# Overview of suitability of fast growing tree species (Salix spp., Populus spp., Alnus spp.) for establishment of economic agroforestry zones for biomass producing in Baltic Sea region climatic conditions

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**Abstract.** The article summarizes the research on managed process of agroforestry zones by short rotation plantations with tree species *Salix* spp., *Populus* spp., *Alnus* spp. and looks at perspectives in the planning of these zones as biomass producers. Short rotation forestry (SRF) with a combination of species and a rotation time of 15 to 30 years, depending on the species used, is the most suitable way for management of these agroforestry zones. Short rotation coppice is suitable for willows (Salix spp.) and poplars (Populus spp.) as these tree species can be harvested at much shorter intervals (SRC), 1–5 and 4–10 years, facilitating their use in agricultural systems. In Alnus spp.short rotation plantation the life cycle for energy wood production is assumed to be 15-30 years. The black alder plantations in agroforestry zones are used for sawnwood and firewood production, with a rotation span of 20–40 years.

Calculated economic agroforestry zone repayment period is about 10-15 years, if costs and prices as in 2021 are used.

**Keywords:** economic agroforestry zone, *Salix* spp., *Polpulus* spp., *Alnus* spp., short rotation coppice (SRC), short rotation forestry (SRF), energy wood.

## INTRODUCTION

### Background

Climate change and increasing biomass demand for bioenergy and at the same time expected to reduce greenhouse gas (GHG) missions and provide carbon storage in soils and vegetation, are projected to add further pressure on managed economic agroforestry zones [1-5]. The agriculture sector is at the same time expected to reduce its greenhouse gas (GHG) emissions and provide carbon storage in soils and vegetation, while reducing

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also other environmental impacts [5-8]. European Green Deal plan foresee that multiple sustainability and climate neutrality in Eurpean Union (EU) countries will be achieved by 2050 [9]. Climate policies, such as Paris agreement will increase the demand for biomass for bio economy needs, including energy, industry and agriculture sector. European Union (EU) aims to increase the share of renewable energy in the final energy consumption to 27% by 2030 [6-8]. EU planning documents state that the use of renewable energy sources in the energy sector must be increased to promote the reduction of fossil resources in energy production [10]. Each member state has set its own individual target, and EU countries goal is to reach 42% (Estonia) - 65% ( Sweden) of the share of renewable energy resources in gross final energy consumption by 2030, which will be done by increasing the use of wood for energy production [11,12]. In addition, Baltic Sea countries strategy for achieving climate neutrality by 2050 sets out to promote sustainable land management and a gradual transition from fossil to renewable energy sources [13-15].

**Agroforestry zones as biomass producer**

Agroforestry is an ancient agricultural practice that is widely implemented in EU Countries [16-18]. In EU research about agroforestry has begun in the 1980s on coastal buffer zones and other landscape features designed to reduce pollution in watercourses and to produce biomass for bioenergy at the same time [19, 20]. Over the next 30 years, in-depth studies were conducted on the effects of agroforestry zones on nitrogen (N) pollution [21, 22], phosphorus (P) pollution [23, 24] and various other pollutants. 30–99% nitrate (N) and 20–100% phosphorus (P) from runoff and shallow groundwater are retained in coastal agroforestry zones [25], this regards also to production of biomass from there [1, 3, 5, 26-30].

Researches in EU of recent years confirm again that agroforestry zones on agricultural land protect surface water quality, soil erosion and reduce diffuse pollution [ [1,3,5, 26, 27,29, 30,31,32]. Agroforestry zones can also play a key role in nature protection and flood risk reduction, as well as in the design of climate-resilient bioenergy measures, the effects of intensive agricultural and policy pressures on the environment [31].

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In EU countries widely used economic agroforestry zones, but the growing demand for bioenergy and agricultural products requires much wider use [1, 3, 5, 26, 27, 29, 30, 31, 32].

Land use is much more important in determining catchment area hydrology than soil type: agroforestry protection zones have a significantly higher infiltration capacity than fields or pastures [3].

Agroforestry zones as shelter belts are also very effective in removing pesticides and preserving the biodiversity of agricultural land and have a high potential for fuel, feed or fibre production [33, 3].

EU Water Framework Directive (Directive 2000/60/EC) calls for good ecological status to reduce water pollution by 2027 at the latest [35]. Rising energy prices, future fossil fuel shortages and impending climate change are also driving new measures that combine environmental protection with energy production and carbon sequestration to mitigate climate change [36, 37]. One way of tackling this problem is to re-evaluate agricultural systems in the combined food and bioenergy production process [35]. Specially planned and designed agroforestry zones reduce nutrient losses and retain pesticides from agricultural land, as well as regulate water cycles, reduce the risk of floods, increase carbon sequestration and reduce greenhouse gas emissions, as well as secure energy production from agriculture [27].

In Baltic Sea region countries legislation allows that on agricultural land wood biomass can be grown as long term tree plantings as agriculture or plantation forests [37, 38, 39, 40]. The maximum growing period for long term tree plantations as agriculture is 15 years, after which the plantations are restored or the land is used to grow other crops [38]. Naturally, ingrown forest can be registered as a plantation regarding forest growths of no more 20 of age, these grown on agricultural land. The term “fast-growing tree plantations” in practice is used for both land uses – agriculture as long term plantations of single-age fast-growing tree species (willow, aspen hybrids, grey alder), grown as a long term tree plantation for 15 years, as well afforested land – plantation forest with a maximum single rotation period $\leq 20$ years and the trees may be grown together with grasses or other crops, then it is agroforestry system in fact, but depending from number of trees planted, could fit as to agriculture as forest land [38].

For economic agroforestry zones, fast-growing tree species are recommended as biomass producers, the terms of which are marked in Baltic Sea region countries, including Latvian regulatory enactments as tree plantings and short rotation coppice, which refers to the cultivation of trees on agricultural land [38]. EU Regulation refers to the term agroforestry system, defined as a land use system in which trees are grown on agricultural land [15, 28].

**Recommended tree and shrub species for economic agroforestry zones for biomass production in Baltic Sea region climatic conditions**

Short rotation forestry (SRF) with a combination of species and a rotation time of 15 to 30 years, depending on the species used, is the most suitable way for management of economic agroforestry zones [26, 41, 42, 43]. Short rotation coppice is suitable for willows (*Salix* spp.) and poplars (*Populus* spp.) as these tree species can be harvested at much shorter intervals (SRC), 1–5 or 4–10 years, facilitating their use in agricultural systems [40, 42, 43].

For tree species as grey alder (*Alnus incana*) and black alder (*Alnus glutinosa* L.) the harvesting intervals of short rotation coppice is aprox. 15-25 years [44, 45, 46, 47, 48, 49, 50]. Production studies on alder plantations indicate the potential for biomass production similar to poplar (*Populus* spp.) and willow (*Salix* spp.) [42, 43, 51, 52].

Suitable species than *Salix* spp., *Populus* spp. can be renewed with coppice 2–3 times until the shoots run out or yields are significantly reduced [42, 53, 54, 55, 56]. Assuming that most short rotation coppice (Salix spp., Populus spp.) will be planted on fertile soils with high nutrient potential as well as successful species combination and growth conditions, the calculated annual DM yield estimate on average per unit area is 5–8 t $ha^{-1}$ (6–18 $m^3$ $ha^{-1}$) by SRF, up to 16 t $ha^{-1}$ (39 $m^3$ $ha^{-1}$) in willow/poplar short rotation coppice [ 42].

Scientists have evaluated the maximum biomass production potential for short rotation plantations and short rotation tree species coppice in European countries [3, 57]. The highest yield is expected from Poplar hybrids, which produce in short-rotation plantations 16 DM t $ha^{-1}$, as well as *Salix* spp. and the short rotation plantations thereof, which will yearly produce 14 DM t $ha^{-1}$, hybrid aspen short rotation plantation growth,

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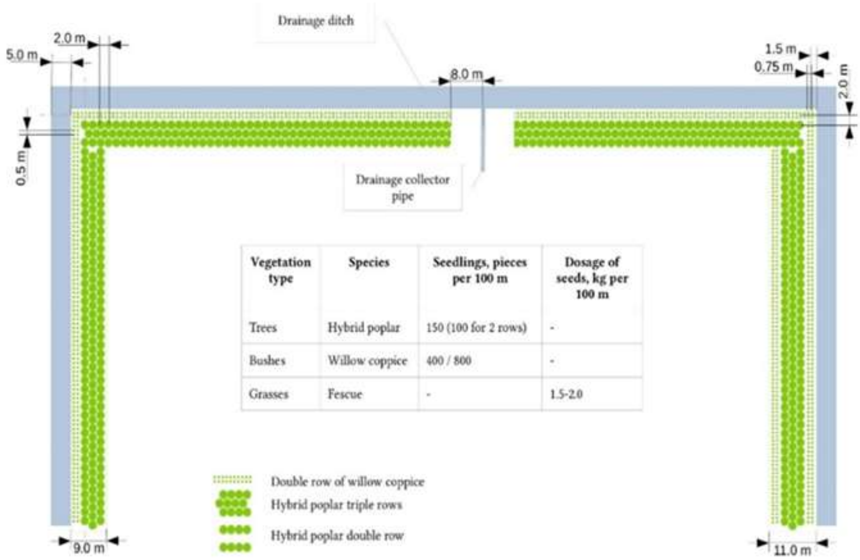
respectively, 10.3 DM t $ha^{-1}$, grey alder short rotation plantations, respectively, 9.7 DM t $ha^{-1}$ [3, 57, 58]. This biomass production potential is also similar to area of economic agroforestry zones with similar soil conditions.

**Schemes of economic agroforestry zone than as biomass producer in Baltic Sea region climatic conditions**

It is determined that in the economic agroforestry zones which serve than shelter belts, willows can be planted alone as a low protection zone or on the ditch ramp in the protection zones of larger trees, to allow movement around the ditch area without cutting large trees, as well as rows of larger trees on the wind side, to lift wind flows over the tops of trees and prevent wind damages [ 3].

Within the scope of the study, Latvian scientists recommended the agroforestry zone than shelter belts marked on agricultural lands as 15 m wide strips along the ditch area on both sides of the ditch (Figure 1).




| Vegetation type | Species | Seedlings, pieces per 100 m | Dosage of seeds, kg per 100 m |
|---|---|---|---|
| Trees | Hybrid poplar | 150 (100 for 2 rows) | - |
| Bushes | Willow coppice | 400 / 800 | - |
| Grasses | Fescue | - | 1.5-2.0 |

Figure 1. Principal scheme of a shelter belt.

Research shows, that in agroforestry zones than shelter belts with a width of 15 m, willows could be planted in 1 double row along the edge of the shelter belt, but grey alder seedlings in rows 1–1.5 × 2.5 m, but fast growing breeds of Poplar spp., Alder spp. – in rows of 1x2.5 m [59].

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The length of rotation cycle is 15–20 years. The rotation period of willow plantations is 2–5 years (5–7 production cycles) to produce wood chips and 6–15 years to produce firewood [42, 43, 60]. The willows can be used to make firewood, wood chips, pellets and charcoal [42, 43, 60].

The life cycle of Populus spp., including aspen hybrids is 15–30 years, in energy wood plantations the life cycle is 15 years [53, 54, 55, 56, 61, 62, 63, 64]. The number of rotation cycles is 1–3. When the purpose of growing a hybrid aspen plantation is to produce energy wood, then the first felling can be done earlier (in about 10 years) and then managed as a coppice [57, 62, 63, 64].

Life cycle of Alder spp. is 15-30 years, in energy wood plantations the life cycle is 15 years [45, 46, 47, 48, 50, 65, 66].

During the first years, in plantations of *Populus* spp., *Alnus* spp. the line spacing can be used to grow other crops, including agricultural crops [67, 68, 69, 70], to make the most efficient use of land and make additional profits. Barley, clover, oats, rye, wheat, corn, potatoes and other crops can be grown between the rows of poplars [68]. Growing crops reduces the growth of vegetation and forms green manure. The poplar crowns later joins, limiting the availability of light, water and nutrients to these crops [70].

The task of sowing grass is to provide income in the first years after the establishment of a tree plantation. The design of the tree plantation predicted such that the area can be used as efficiently as possible until the tree crowns closed [69, 71].

**Economic agroforestry zone than short rotation tree plantations for biomass production by Salix spp., Populus spp., Alnus spp.**

Studies have shown that in the Baltic Sea regio climatic zone, the most suitable tree species as a biomass producer are Salix spp., Populus spp and Alnus spp, if they are established and managed as short-rotration plantations [28, 42, 43, 72, 73, 74, 75]. The average annual growth of willow biomass is 8 tons of dry matter per ha per year [42]. In Sweden, the average yield is 7–20 tons of dry matter per ha [29] and in Poland – 7–12 tons of dry matter per ha; in Germany: 6–14 tons of dry matter per ha; in Latvia 8–12 tons of dry matter per ha [43].

In order to produce as much biomass as possible in a short period of time, in economic agroforestry zones poplars are recommended to be grown in short rotation (3–5 years) plantations and plantations regenerate with coppice [42, 43]. The length of rotation cycle is 20–30 years [29, 42, 43]. After 20–30 years, the plantations are replanted or the species is replaced. The recommended number of rotation cycles is 3–4. At the end of rotation period, growing stock reach 20–45 t $ha^{-1}$ of naturally wet wood [29, 42]. The average annual increase in biomass in Europe for poplars varies from 2 to 13.5 t $ha^{-1}$ [29, 42].

The growing stock of hybrid aspen plantation with initial density of 1,100 trees per hectare at an age of 8 years reach 50 $m^3$ $ha^{-1}$, but, if the initial density is 2,500 trees per hectare, at the age of 10 years growing stock reach 200 $m^3$ $ha^{-1}$, in 15 years is 230 $m^3$ $ha^{-1}$, in 20–25 years – 300–400 $m^3$ $ha^{-1}$ [64].

The research show, that in Baltic Sea countries climatic zone- Sweden, Estonia, Latvia, Lithuania etc. trees by Alnus spp. are suitable for producing biomass by energy wood production [ 3, 44, 48, 50, 58, 65]. Scientists from Sweden and Finland demonstrated the highest biomass yields from grey alder plantations – 17 DM t $ha^{-1}$ per year [75]. In Latvian climatic conditions Grey alder growing stock in 5-year-old stands, depending on soil fertility and stand density, is 8–32 $m^3$ $ha^{-1}$ (20–97.5 $m^3$ of wood chips), in 10-year old stands 20–102 $m^3$ $ha^{-1}$ (50–255 $m^3$ of wood chips) and in 15-year old stands 34–178 $m^3$ $ha^{-1}$ (85–445 $m^3$ of wood chips) [65, 76, 77].

In the Nordic of Europe, the Netherlands, Sweden, Estonia and elsewhere black alder is considered a major producer of biomass [57, 58, 72]. Estonian scientists have found that the surface biomass produced by black alder at 21 year age can reach 88.8 t DM $ha^{-1}$, giving an annual biomass production of 17.1 t DM $ha^{-1}$ [58, 75]. In Sweden black alder is found to be able to produce at 21 to 91 years age 152.3 ± 7.7 t of dry matter $ha^{-1}$ [44].

In Latvian climatic conditions the growing stock in **black alder** plantations at the age of 15 years is up to 249 $m^3$ $ha^{-1}$, if 2–3 root offshoots have been left near the trunk during the early tending , but at maturity age reach growing stock of up to 400 m3 $ha^{-1}$ [ 48, 77].

The biomass productivity of woody plants in SRC and SRF for producing biomass is summarized in Table 1.

**Table 1.**

**Biomass extraction potential from tree species suitable for SRF and SRC in Latvia**

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| Species | Latin name | Duration of rotation, years | Average annual growth, DM t ha$^{-1}$ | Stock produced | |
|---|---|---|---|---|---|
| | | | | per year | in 5 years, willow, poplar; 10–25 years, aspen hybrids |
| Willow hybrids | *Salix viminalis* L. based and other hybrids | 1–5 | 8–12 | 30–36 m$^3$ ha$^{-1}$; 75–90 bulk m$^3$ ha$^{-1}$ | 50–60 m$^3$ ha$^{-1}$; 125–150 bulk m$^3$ ha$^{-1}$ |
| Aspen hybrids | *Populus tremula* L. based | 10–25 | 23 | 15–20 m$^3$ ha$^{-1}$ | 200–400 m$^3$ ha$^{-1}$ |
| Poplar hybrids | *Populus detroides* L. based and other hybrids | 3–5 | 7 | 5–9 t ha$^{-1}$; 9–16 m$^3$ ha$^{-1}$ | 20–45 t ha$^{-1}$; 36–80 m$^3$ ha$^{-1}$ |
| Grey alder | *Alnus incana* L. | 5–15 | 3.4–5.5 | 11.8 m$^3$ ha$^{-1}$ | 178 m$^3$ ha$^{-1}$ |
| Black alder | *Alnus glutinosa* L. | 15–20 | 15.5 | 19–26 m$^3$ ha$^{-1}$ | 249 m$^3$ ha$^{-1}$ |

**Herbaceous undregrowth crops in economic agroforestry zones**

In order to maximize the use of the area of economic agroforestry zone, in many European countries, herbaceous plants are grown in the rows of tree plantations, for several reasons, e.g. on food and feed supply and on nitrogen balance were considered focusing on: a) landscape aesthetics and biodiversity b) groundwater protection, c) maintaining current food and feed production, or d) on site carbon sequestration [72, 74].

The study evaluated 3 different herb mixtures, including a mixture dominating by nectar plants, a mixture of fodder herbs and an industrial mixture of herbs. All herb mixtures evaluated in the study are universal and can be used in different types of agricultural soils [68,70].

It should be noted that the grass mixture can only be transplanted at the same time, when the economic agroforestry zone is replanted; therefore, it must be taken into account that in a few years a new community of undergrowth vegetation will take place of the sown crop. The composition and productivity of the undergrowth vegetation is

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determined by the growing conditions and the design of the economic agroforestry zone. The mixtures of herbs proposed according to an earlier study [70] is described in Table 2.

**Table 2.**

**Proposed grass mixtures in the shelter belts of hybrid aspen, poplar hybrids, grey alder and black alder**

| No | Explanation | Mixture of nectar plants | Fodder grass mixture | Industrial grass mixture |
|---|---|---|---|---|
| 1 | Herbaceous species | *Trifolium pratense, T. repens, T. hybridum, Lotus corniculatus, Trifolium incarnatum, Melilotus albus, M. officinalis, Festuca ovina, F. pratensis* | *Lolium multiflorum, L. perenne*; *Festulolium, Festuca pratensis, Phleum pratense, Trifolium pratense, T. repens, Medicago sativa/ varia* | *Lolium multiflorum, Festuca arundinacea, F. pratensis, Festuca rubra; Phleum pratense*; *Alopecurus pratensis* |
| 2 | Rotation cycle length | 5–6 years | 4–5 years | 5–7 years |
| 3 | Number of rotations recommended prior to change of species | 1 | 1 | Can be sown repeatedly |
| 4 | Above- and below-ground biomass | Increase of above-ground biomass 5–6 t DM ha$^{-1}$; below-ground biomass is about 50% of the total plant biomass | Increase in above-ground biomass 8–10 t DM ha$^{-1}$; below-ground biomass is about 50% of the total plant biomass | Increase in above-ground biomass is 5–12 t DM ha$^{-1}$, depending on growing conditions and lawn mowing regime |

Perennial grasslands have the potential to produce bioenergy in temperate climate, given their growing conditions, productivity, biomass quality and productive longevity. To help achieve these goals, a study was conducted on growth possibilities of grasses (Phalaris arundinacea L.), as well as hybrid (× Festulolium) between trees, using as fertilizers biogas digestate and wood ash [68].

**Economic evaluation of the economic agroforestry zones in the Countries of Baltic Sea region**

A number of measures are affecting results of establishment and management of the economic agroforestry zone: site evaluation (soil properties, moisture regime), overgrowth removal, soil preparation before planting, use of fertilizers, quality and delivery of planting material, planting, early tending and following management activities, biomass extraction and regeneration of the agroforestry zone.

Soil preparation costs before planting are similar for all tree species. Data for the cost calculations are taken from Latvian Rural Advisory and Training Centre agriculture service costs database and represents situation in 2021 [78]. Soil preparating are as follows – ovegrowth removal (300 EUR $ha^{-1}$), herbicide costs (24 EUR $ha^{-1}$), fertilizers costs (173 EUR $ha^{-1}$), plowing (55 EUR $ha^{-1}$), herbicide transport (18 EUR $ha^{-1}$), herbicide spraying (23 EUR $ha^{-1}$), discing (40 EUR $ha^{-1}$), cultivation (33 EUR $ha^{-1}$), fertilizer transport (18 EUR $ha^{-1}$) and fertilizer spreading (19 EUR $ha^{-1}$), in total 701 EUR $ha^{-1}$.

Due to the increase in fuel prices by 26.6%, the average consumer price index increased by 8.7% leading to increase of the total costs [79]. The cost of soil preparation is 762 EUR $ha^{-1}$. It should be noted that due to continuous rising of fuel price in 2022, soil preparation costs may be significantly higher at the end of 2022 and in 2023.

The area is marked according to previously elaborated design and planted after soil preparation. Planting cost includes planting material and planting, as well as seeds and sowing. Assuming that a agroforestry zone consist of willows in average 13,000 seedlings are necessary per hectare, which is the optimal number of seedlings in Latvia. The total cost of establishment of one hectare of willow plantations is 1,060 EUR, of which 845 EUR (75%) is the price for planting material and 215 EUR (25%) is the price for planting. Cuttings of selected willow varieties are used as planting material, while planting is carried out using a planting machine. Prices of cuttings and planting costs are provided by the by harvesting every 4$^{th}$ to 6$^{th}$ year and fertilizers are used onlyduring the establishment of the agroforestry zone. If the company “Salixenergi Baltic”.

Willow in agroforestry zone could be managed intensively by harvesting every 3$^{rd}$ year and fertilizers have to be used after every harvest, while not mandatory in agroforestry zone receiving nutrients from surrounding cropland, or extensively main

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objective of the agroforestry zone is water protection by retaining nutrients and biomass production as added value, the buffer one should be managed extensively. In agroforestry zones surrounding agricultural lands addition fertilization is not crucial and even may be avoided to reduce nutrient leakage to water bodies.

The mechanized harvesting method of willow SRC uses self-propelled shredders, where the mowing is carried out together with the chipping, while the biomass is loaded into the supply tractor. The supplied biomass is stored for some time in open piles at the edge of the field, where biomass dries before further transportation. Manual harvesting can be used to produce willow cuttings or firewood from larger shoots, while this method is very expensive considering small dimensions of trees. The transport of biomass to a roadside is performed by a middle- or compact-class forest forwarder or a suitable agricultural tractor with a trailer adapted to transport long shoots. In case of chip production stems are comminuted after certain drying period with mobile chippers. Biomass can be delivered to customers using tractors or chip trucks (load size up to 90 $m^3$ in Latvia).

The cost of mechanized willow harvesting is around 3.00 EUR bulk $m^3$, while manual harvesting using chainsaw costs 4.19 EUR bulk $m^3$, which is by 43% more (Makovskis, 2021). The mechanized willow harvesting method is used in plantations with a total continuous area of at least 5 ha [43]. Therefore, in economic agroforestry zone managed extensively manual harvesting method may be considered as a viable alternative to mechanized harvesting, especially because whole stem harvesting permits drying of biomass in contrast to instant chipping with self propelled harvesters [30]. In the extensive model the average increment corresponds to 54 bulk $m^3$ $ha^{-1}$ of wood chips [30]. Assuming that harvesting takes place once per 4 years, the total amount of wood chips per rotation corresponds to 216 bulk $m^3$ $ha^{-1}$.In case of 6 harvests before the regeneration of a agroforestry zone, where the total output of wood chips is 1296 bulk $m^3$ $ha^{-1}$. Wood chip selling price is 9.4 EUR bulk $m^3$ [79]. Under such condition repayment period of ashelter belt is about 10 years, however, significant increase of forest biofuel leads to higher economic efficiency of agroforestry zone.

Aspen hybrids are suitable for short-rotation biomass production because they demonstrate good growth rates during early development. Planting of aspen hybrids in economic agroforestry zone recommended if simultaneous cultation of trees and grasses during certain period of time is envisaged. These agroforestry zones can be harvested after 15 years and replanted after 30 years [64]. For first 5 years grasses can be moved and seeds sold. After harvest, main timber products are pulp wood, firewood and wood chips. Calculated agroforestry zone repayment period is about 15 years, if costs and prices as in 2021 are used.

In the grey alder plantations the duration of rotation of the SRC for energy wood production is assumed to be 15 years (2 rotations) and the total life span is 30 years. Then the plantation should be restored [30]. Such plantations are managed for production of wood chips. Studies show that it is best to keep grey alder in places where it has already grown, because then it is not necessary to purchase and plant seedlings, which significantly improves the economic return of the short rotation plantation of grey alder [ 30].

Plantating of black alder (*Alnus glutinosa* L.) as a short rotation crop is recommended in economic agroforestry zones with 30–40 years long rotation period. Plantation is managed for 1 rotation, after which the plantation should be restored [ 30]. Obtainable products – sawlogs, firewood and wood chips.

## CONCLUSSIONS

Earlier studies prove that SRC with a life cycle of 15–20 years is recommended for willow (*Salix* spp.) as biomass crop in economic agroforestry zones. The recommended rotation period of willow SRC is 2–5 years (5–7 production cycles per a life cycle) for the production of wood chips and 6–15 years for the production of firewood. The willows can be used to make firewood, wood chips, pellets and charcoal.

In poplar plantations (SRF) as a biomass producer in economic agroforestry zones the recommended rotation cycle is 20–30 years. The recommended number of rotation cycles is 3–4. After 60-80 years, the plantations should be replanted considering also use of other species.

The recommended life cycle of hybrid aspen in the SRF is 15–30 years, while for energy wood production the life cycle is much shorter – 15 years. The number of rotation cycles per lefe cycle is 1–3. If the purpose of establishment of the plantation is to produce energy wood, then the first harvest can be done earlier (in about 10 years) and then the plantation can be managed as SRC.

In the grey alder plantation the life cycle of SRC for energy wood production is assumed to be 15 years (the plantation is managed in 2 rotations) and the total life span is 30 years, after which the plantation should be restored. The plantations are managed to produce wood chips; while it is not economically viable solution.

The black alder plantation is managed for sawlogs and firewood production with a life span of 20–40 years, after which it can be managed as a SRC or SRF.

ACKNOWLEDGEMENTS Research is supported by European Regional Development Fund project "Investigation of economic and environmental aspects of biomass production in the buffer zones of amelioration systems and in the areas adjacent to the protection zones of natural watercourses" (agreement No 1.1.1.2/VIAA/3/19/437).

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