illnesses, including the most dangerous ones: cancer and atherosclerosis. Aronia is recommended for diabetics because of the presence of chlorogenic acid which slows the absorption of glucose.

At Pomeranian Medical Academy in Szczecin and Cardiology Department at Medical University in Warsaw it has been proved that extract from aronia effectively regulates hypertension, prevents deposition of cholesterol in artery walls and protects from heart diseases. A drop of pressure was noticed just after six weeks of therapy in almost all of the studied people. The richness of antioxidants supports body's defense system in protecting cells from free radicals, which may cause degenerative changes and contribute to the formation and development of cancer cells.

Aronia is said to combine the benefits of green tea and young, red wine. It also contains valuable macro- and microelements such as calcium, iron, copper, molybdenum, manganese, iodine and boron which are necessary for the proper occurrence of many processes in a plant. Consumption of aronia in the form of a fresh fruit, powdered extract, dietary supplements or juices has many benefits: presence of anthocyanins slows ageing, improves metabolism and fat metabolism, and what is more, it makes the skin impervious to the sun’s harmful UV radiation. In short – aronia should be used in prevention of many diseases, especially so called diseases of affluence.

The above-stated benefits of aronia are in no way exaggerated. This fruit should be present in everybody’s diet. Aronia is most commonly consumed in the form of juice, drunk directly, as a tea additive, or in the form of fruit compotes. Organic, concentrated aronia juice can also be increasingly commonly encountered, which – thanks to a special production method, without the use of any chemicals, preserves properties of a fresh aronia juice that is very valuable to the organism. It is an ideal additive to cakes, natural yoghurt, tea or cornflakes. Dietary supplements with aronia extracts or aronia extracts consumed as an addition to cakes, desserts, yoghurts, etc. are recommended for diabetics or people who do not like the taste of aronia juice.

More and more Polish people become aware that it is worth using aronia, because once you “have a first-hand experience” of the aronia health effects, you will never want to stop eating this fruit.
Field preparation for plantation establishment is a very important issue. Properly prepared soil has a direct impact on bush growth (especially in the first years, when rapid growth is greatly desired) and yields in later years. When preparing soil one has to remember about eliminating weeds, checking soil pH and taking care of its right structure. It is recommended to conduct soil tests in order to check if there is a deficiency of minerals, and in the case it is so, replenishing them.

The optimum pH for aronia plantation is 6.5. A year before establishing a plantation soil pH should be checked, and if necessary, brought to the desired level. In Poland, the most common soils are acid and moderate acid soils, thus farmers must lime more often in order to bring pH closer to the neutral level. The author of this guide recommends using magnesium lime of good repute. It is a specific lime, rich in microelements and with a high level of magnesium, which not only regulates pH but also enriches soil. Magnesium lime can be also used in ecological plantations, which is one of its major advantages. Eliminating weeds will help to run the plantation, especially in the first 2-3 years, when the bushes are still not sufficiently developed to on their own stop the prolific growth of weeds.

Additionally, it is worth mentioning here that young aronia bushes are quite vulnerable to weed infestation and therefore the elimination of unwanted plants as well as planning how to fight with these intruders should begin early enough. Ecological aspect argues for the method of agro-cultivation, however using herbicides is more effective and less time-consuming. On the other hand it can be expensive and harmful to the environment.

The method of agro-cultivation consists in not allowing the weeds to bloom. Frequent movement of soil results in wiping out of the already existing weeds as well as fast sprouting of new weed seeds, which, however, will soon be destroyed. After a few such treatments weeds can be eradicated effectively (to 10-20% level of presence in soil). This method of fighting with weeds takes about a year, and therefore requires time and a lot of effort. However, what is important, it is soil and environment-friendly method. During the growing season that precedes plantation establishment, one can use a mixture of ground cover for earlier plowing, which should consist of papilionaceous plants. In addition, plants which are plowed under also choke weeds up and enrich the soil with humus and nitrogen.

Properly prepared soil should be leveled, mellow, crumbly, and with a lumpy structure which is an indicator of its richness. Leveling the soil will help in planting and taking care of the plantation in the future. If the soil is not rich enough in minerals, it should be fertilized and thus complemented with the deficient substances. It is also recommended to use different kinds of humus and effective microorganisms. This last ones are very beneficial, especially in the case of young bushes, and their usage significantly improves the speed and quality of plant growth.
Plantation establishment – determining the shape of a plantation and distribution of rows

Before planting, one needs to measure out and mark out the future rows. The distance between rows in the case of plantations designed for mechanical harvest should be between 4 and 4.3m. The edgings should be located about 2.5m from the side boarders of the field to the bush-line, in order to enable combine harvest and make it accessible for mower-shredder that will be necessary to mow down weeds in the interrows in the future. On light soil, if necessary, the distance between rows can be reduced, but it cannot be smaller than 3.7 meters. In the case of richer soils (class 3 and 4) it is vital that the 4-4.3m distance is maintained. This is related to the more rapid growth of bushes on rich soils. In the case of agricultural area with a relatively sharp inclination, the bushes should be planted along the slope (this is especially true for highland and submontane areas).

Fruit harvesters, especially self-acting, have a high-mounted center of gravity, which may result in the machine overturning if it works at areas with too sharp inclination.

When drawing up a plan of the plantation, it is also necessary to make sure that the access roads are distributed correctly, especially in the case of large areas. With very long rows, one needs to remember to leave maintenance gaps every 300-400 meters. These will allow pickup of fruits from the harvester (fruit boxes and pallet boxes that can be at one time placed on the harvester have limited capacity).

VICTOR – the currently leading edge aronia harvester, manufactured by the Weremczuk company in Lublin, can collect on its loading platforms up to approx. 2 tons of cargo in the standard version, and approx. 2.5 tons in the extended platforms version. Crossroads are also necessary in order to provide quick access in the case of machine malfunction. It is also necessary to remember to leave a 5-6 meter long maneuver area at both sides of the plantation, to allow smooth and trouble-free harvester maneuverability (turning, operation of loading platforms, machine maintenance when necessary).
What to pay attention to when choosing a cutting?

The undeniably most important point in establishing aronia plantation are cuttings. Only cuttings produced by division of the parent plant (vegetative) guarantee high, annual yields. Generative plants, the so-called “siewka” grown from seeds, bear fruit irregularly, less abundantly with years, and furthermore have a tendency for rapid upward growth, which makes future combine harvesting impossible.

“Seedling” cuttings, due to a very easy and cheap production process are considerably cheaper than vegetative ones. However, the apparent savings when purchasing seeds from an uncertain source or from producers who sell cuttings at „bargain” prices, may result in huge losses in the future (smaller yields through the entire fruition period, so as long as 20 years!, slower growth of bushes in the case of low quality of nursery stock or too rapid growth in the case of generative plants, commonly known as „Siewka”). Investing in cuttings which are reproduced vegetatively and created using nursery of the highest quality, guarantees quick growth, high yields in the future, and fruition as soon as in the first year in the case when planting with strong plants.

Another important point when choosing cuttings is their variety. The most common variety used in plantations and mechanical harvest is the NERO variety. It stands out from all the other varieties available on the market due to its high elasticity of shoots (which do not break during combine harvest), regular annual fruition and a moderate height of a mature plantation.

Vegetative cuttings are divided into annual, biennial (two-year) and triennial (three-year). Examples of all 3 types can be seen below. For planting it is recommended to use two- and three-year cuttings. One year old cuttings are very underdeveloped and poorly rooted, which does not guarantee that they will fully take roots. Furthermore, due to the fact that the 1 year old cuttings are very weak, they can be choked up by weeds or damaged by chemical treatments. One should not be deceived by a lower price of such cuttings – it is important to remember about the age-long rule governing the market: buy a good and trusty article – not only will you be satisfied, but also you’ll make up the difference in price quickly.

![1 year old plants](image-url)
What to pay attention to when choosing a cutting?

When choosing a 2 years old plants from a good, trusty source, one needs to pay close attention to the root system. It needs to be extensively developed, with a large number of root hair, without any tumorous changes (the so-called root cancer), and unbreakable. These three determinants allow to virtually unmistakably assess the quality of the cuttings’ root system and distinguish high quality nursery material from a low quality one. When choosing cuttings it is also important to have a look at the plantation of the nursery material’s owner. Usually it has been created with home-grown material. A short visit like that will allow you to check and assess on your own both the plants and the parameters of a mature plantation (height, row distribution, plantation managing, the number of fruits). When choosing cuttings one should pay attention not only to their height. Equally important are the number of shoots and the proportion between the size of the root and the height of the surface part. We would like to dissuade you from buying nursery material with a green leaf, as its presence suggests that the plants were taken from the ground before the vegetation period could be completed.

In such case the shoots are not fully lignified, and the top buds are not yet completely developed.
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When planting bushes, it is recommended to use an orchard tractor planter (standard model, used for planting bushes) slightly modified and adapted to planting aronia. The planter should be lengthened by approx. 30 cm and deepened by 5-7 cm. Changing the length allows precise and easy planting of a cutting into a crack in the ground, whereas the depth increased to 35 cm allows a cutting to be dug in a few centimeters deeper. This, in turn, may be of the utmost importance in the first few years, especially on less fertile soils. Deep planting allows the plants to penetrate the soil better, that is, to absorb more water and nutrients from the ground. The suitable depth of planting is crucial both in the first period of growth and when the plantation reaches maturity. Thanks to this simple treatment the plantation will profusely bear fruit – and all of this due to the ability to better absorb necessary nutrients, essential for bearing and maintaining fruit, from a larger area.

Approximately 4 to 5 thousand of cuttings are used for establishment of 1 ha plantation. Fewer cuttings are planted on richer soils, whereas more on poorer soils. Bushes should be planted at the level of 50 cm on class 6 soils. Is such case, around 5 000 cuttings are required to establish a plantation. When establishing a plantation on soils class 2 and 3, the bushes should be planted every 60-70 cm.

This distance between cuttings in a row creates an avenue (density of bush branches should resemble a quite dense hedge) which allows mechanical harvesting. When the cuttings are planted not enough close to each other, they will not create a dense avenue which may result in the branches being broken or slipped out from the harvester’s shaker heads – which in turn brings less precise harvest. When the work organization is good, one hectare of plantation can be established during one working day, i.e. within about 10 hours of planter's work. In order to improve the aesthetics of the established plantation, after the planting is finished, it is recommended to level the soil along the row by using a tooth harrow or a combined cultivator.
After the aronia bushes are planted, they should be reinforced by fertilizing the plantation, which is extremely important especially on poorer soils. Normally, it is recommended to scatter approx. 100 kg/ha of phosphorus-potassium fertilizer along the row, in a 40-50 cm width from the bush (on both sides). Young plants have a poorly developed side root system and therefore they cannot absorb minerals from distance larger than the above-mentioned one. Fertilizing the whole plantation (including interrows) is economically unjustified and even harmful to the plantation because of faster weed growth.

If the soil test indicated deficiency of some of the minerals in the soil, the first year after their plantation is the best moment to supplement their intake. Many times this has a tremendous effect on the fast growth of the young bushes.

If the nursery stock used for planting had a well-developed root system (this concerns 2-years-old plants), and if the cuttings are not higher than 40-50 cm above the ground after they are planted, there is no need to cut them. Higher 2-years-old cuttings should be definitely cut at the height of the third eye, i.e. to the height of about 10-15 cm. Thanks to this, the young bush will concentrate on developing its root system and growing the new sprouts, which will systematically come out to the surface.

In the case of cuttings which have a weakly developed root system it is also recommended to cut the cuttings up to 10-15 cm above the ground.

There is no need to cut the cuttings if they are 2-years-old cuttings, with many sprouts and are 70 cm high or higher. Usually such nursery stock has a really well-developed root system which allows the bushes to grow very fast. Undoubtedly, an important advantage of the 3-year-old-cuttings is the fact that they speed up fruitification by a year, thanks to which the costs incurred on the establishment of the plantation can be made up in the form of fruits a year earlier. However, one has to bear in mind that it might be necessary to install an irrigation system for the 3-year-old cutting (especially on poor soils) in order to secure the plantation from water shortage during drought.
The plantation should be taken care of, especially during the first year. Under no circumstances are weeds allowed to grow. A young plantation should be weeded every 3-4 weeks or the weeds should be plucked with a garden hoe every 3 weeks, which will also effectively destroy weeds around the cuttings. Another method to prevent weeds from growing at this stage is the use of herbicides with coating activities on emerging weeds, which causes them to decay when they sprout. Especially during the first year should the dose of herbicide and the time of treatment be carefully chosen in order to reduce the risk of hazardous substances entering into the root system of young plants.

When the young sprouts reach the height of 10 cm, another dose of fertilizer rich in nitrogen, calcium and magnesium, should be used in the amount recommended by the producer for fruit plantation. The treatment is aimed at stimulating fast growth or improvement of the overall health of the bushes, which in turn will have a beneficial effect on the growth of plants in autumn.

This treatment can be applied as often as every 3 weeks during the first year. This way of running a plantation provides that in the first year the plants reach a height of 50-60 cm, which is a very good starting point for further development of the bushes. In the first year of cultivation fruitification is not expected.
Running a plantation - second-year treatments

It is recommended to use a spray preventing weed infestation in rows across the width of approx. 0.5 m on both sides of the bush. This treatment allows one to avoid labor- and capital-intensive hand weeding. In the second year, weeding, especially in the nearest belt of shrubs, is still very much needed, and may even be considered necessary. Such spraying will give you a weed-free belt with a width of approximately one meter. In the second year, herbicide spraying is not recommended on the entire surface of plantation (i.e. also in the interrows), in order not to introduce too much chemicals into the soil.

From the second year, the area between the rows of cuttings should be mowed with a tractor mower. This treatment is usually repeated 3 times a year. The time of such treatments is an individual matter of every farmer and depends largely on the rate of growth of grasses and weeds in the interrows. Mowing maintains high cultivation aesthetics, which further promotes the optimal development of the plantation. In the second year, the soil should be fertilized with a compound fertilizer rich in nitrogen, calcium, magnesium, and other ingredients whose deficiency has been revealed by annual soil testing. If necessary, use phosphorus-potassium fertilizer, preferably in late autumn. Properly run plantation, which has not suffered from drought or flood, should begin to bear fruit just in the second year after planting. The yield is expected to reach approx. 2000 kg/ha and about 3 tons per hectare of the plantation planted with strong seedling. Fruits of the two-year plantations can be mechanically harvested (combine harvester with a set of adapters for young shrubs), but if there exists a possibility, hand harvesting is better for a two-year plantation, as this method significantly reduces damage to the delicate two-year bushes. In the second year, in the case of mechanical harvesting, hand-picking is necessary after machine harvesting to leave as little berries on the bushes as possible. The remaining fruits fall and provide food for rodents that nest in the plantation, dig burrows and gnaw at the roots. This is quite dangerous for a young plantation, which is why, despite the fact that from an economic point of view hand harvesting after combine harvesting is unprofitable, this procedure should be performed.

Running a plantation - third-year treatments

In the third year, the plantation should be supplied with fertilizer containing phosphorus and potassium. Approx. 300 kg per hectare should be distributed, spreading to the width of about a meter from the bush on both sides. The fertilizer should be applied in late autumn or very early spring, so that it can decompose in the soil. You should also remember about soil testing. In the third year, seedlings enter a period of intense fruiting. A deficiency of certain microelements can cause lower yield, which manifests itself in, for example, weak buds forming, a high rate of windfall in the inflorescence, and withering of ripening fruit. If the plantation, after 2 years, reached a maximum height of 1-1.3 m, nitrogen fertilizers should no longer be applied. If the height of the bush is 70-80 cm, you should apply another dose of fertilizer rich in nitrogen, one time and at a dose similar to those from previous years. You should also take care of weeding, using an herbicides around the bush under a cover (if you don't run the plantation in an environmentally friendly manner or Organic way of growing) and mowing the interrows in the same way as in the previous year. In the third year, the yield of plantation planted with biennial cuttings is expected to be approx. 4-5 tons per hectare. The height the shrubs reached, allows the full use of mechanical harvesting.

If the height of the plantation exceeds 1 meter, the VICTOR combine collects approx. 95% of the fruit. In this case, hand-picking is not required.
In the fourth year, the plantation also should be supplied with fertilizer containing phosphorus and potassium. Approx. 300 kg per hectare should be distributed and spread to the width of about a meter from the bush on both sides. Just like the year before, the fertilizer should be applied in late autumn or very early spring, so that it can decompose in the soil.

The yield in the fourth year should amount to approx. 7-8 tons. In the fifth year, it should reach 10-11 tons. If the plantation is located in an area struck by drought, you should consider the installation of the plantation irrigation system based on an underground water well and drip irrigation. This will further increase the yield even up to 12-13 tons per hectare in the case of non-organic crops, and up to 10-11 tons in the case of organic cultivations.

In the following years, when the plantation reaches full maturity, the soil should be regularly fertilized and tested every 2-3 years, and particular attention should be paid to the appropriate level of micro- and macroelements. Any deficiencies should be supplemented with chemical or organic fertilizers, which will enrich the soil. In addition, when the plantation reaches full maturity, you should perform a garden trimming every 3-4 years. This allows you to keep better aesthetics of the plantation and to improve the yield.
Ekologiczny sok z Polskiej Aronii

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