
Recognition the species and
age of planting stock

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Partial credit:

- Practical determination of the species and age of planting stock

Planting stock

= young trees of a generative and vegetative origin used for reforestation

Seedling – a plant **without a root system (RS) treatment**

Plant (transplant) – a plant **with a RS treatment** (undercutting, transplanting, replanting into a container, pricking-out) of plants with an above-ground part height **up to 70 cm**

Large-sized plant – a plant with a height of **51-120 cm** above-ground part, usually with a **double RS treatment or a shaped crown**

Sapling – a plant with a height of **121-250 cm** above-ground part, usually with **a triple RS treatment and a shaped crown**

Age and method of planting stock cultivation

+ transplanting or replanting into containers

- undercutting of roots

f cultivation in artificial cover (polyhouse, greenhouse...)

k cultivation in an root-impenetrable container

v cultivation in an container with air pruning

0.5 - 0.5

one-year-old bare-rooted plant grown in uncovered mineral soil

(the bare-rooted seedling had its RS undercut during its vegetative period)

f1 + v1

two-year-old containerized plant

(one-year-old seedling grown in artificial cover and transplanted into a container in which it was grown by air cutting for 1 year)

Examples of planting stock cultivation formulas

Pine, Larch, broadleaves						
1	1+0	2+0	0.5+0.5	f1	fv1	
2	1-1	1+1		f1+1	1+v1	
3	1+2	2-1	1-2	f1 +2	2+v1	
4–5	1+2-1			f1+1+-1	1-1+v1	
Spruce, Pseudotsuga, Fir						
1	2+1	3+0		f1 +1	fv1	
2	2+2			f1+2	f1+v1	fv2
3	2+3			f1+3	2+v2	f1+v2
4–5	2+2-2			f1+2-1	2+2+v1	f1+2+v1

1 thin **2** medium thick **3** thick **4** large-sized plant

Number of plants planted per 1 ha

– for forest regeneration and reforestation, minimum numbers of individuals per hectare must be used, see 139/2004 Coll.

– numbers differentiated according to the management sets of stands

The management set of stands (MSS)

= unit of framework planning economic measures defined by related natural conditions, stand conditions and the same functional orientation of the forest

- made up for forest management purposes and based on principles of forest typology; the basic unit of general planning

Example: MSS 25 → **Ecological series** - numbers by forest category

Forest altitudinal zone (FAZ)

Number 1-7

Economic forests	Special purpose forests	Protective forests
1 exposed	0 exposed	1 extremely unfavourable sites
3 acidic	2 acidic	2 mountain forests
5 nutritious	4 nutritious	3 pine FAZ
7 gleyed	6 gleyed	
9 waterlogged	8 waterlogged	

1, 2 – lower altitudes

3, 4 – middle altitudes

5 – higher altitudes

7 – mountain altitudes

Minimum number of individuals per hectare of land (bare-rooted planting stock in thousand of units)

Species	Site (Management set of stands MSS)	Basic tree species of plant
Picea abies	Mountain locations, all MSS sites 71,73,75,77,79 (02,03)	3
	Sites not affected by water; high, medium and low altitudes: MSS 51,53,55,41,43,45 a (13,21,23,25,31,35)	4–5
	Sites affected by water; high, medium and low altitudes: MSS 39,57,59,27,29	3,5
Abies alba		5
Abies grandis		2
Pseudotsuga menziesii Larix decidua		3
Pinus sylvestris	Lower altitudes, exposed acidic nutritious sites: MSS 13,21,23,25, 31,35	9
	Middle and higher altitudes predominantly acidic (partly also exposed) and nutritious sites MSS 43, 53 (41, 45, 51, 55) and all sites affected by water: MSS 19,27,29,39,57,(01)	8
Pinus nigra and exotic pine species		7
Pinus strobus		5
Pinus mugo		2,5

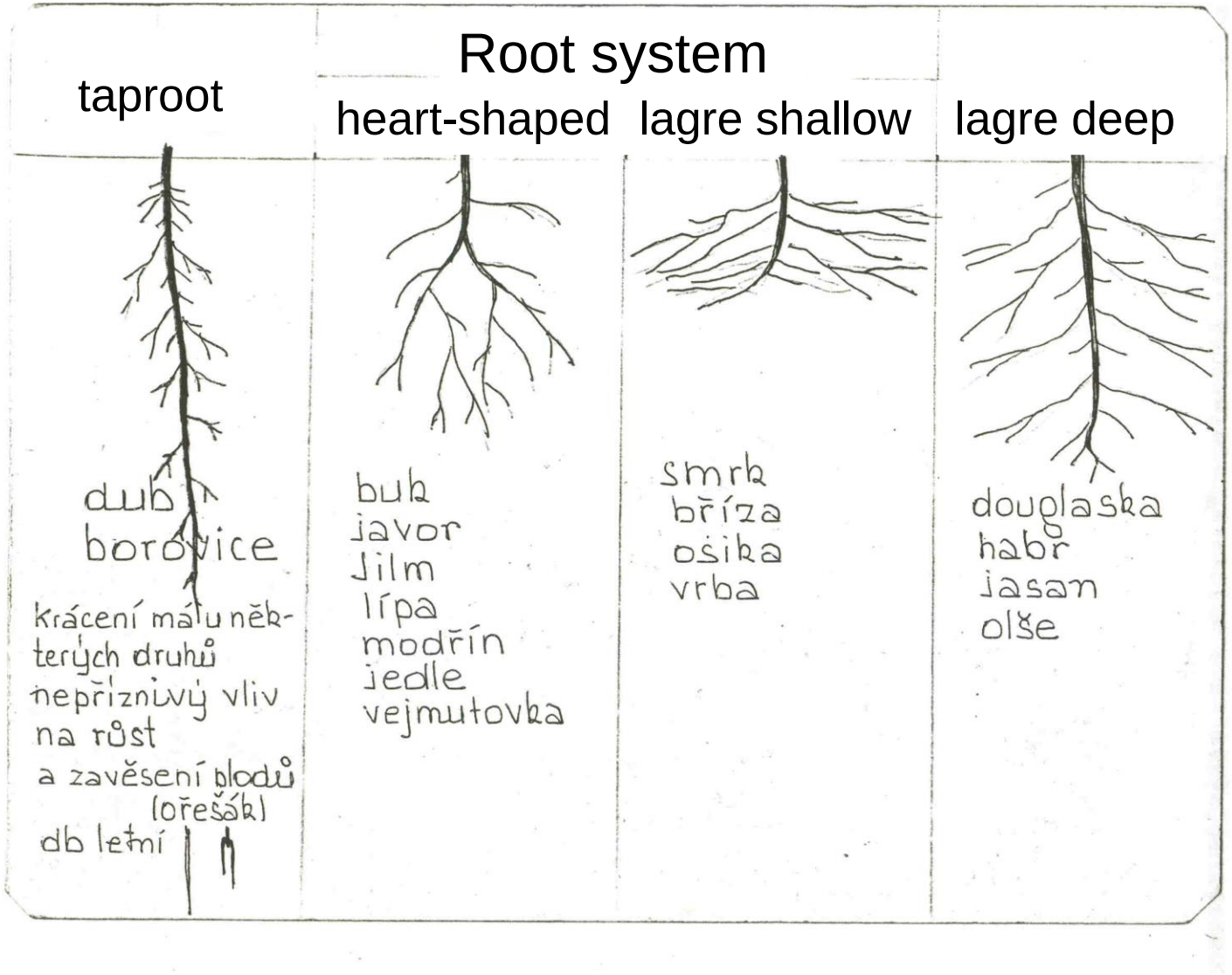
Species	Site (Management set of stands MSS)	Basic tree species of plant
Quercus robur, Quercus petraea	Floodplain and nutritious sites: MSS 19,25,35,45	10
	Other sites (acidic, exposed, gleyed, waterlogged): MSS 13,21,23,27,31,39,43,(01)	8
Fagus sylvatica	Nutritious sites at low, medium and high altitudes: MSS 25,27,35,45,55	9
	Other sites (acidic, exposed, gleyed, mountain): MSS 13, 21, 23, 31, 41, 43, 51, 53, 71, 73, 75, (57), 01	8
Tilia, Acer, Fraxinus, Quercus rubra		6
Populus tremula, Alnus		4–5
Betula and Sorbus		6

Identifying the species and age of planting stock

Recognition of species

- number, colour and arrangement of cotyledons
- cross section of cotyledons
- primary needles and genuine leaves (needles)
- buds
- trunk and twig surface, pulp cross-sectional shape (deciduous)
- root system shape

Root system of tree species



Determining of age

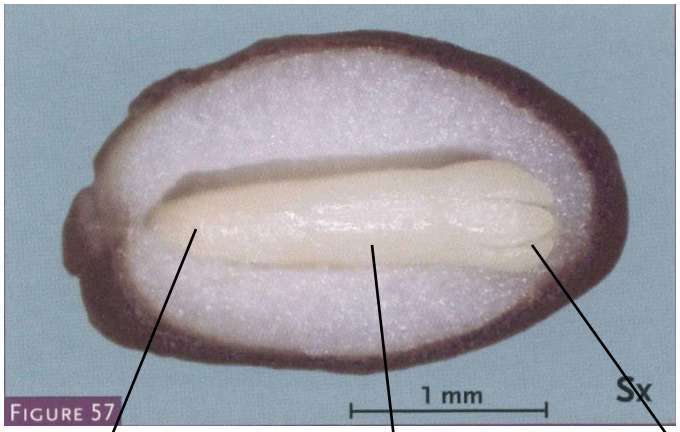
- size (height)

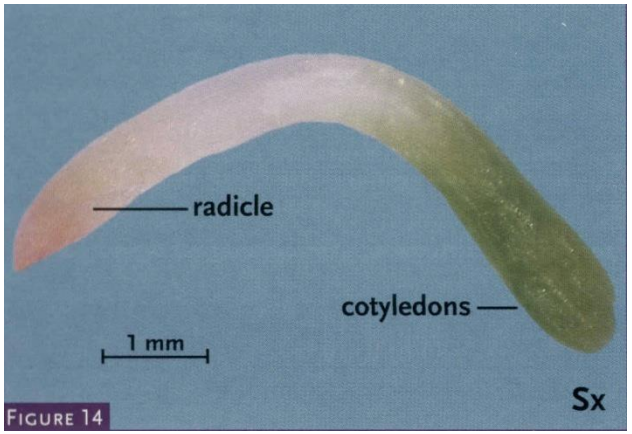
Growth when at a young age:

very rapid:	*Larix, Betula, Alnus, Populus, Salix*
rapid:	*Pinus, carpinus, Tilia, Acer, Ulmus, Fraxinus, Sorbus*
moderate:	*Picea, Quercus, Fagus*
slow:	*Abies*

- growth increments
- knowledge of plant morphology
- occurrence of „hunger“ (short) increments
- RS architecture
- number of tree-rings

Seed germination and seedling formation





primary root (radicle)

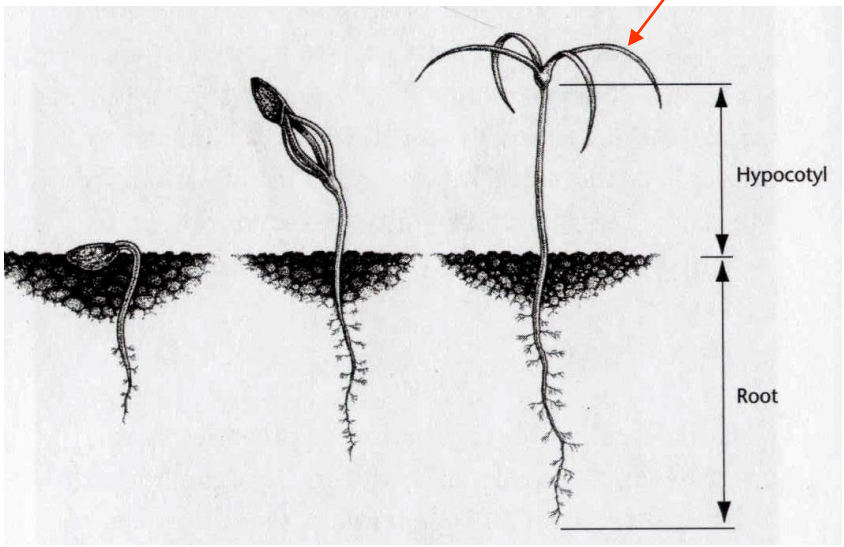
hypocotyl

cotyledons

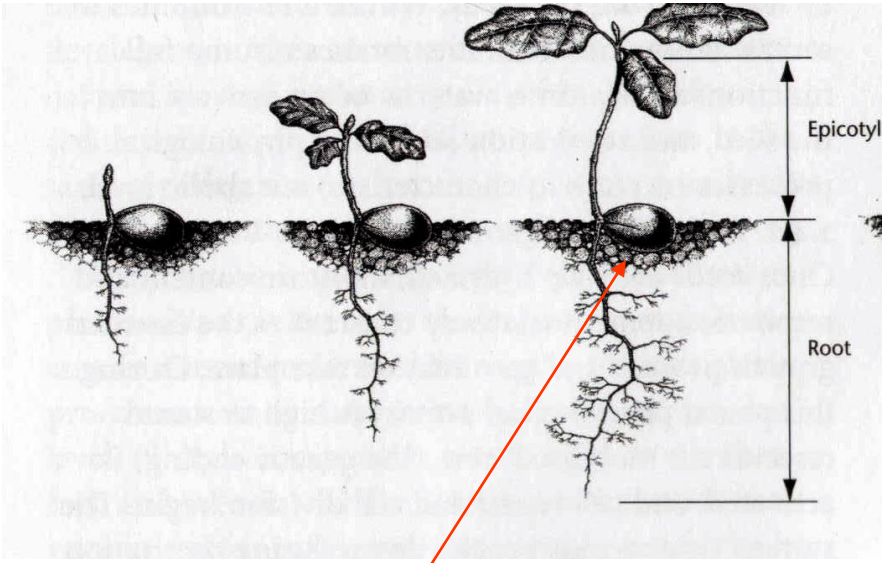
Types of germination

epigeic

cotyledons



hypogeic



cotyledons

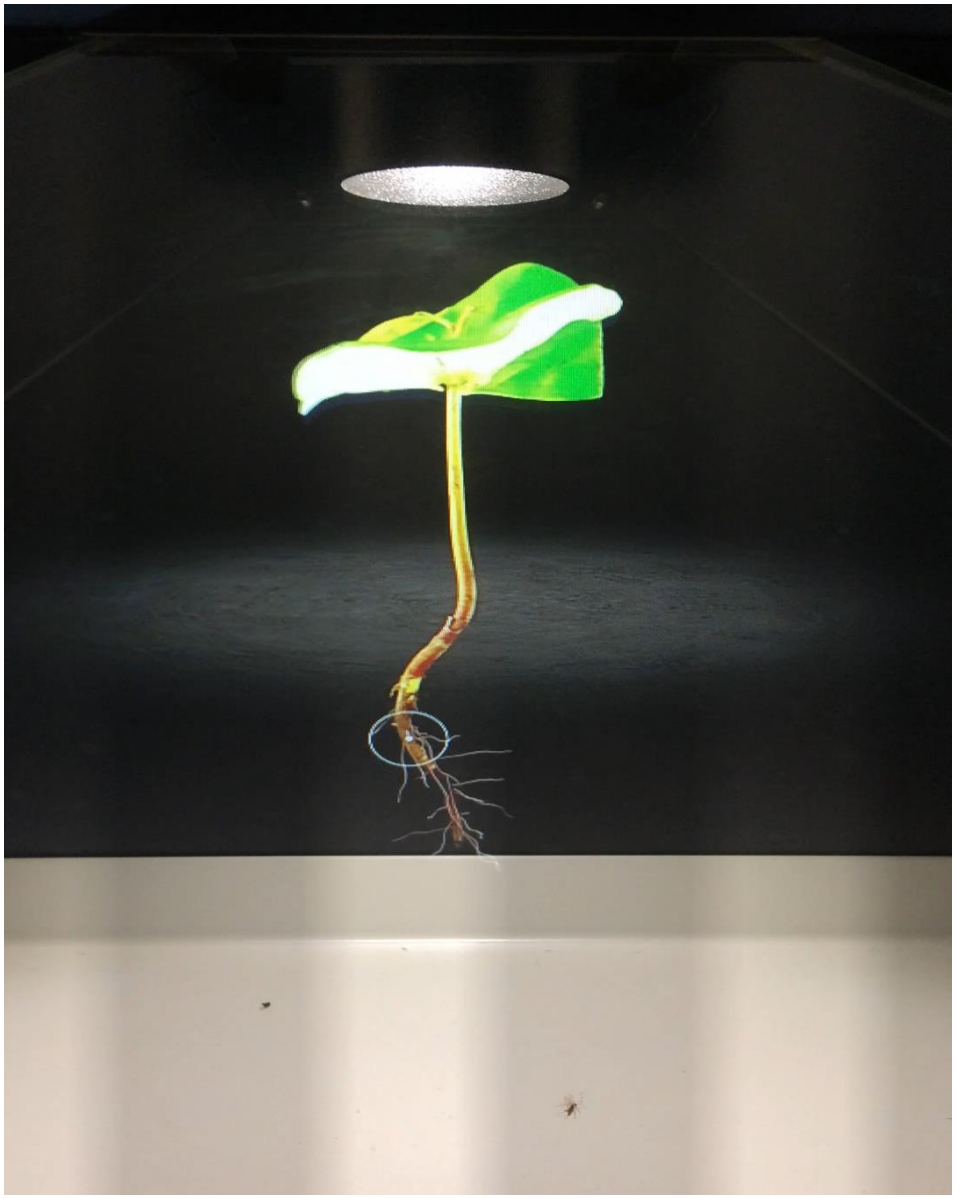
seed

↓ *germination*

plantlet (young seedling)

↓ *outgrowth of a rising peak*

seedling



Basic terms

terminal bud - terminates the shoot

axillary (lateral) buds

- based on the shoot
- in axillaries of all leaves in angiospermous plants
- in axillaries of some leaves in gymnospermous plants

syleptic branches - growing with the elongation of the terminal shoot

proleptic branches - growing from buds established in the previous year, e.g. from buds that have undergone shorter or longer rest periods

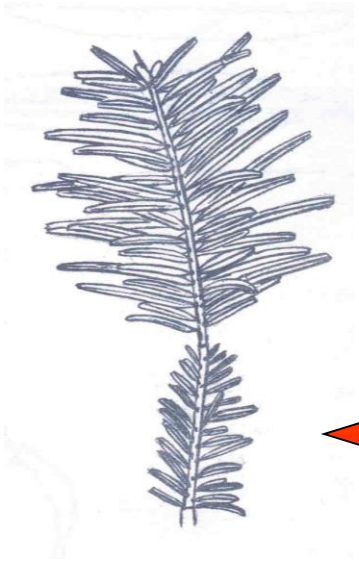
Lamas shoot

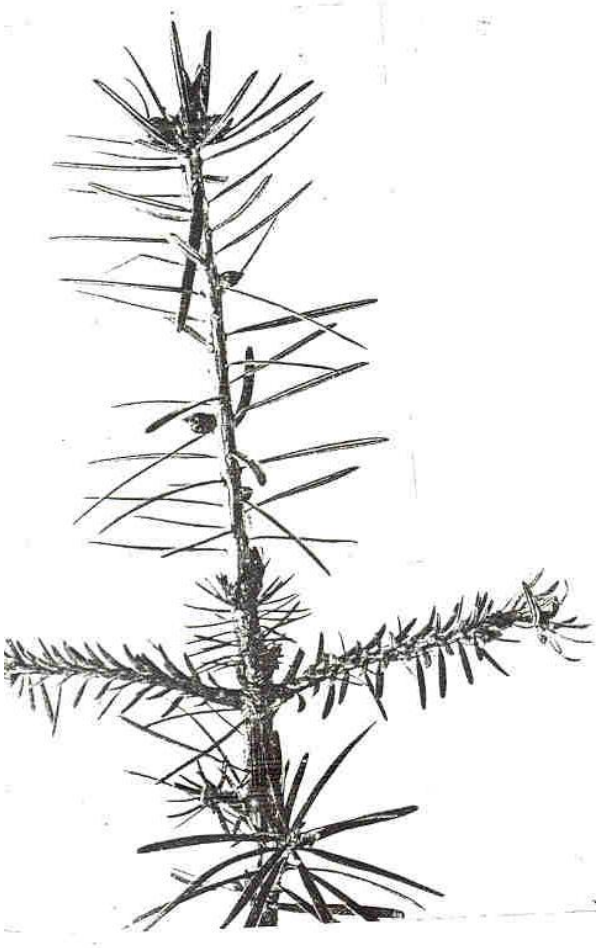
- a specific type of proleptic shoot
- that arises by restoring the growth of the terminal bud that ended its growth and then resumed activity in the same year (*Picea, Abies, Quercus, Pseudotsuga*...)

hunger increment

- short increment with short needles

usually occurs after transplanting or planting



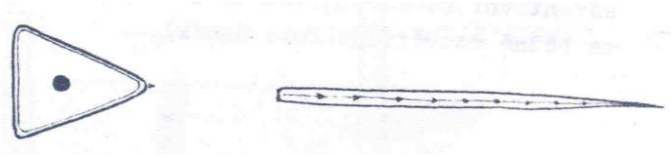


Norway spruce
(*Picea abies*)
1+0

Plants of the same age may differ in height and maturity (the presence of buds and branches)

Norway spruce (*Picea abies*)

Shapes of needles

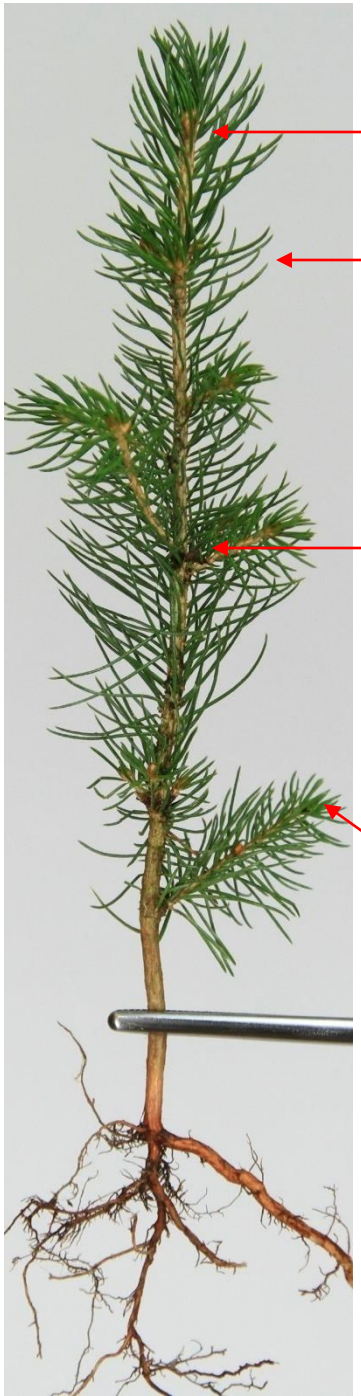


Cotyledon

1-year needles

Older needles

Norway spruce (*Picea abies*) 2+0



several lateral buds below the terminal bud – the basis of a future whorl

buds and branches on a 2nd year increment

scales after the terminal bud

crowded needles that covered the bud

buds and branches of double age on the first year of growth

Norway spruce (*Picea abies*) 3+0

buds and branches on a 3rd year increment

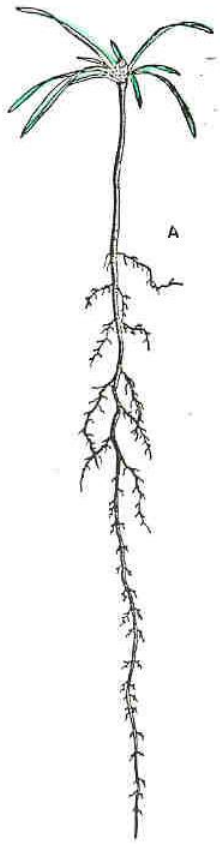
crowded needles that covered the terminal bud

scales after bud, different bark

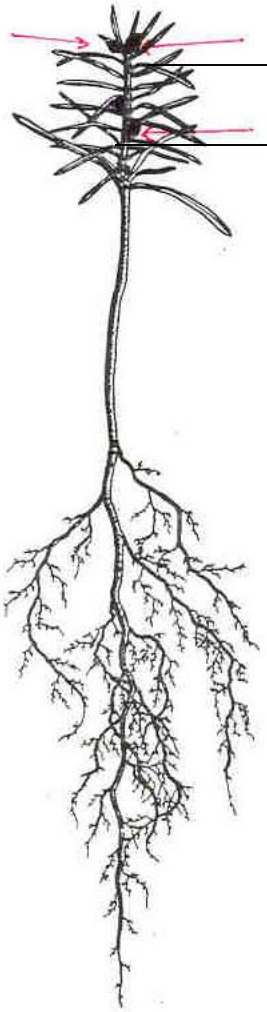
possible occurrence of a Lamas shoot

Silver fir (*Abies alba*)

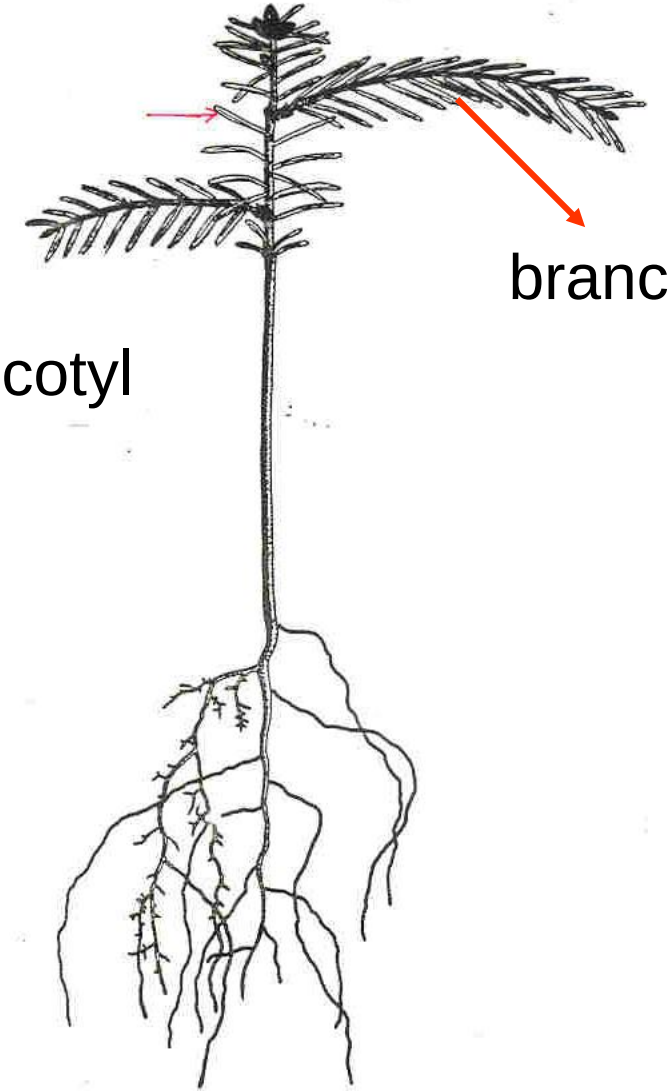
- slow growth



1+0

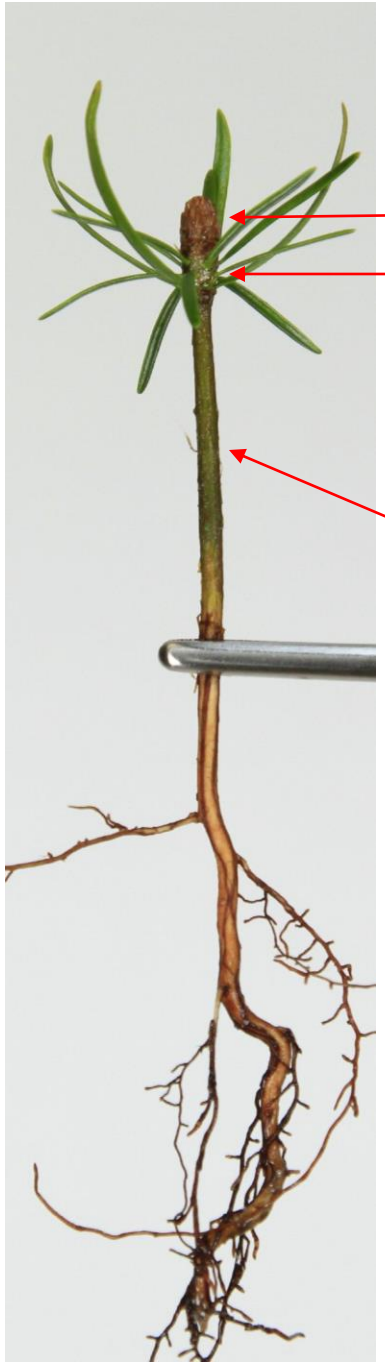


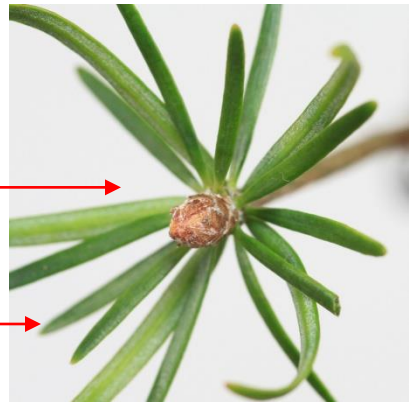
2+0



3+0

Silver fir (*Abies alba*) 1+0





brown terminal bud

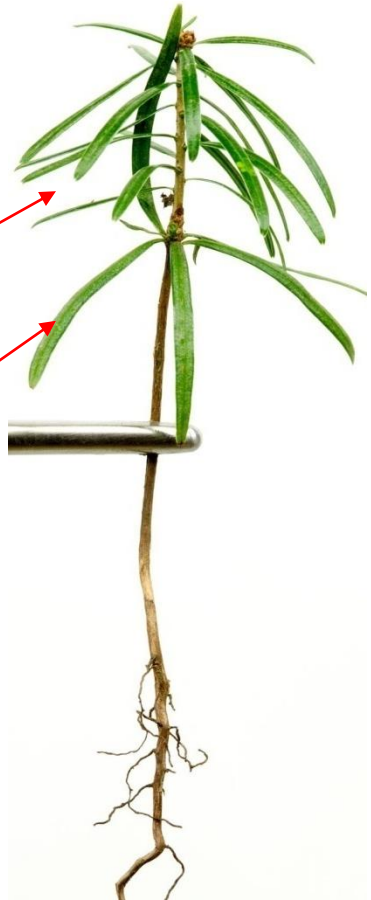
cotyledon nodus

cotyledons (longer) and primary needles (shorter) in alternating positions

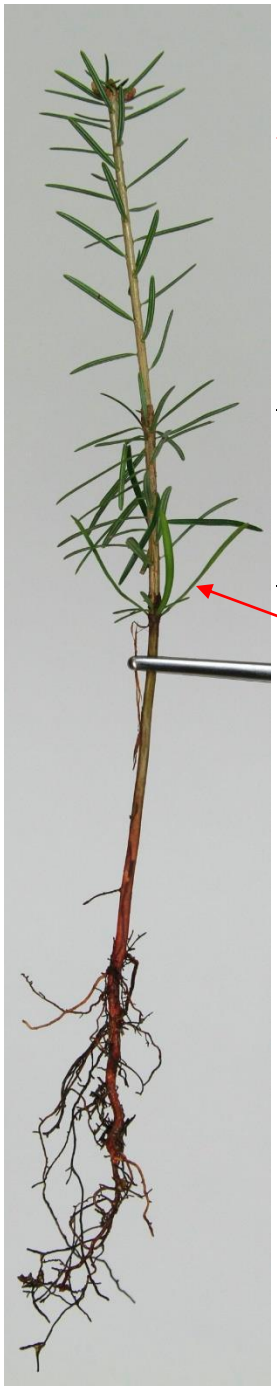
hypocotyl always without any needles

Note:
under favourable conditions,
firs can create a short epicotyl
in the 1st year

cotyledons (longer)



Silver fir (*Abies alba*) 2+0



2nd year

1st year

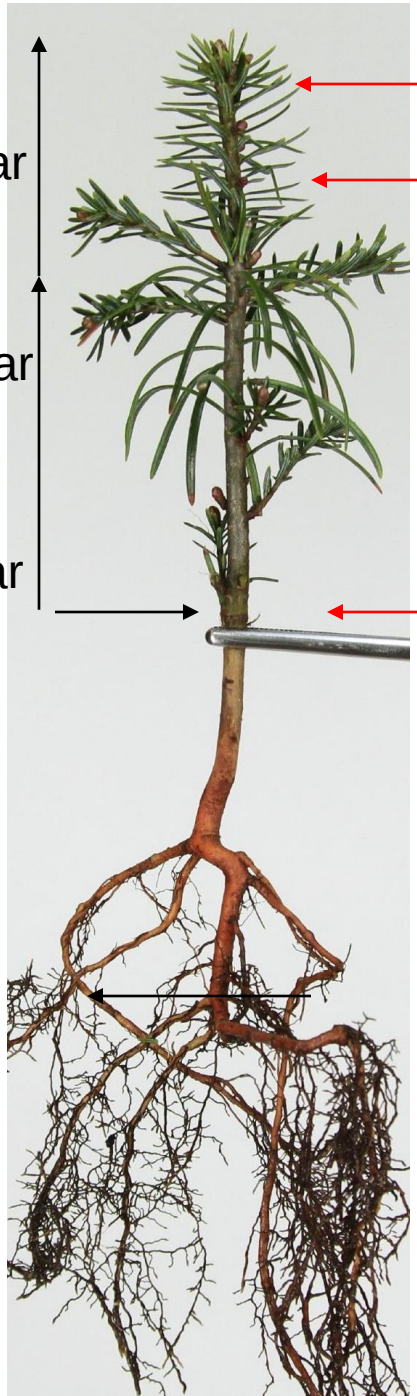
terminal and axillary buds = the basis of an incomplete whorl

epicotyl produced in year 1

cotyledon needle

Note: under favourable conditions, firs can create a short epicotyl in the 1st year

Silver fir (*Abies alba*) 3+0



terminal buds with 2-3 buds at the base

„hungry“ needles at the increment of the third year

cotyledon nodus

Differentiation between *Abies grandis* and *other firs*

Abies grandis

- fastest growth, forms an epicotyl of 5-10 cm in 1 year (*Abies grandis* 1+0 corresponds to *Abies alba* 2+0)

- spherical, resinous, slightly purple terminal bud

- needles bluntly ended in the first year, sticking in all directions, lemony smell

- yearlings usually branched, needles on the branches are not staggered (double-row)

- forms a regular whorl as early as the 3rd year (*Abies alba* in the 4th year)

Scots pine (*Pinus sylvestris*)

1+0 - simple, flat, saw-tooth primary needles

2+0 - terminal bud + axillary buds = rosette

- needles in bundles (double needles)

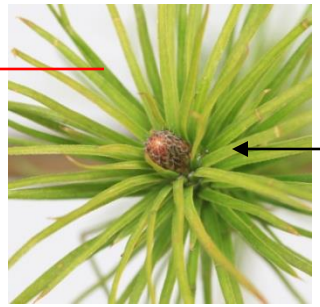
3+0 - rosette

- needles in bundles (double needles)

- between year 2 and 3 = whorl of one-year-old branches

Scots pine (*Pinus sylvestris*) 1+0

1st year



one terminal bud, dense shorter needles around

simple, flat, saw-tooth primary needles during the 1st year increment

cotyledon nodus with dried cotyledon needles

branches may be present in the cotyledon nodus

Scots pine (*Pinus sylvestris*) 1+0

1st year

dense needles around the terminal bud

simple needles during the 1st year increment

lateral buds may appear on the epicotyl

syleptic branch in the cotyledon nodus

Scots pine (*Pinus sylvestris*) 1+0

The height and maturity of pine 1+0 seedlings may vary

Scots pine (*Pinus sylvestris*) 2+0

2nd year

1st year

terminal bud, rosette of axillary buds around = the basis of the future whorl

needles in bundles (double needles) on the 2nd year increment

remains of simple needles on the 1st year increment

Pine 2+0 creates no whorl
(but may have branches in the nodus!)

Scots pine (*Pinus sylvestris*) 2+0

The height and maturity of pinus 2+0 seedlings may vary

Scots pine (*Pinus sylvestris*) 3+0

3rd year

1st and 2nd years

terminal bud, rosette of axillary buds around

double needles on the 2nd and 3rd year increments

whorls of branches on the threshold between years 2 and 3

the threshold between 1st and 2nd years is no longer visible (denser position of the needle scar at the end of year 1)

Pine 3+0 always produces a whorl!

Black pine (*Pinus nigra*) 2+0

rosette of axillary buds around terminal bud = the basis of the future whorl

remains of simple needles on the 1st year increment, double needles on the 2nd year increment

cotyledon nodus with developed branches (not a true whorl)

Pinus nigra 2+0 does not produce whorl (but may have branches in cotyledon nodus!)

Differentiation between *Pinus sylvestris* and *Pinus nigra* by buds

Pinus sylvestris

Pinus nigra

terminal buds of two-years-old plants

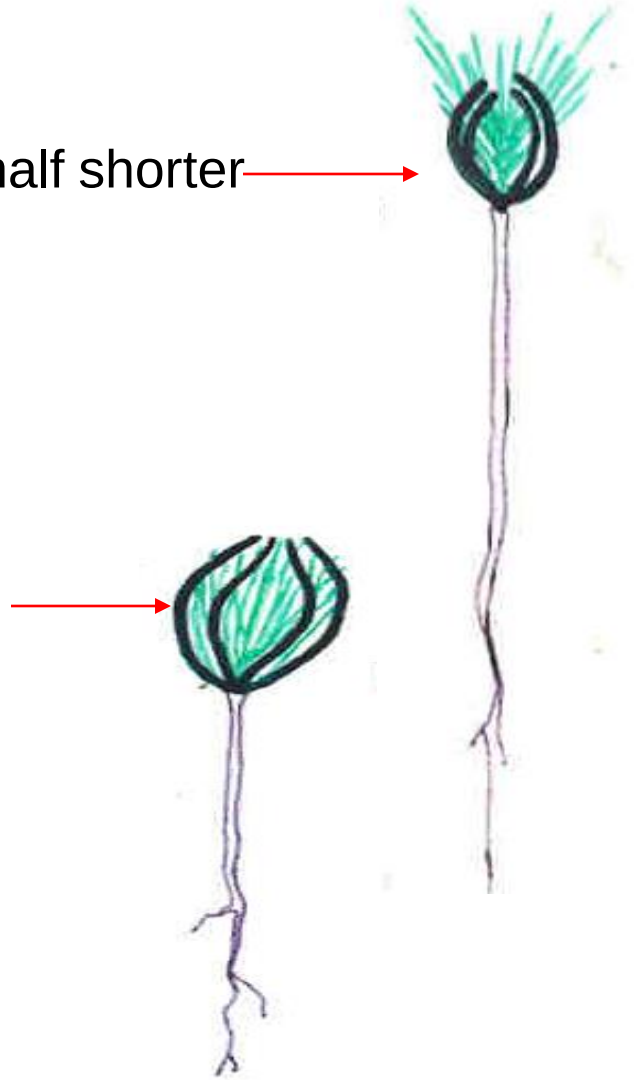
Differentiation between *Pinus sylvestris* and *Pinus nigra* by needles

Pinus sylvestris – cotyledon needle about one-half shorter than primary needles

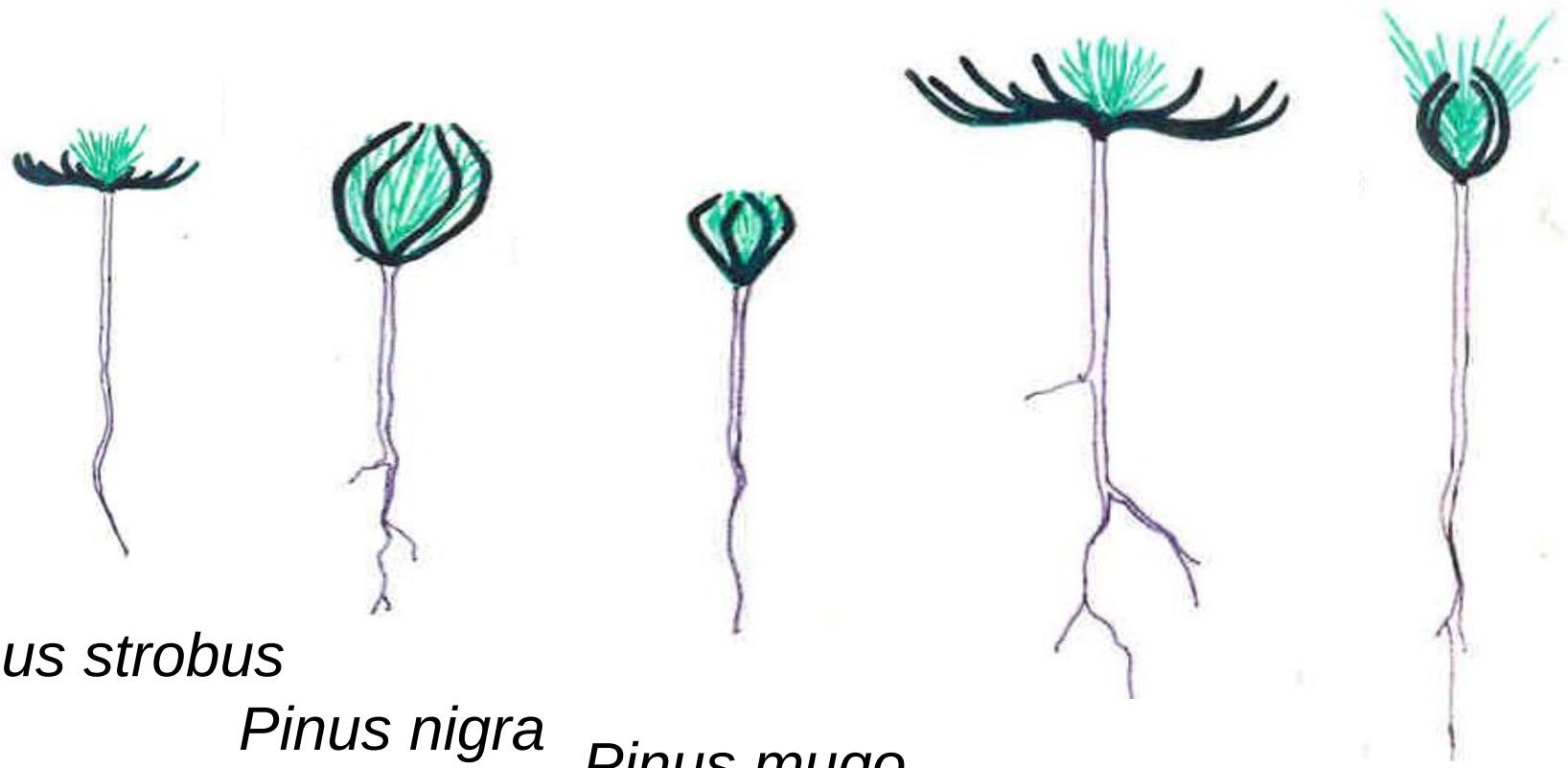
- cotyledon needles are bent and dried up at the end of the 1st vegetation period

Pinus nigra – cotyledon and primary needles of equal length

- cotyledon needles enclose primary needles and last for more than a year



Pine differentiation



Pinus strobus

Pinus nigra

Pinus mugo

Pinus cembra

Pinus sylvestris

European larch (*Larix decidua*) 1+0

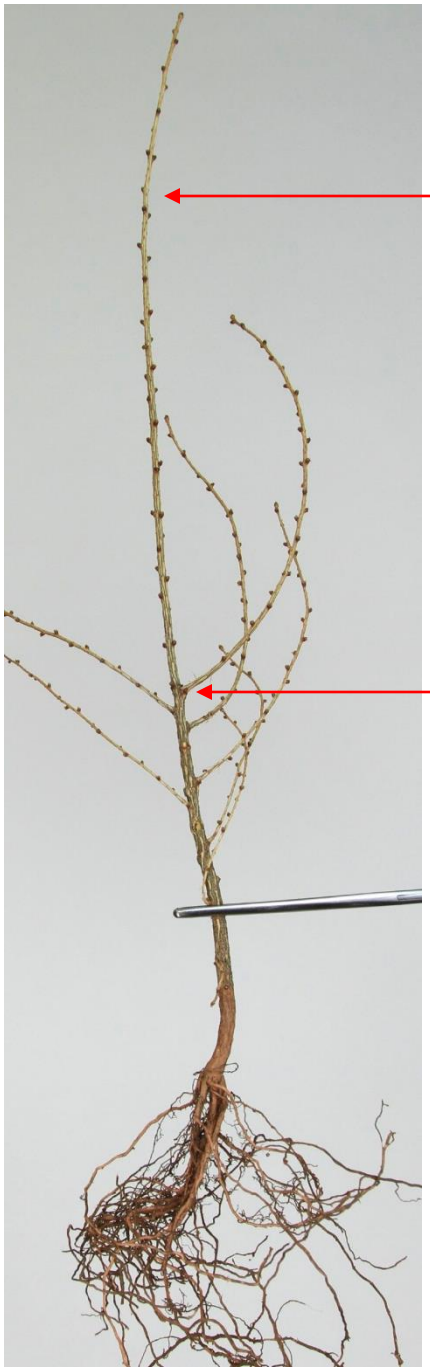
1st year

simple needles without brachyblasts, denser under the terminal, usually no shedding in autumn

simple needles in the vegetative period, spherical buds in the needle axilla

cotyledon nodus,
syleptic branches occasionally in the lower third

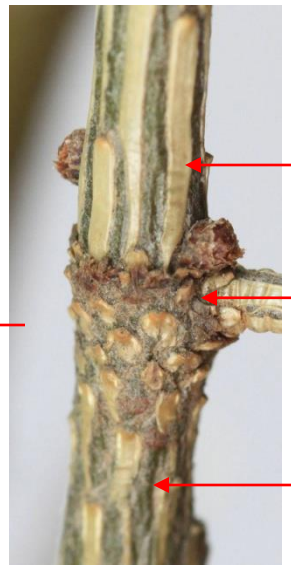
European larch (*Larix decidua*) 2+0



2nd year

1st year

brachyblasts on which needles grow in bundles



change of bark character

scales after bud

needle scars on the 1st year increment, linear bark pads underneath

Larch does not form regular whorls!

Douglas fir 1+0

1st year

denser needles around the pointed, cinnamon-brown terminal bud

pointed buds in the needle axilla

cotyledon nodus with the remains of cotyledon needles

Syleptic branches may appear on the 1st year increment.

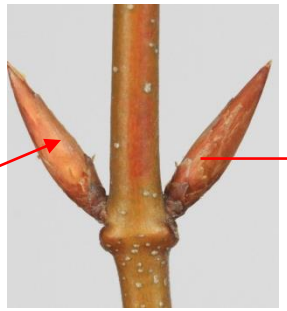
Douglas fir (*Pseudotsuga menziesii*) 2+0

denser needles
scales after the terminal bud
cross ring on the bark
branches forming whorls

spindle bud

European beech (Fagus sylvatica) 1+0

buds in
alternating positions



opposite-growing buds

1st year

cotyledon nodus
cotyledon opposite scars

cotyledons

plantlet

2+0 - syleptic branches and proleptic branches on the 1st year increment

Threshold between years 1 and 2

- ring scars under the terminal bud

Oak (*Quercus*) 1+0

Determining the age of oaks is complicated by the occurrence of a Lamas shoot, which usually occurs every year, sometimes twice!

Crowded side buds under the terminal bud, then a short zone without any leaves and smaller buds in alternate positions.

two cotyledon scars on the cotyledons nodus

Oak (*Quercus*) 2+0

Lamas shoot

2nd year

1st year

crowded lateral buds under the terminal bud

crowded buds

darker and coarser bark

scars under the original terminal bud (rings)

Seedling 2+0 can be branched and often has Lamas shoots.

European ash (*Fraxinus excelsior*)

1+0 - broadly conical, crisscross, scale-covering buds black

2+0 - no branching

Threshold between year 1 and 2 increments

- crowded buds
- rings

Norway maple (*Acer platanoides*) 2+0

2nd year

1st year

threshold between year-on-year increments in the form of rings around the entire trunk circumference

ovoid to elliptical terminal bud

buds pressed against the stem, cinnamon-purple scales, green at the base, keeled

horseshoe-shaped leaf scars, narrow, touching each other

Sycamore maple (*Acer pseudoplatanus*) 2+0

2nd year

1st year

threshold between year-on-year increments in the form of rings around the entire trunk circumference

crisscross buds, opposite-growing, ovoid, pointed, the terminal is larger

green bud scales with a brown edge

buds stand slightly away from the stem, leaf scars do not touch

Lime (*Tilia*) 1+0

1st year

alternate, ovate, obtuse buds

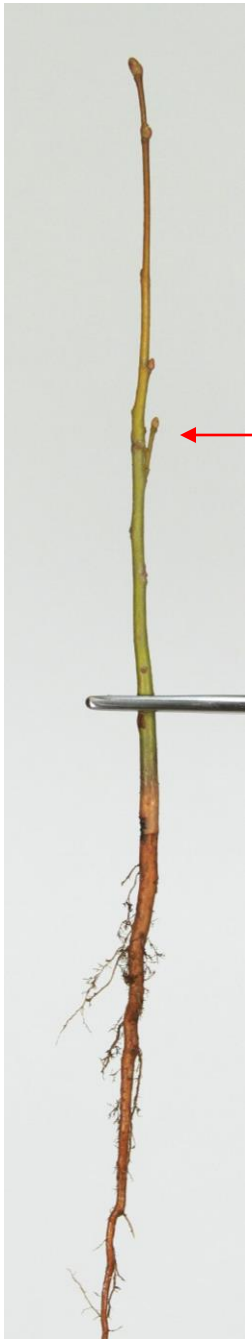
cotyledon nodus

An one-year-old lime tree is mostly non-branched, sometimes one lateral branch grows from the cotyledon nodus.

Lime (*Tilia*) 2+0

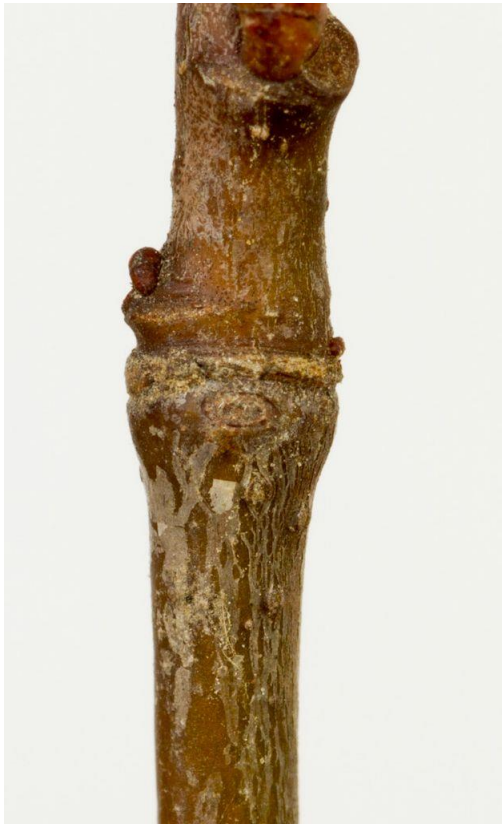
2nd year

1st year



threshold between year-on-year increments in the form of rings around the entire trunk circumference

Lime - threshold between increments



Threshold between year-on-year increments in the form of rings around the entire trunk circumference.

Differentiation between lime species by buds

Small-leaved lime (*T. cordata*)

- ovate, large, obtuse, sitting, yellow-green to red-brown, bare buds
- two lower scales are smaller, only side pressed, hooded
- broad leaf scar

Large-leaved lime (*T. platyphyllos*)

- buds are large, ovoid, obtuse or slightly pointed
- outer scales are smaller than in *Tilia cordata*, brown to reddish-brown
- narrow leaf scar

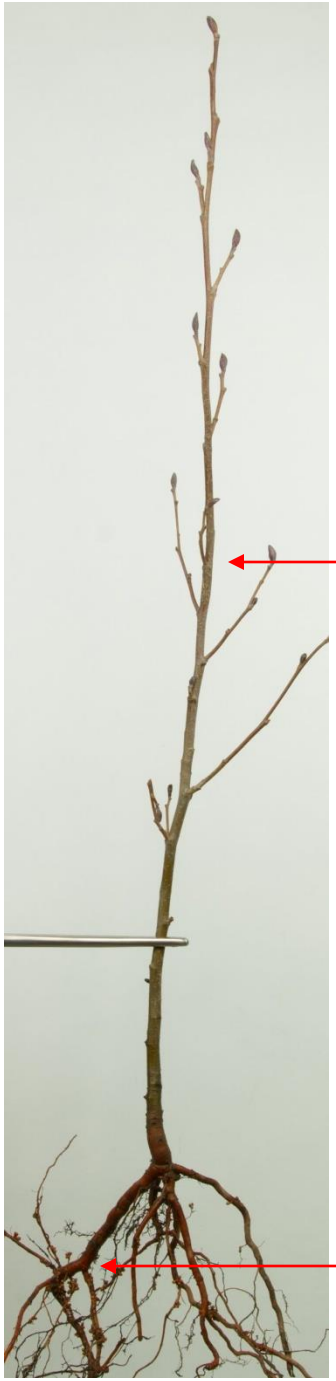
Birch (*Betula*) 2+0

threshold between year-on-year increments in the form of rings around the entire trunk circumference

buds are alternating, ovoid-conical, pointed, green-brown to red-brown

Birch 2+0 branches out, has opposite-growing branches.

Black alder (*Alnus glutinosa*) 2+0



spirally standing stem buds

shoots covered with lenticelas

threshold between year-on-year increments in the form of rings around the entire trunk circumference

tuberous bacteria on the roots

Alder differentiation

A. glutinosa

- buds are oval, distinctly caulescent, glabrous, brown to brown-purple, bluish-frosted, sticky
- 2 bud scales, long and caulescent

A. incana

- buds on short brachyblasts, caulescent, slender, hairy, spirally standing, not sticky

A. viridis

- sitting buds, without any stalks, pointed, brown speckled, sticky
- 3 visible scales

European mountain ash (*Sorbus aucuparia*) 2+0

2nd year

1st year

threshold between year-on-year increments in the form of rings around the entire trunk circumference

buds long and conical, black-violet with silky hairs

Common hornbeam (*Carpinus betulus*)

1+0 - rounder buds

- spiral scales, slightly protruding, green-brown or light-brown

2+0 buds grow alternately in double-rows, have a long ovate-pointed shape