Engelsk

Planting

SKOGKURS
Forestry Extension Institute

This booklet is designed for use in courses for foreign workers. The booklet is intended as training documentation and knowledge base for courses organized by the Activity in Forestry.

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Planting

To ensure a satisfactory regeneration is of great economic significance. This mainly means to bring up new forest with a satisfactory density of plants without too long waiting time (regeneration period). This must happen within sound economic limits. Through some «help measures» we can increase the possibilities for a quick and successful regeneration where conditions otherwise can be problematic.

Why planting?

- Through planting we can select appropriate tree species.
- We can use specially bred plant material or fastgrowing provenances.
- Planting is a secure regeneration method.
- Planting secures quick establish-ment and shorter rotation period (lifespan).
- Planting gives a regular stand density with good quality and high production.
- The need for density regulation in young forest tending (or cleaning) will be less.

Transportation

The plants should always be transported in a closed car or closed trailer. Too high temperature during transport must be prevented.

Already at 40 °C, plants can be damaged, and at 50-60 °C they die. Plants that are transported without cover, can be fatally injured due to dehydration by wind. Driving in 80 km/h corresponds to small storm. Such transport must be avoided, even over short distances.

Number of plants

The number of plants per decare affects volume production and quality. If 200 plants are planted per dekar (1000 m^2), and all the plants grow up, the production potential of marketable dimensions is utilized.

Unfortunately, the mortality after planting is often 20%. If only 160 plants per decare survive on good site quality, volume production will be reduced, and the quality will

diminish due to broad growth rings and thick branches. The site quality is the factor that most strongly affects annual growth ring width and branch thickness.

An increase in plant density towards 500 per decare or more will not pay off when the goal is to reduce branch thickness and annual growth ring width on the best site qualities. The largest trees will still get thick branches and wide tree rings because of natural thinning. Therefore, a maximum of 300 plants per decare is proposed even on the best site qualities. However, quality-oriented young forest tending and thinning is recommended. "Wolf trees" and trees of poor quality will be cut, and the stand quality directly and effectively improved.

Follow the instructions for preferable number of plants on the various site qualities.

Planting instructions

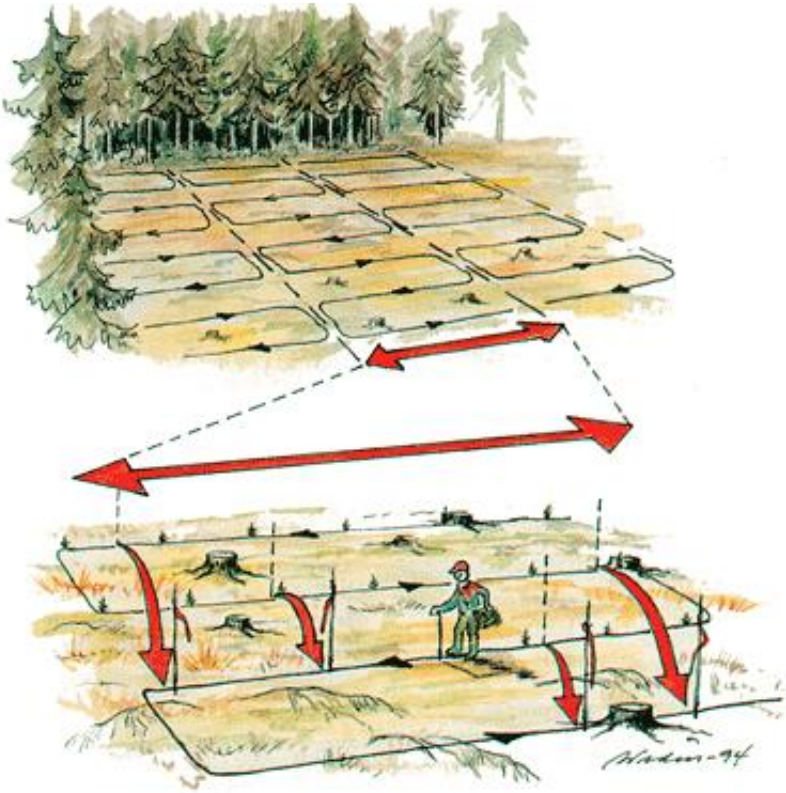
Good planning is the basis of efficiency, site customization and good labor quality. Unfortunately, too often planning of planting is not emphasized. In order to plant efficiently with good site adaption and quality of work, it is important to choose tools that are adapted to the planter, the plants and the conditions in the planting field. Moreover, it is important that the planters are taught the correct technique when using the various tools. In this booklet the technique is not described in more detail, because this must be taught by an instructor in the field.

Parcel division

- Divide the area that shall be planted into parcels.
- Make plant depots in each parcel, so you can fill up with plants as you work your way around, without having to walk unnecessary distances.
- In sloping terrain, it is advantageous to plant across the slope orientation. By dividing into parcels, we also take into account the obstacles that can cause unwanted stops and delays in the work.

Directional sticks

The planters should have at least 3 directional sticks with a colour that clearly distinguish them from logging waste and vegetation in the field. To use directional stick means that the planters always have a direction indication. Directional sticks contribute to increased efficiency, correct number of plants and control of planting costs. Without sticks much time will be lost searching for the previous plant row. The plants should not necessarily be placed in the line between the sticks, but placed on good planting sites within approx. 1 meter on each side of the direction between the sticks.



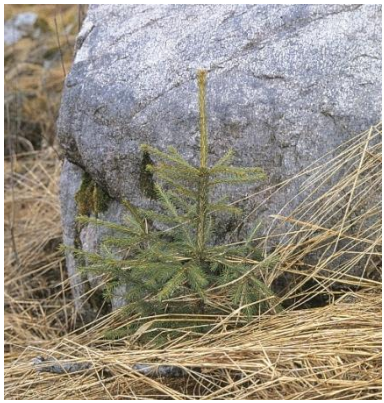
Top: Example of parcel division. Bottom: Example of the use of directional sticks.

Planting site

Within the row good planting sites should be utilized, rather than keeping proper distance. Good planting patches are close to:

- Stumps
- Stones
- Strimmed-off butts

These planting places provide protection, warmth and nourishment. In sloping terrain the plant should be planted below the stump to protect it against snow sink. Where the patch is flat, dry and sun exposed, put the plant preferably on the north side.



Avoid putting plants in dense grass mat. Close to stumps we usually find good planting patches.

Main points

- Select planting equipment that fits the actual field
- Keep direction by using the directional sticks
- Find a good planting patch
- Remove the humus layer. The plug should reach down into the mineral soil
- Plant high, but deep. The plant should be placed high on the pile, the reverse turf or a natural mound in the terrain, but the roots must be so deep that the water supply is good
- Look “slightly ahead" with a focus on the next planting patches
- Prioritize good planting patches higher than constant distance
- Take advantage of the pre-grown plants that already exists on the field.

Soil scarification

Soil scarification is a treatment of the soil surface to create good germination or planting patches. This can be done in different ways and with different equipment. We can use small tools to be carried around (brush saw with soil scarification equipment), tools adapted to agricultural tractors, an excavator or a soil scarifier mounted on a forest logging machine.

Purpose:

- Easier and faster planting for greater survival and faster growth during the first years.
- Several good planting patches and even distribution of plants in the field
- Better germination and establishing conditions for natural regeneration and sowing

Because it gives:

- Higher soil temperature
- Reduced risk of frost damage
- Improved water management
- Better access to nutrients when the mineral soil and humus is mixed
- Seedlings and plants get less competition from other vegetation
- Reduced death risk because of vegetation lying over and suppressing the seedlings
- Better soil structure

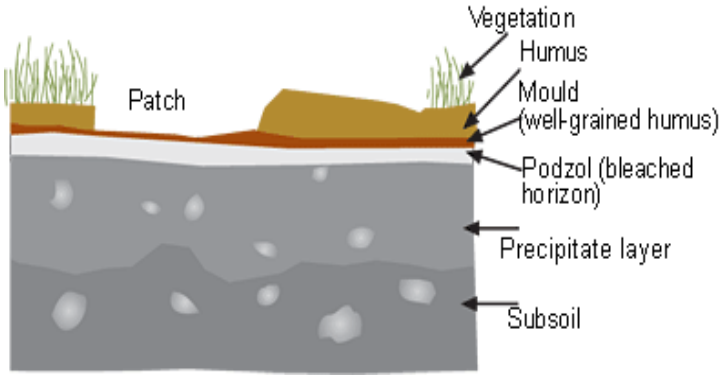
Methods

Depending on the equipment, soil scarification is carried out as spot scarification, or by making furrows/stripes (furrow scarification). The furrows can have various lengths, but should not be continuous over a long stretch. The furrows can, like the spots, be deep or shallow, and it can make small mounds along the edges. By furrow scarification we can for the same cost prepare a larger area with exposed soil. Biologically there are only small differences between spot- and furrow soil scarification.

Effects of soil scarification

Growth increases as soil temperature rises after soil scarification. Nutrition is released faster when mineral soil and humus are mixed. In soil scarification spots, daytime sun radiation will provide the upper layer of earth with a higher temperature than untreated soil. At night when the outgoing radiation is high, the air temperature over the patch will be higher than over the untreated soil. In quiet, cool summer nights the lowest temperature is at the soil surface.

If planted on top of a mound, the risk that the plants die because of night frost is further reduced. How much the temperature will increase depends on the heat capacity in the soil and the temperature the day before. Soil scarification mounds can raise the temperature approx. 3 ° C.

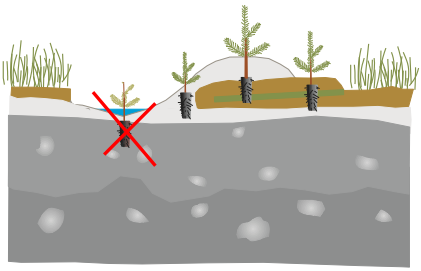


Cross section of a soil scarification patch

Turned-over-turf

By turned-over turf (or turned-over humus as it really should be called) the humus layer is “folded” up, often with a small mound of mineral soil on top. It is an advantage to plant in turned-over turf as long as the plant is set so deep that it reaches down to the good moisture conditions between the turned-over-turf and soil surface.

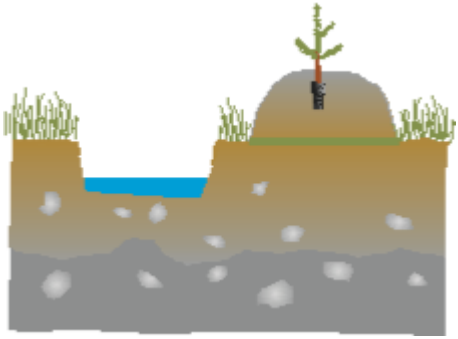
Notice that the plants should NOT be set in the pit where the humus and parts of mineral soil is removed. Water is often accumulated here, and the plant drowns. Turned-over turf should have a mound of mineral soil on top to get maximum effect of increased heat storage.



Turned-over-turf

Mounds

Mineral soil is dug out and laid in mounds on the so il surface (often mixed with humus). These mounds give good sites for planting because the seedlings then avoid the danger of drowning, for example in great-fern forest. The frost risk is also reduced on the mounds.

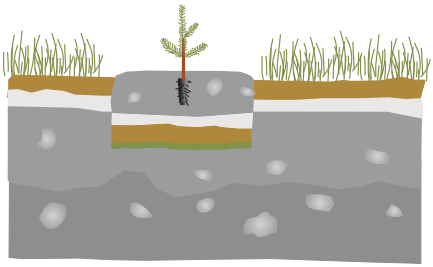


Making mounds

Inverse soil scarification

Inverse soil scarification means that humus and mineral soil is dug out and replaced in the pit with the humus layer turned downwards. The result is that there will be no elevation of the soil surface, and only a small area is affected by the digging. It provides increased access to nutrition, and the plant patch will be less compact.

The plant patch is not raised from the surrounding soil surface and thus the frost risk is not reduced. Except this, the same soil properties are achieved as with the other types of soil scarification where mineral soil is laid bare.



Inverse soil scarification

Planting- implementation

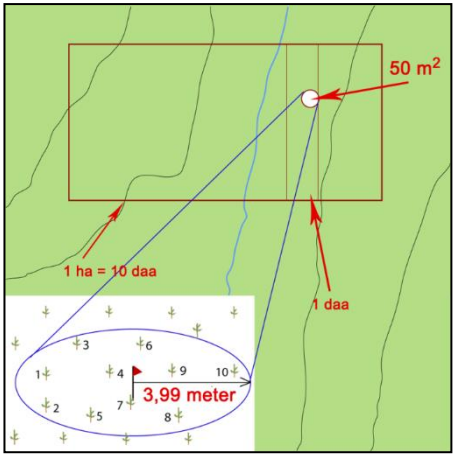
- Remove the vegetation so that only well transformed humus is left on the top of the mineral soil.
- The roots should be placed deep into the planting pit, and they should not be compressed into a too narrow pit. The roots should be situated in the mineral or mould soil and the top of the root should be at least 3 cm below the soil surface.
- Bare root plants should be planted at least 3 cm deeper than in the nursery. It is better that a part of the needles are inserted into the ground, than that any part of the root system is in contact with air (too deep is better than too shallow).

- Plant high (in the terrain), but deep (in the soil)!
- On scarified fields the best plant patches are in mineral soil on turned-over turf. The next best is on turned-over turf. The plant should be placed in the center of the turf and so deep that the root plug reaches down into the original surface. The transition between the mineral soil and the turf is also a good planting patch. Pure mineral soil is normally a poor planting patch. On fields where a mound of mineral soil is beneficial, the mound is a good planting patch. The figures under the section soil scarification show where the best planting patches are.
- In scarified fields the spacing will vary depending on how the scarification is done. This applies particularly to furrow soil scarification where the distance between the furrows varies. The spacing (of the plants) has to be correct within the whole area.
- Check the spacing often.

Internal control

At the internal control use a pole or a string that is 3.99 m long, the radius of a circle that covers an area of 50 m^2. Count the plants within the 50 m^2 circle. This figure multiplied by 20 gives the number of plants per decare (1000 m^2). Multiplied by 200 gives the number of plants per hectare (10 000 m^2).

Examine if the number of plants is in compliance with the recommendations for that location. Internal control should be done immediately after the planting starts. Make checks at regular intervals on each field. Check also if the choice of planting patches is good and if the plants are set deep enough.



The number of plants inside the 3,99 m circle multiplied with 20 gives number of plants per decare (1000 m^2).

Tools and equipment

To ensure good quality of the work, it is important that the planting methods and the tools are adapted to vegetation type, soil type, stone content and terrain conditions. Choice of tools is also dependent on whether the field is scarified or not.

When plug plants are used and soil scarification is performed, the planting tube is the best tool - both considering the working technique and the quality of the planting. Hole Pipe (Dibble), planting tube , planting mattock and planting auger should all be used in different ways and with different working positions.

Plant belt with shoulder straps.

Work performed incorrectly is tiring and it can lead to poor quality of the planting.

Equipment for carrying plants in the field

When planting, the plants are carried in a planting belt that hangs around the waist. The plants are placed in large pockets. There are many types of plant belts, but they should have shoulder straps and opportunities for adaptation to slim and small people. By planting repackaged plants, delivered in bundles and chip boxes, the planting belt is the best option.

Plant boxes can be used, but they often roll over and the plants dry easily. If plants are delivered in trays, you can use a carry handle and carry the whole tray out in the field. Use of carrying belt is still so much more efficient that it pays to move the plants from the tray to the belt. Bare-root plants can be carried in a plant box, or in damp jute sack. If a bin is used, make sure that the roots are kept moist and not exposed to sunlight.

Gloves

Planters should always wear gloves to prevent sores, wounds and also allergic reactions because of pesticides that are sprayed on the plants in order to prevent snout beetle damage.

Hole pipe

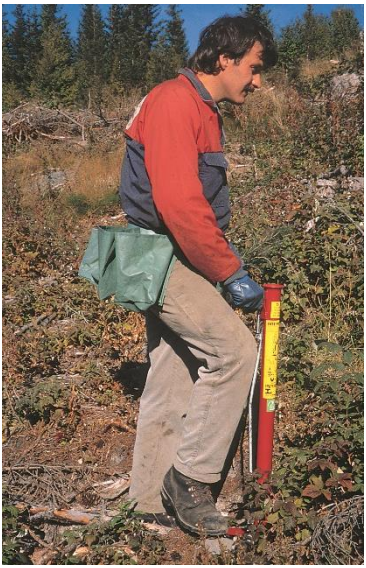
Planting with hole pipe og planting belt.

Hole Pipe in combination with planting belt is the most used equipment in recent years. This tool is suitable only for plug plants. It is not suitable when there is much need to remove vegetation, or on dense soils. On dense soils the pipe hole will make a pit with hard and impregnable walls, so that it will be difficult for plant roots to grow through the pit walls. The hole pipe works well only if it is maintained with filing to keep it sharp, and should never be used when it is filled with compact soil. When the hole pipe is used, the humus layer must be removed so that the plants are placed well down in mineral soil or well transformed humus. The plant must not be pressed into a planting pit that is too shallow. The root lump shall slip easily into the hole. The top of the root lump should be at least 2-3 cm below the soil surface. There are hole pipes for both the M60 and M95 plug plants.

Planting tube

The planting tube is well suited in combination with the planting belt. This combination of tools is effective and ergonomically favourable.

The planting tube should only be used after soil scarification, and on brown-soil after spraying. Planting tubes are made in different varieties and sizes. Proper working technique and good maintenance of the planting tube is very important.



Planting with planting tube on scarified field.

Important environmental considerations and the Norwegian PEFC forest standard

The Norwegian PEFC Forest Standard and its certification system, aims to contribute to a sustainable management of the forest resources. The standard contains certain points we must relate to when working with rejuvenation measures such as ground preparation, planting, fertilising and use of pesticides. In the textbox you can see the main points you must know about.

Garbage /waste

All forms of waste should be brought out of the forest and thrown in the waste container. Empty oil and fuel cans are special garbage (or waste) and should not be placed in ordinary garbage, but collected and delivered to gas stations or others who receive this.

Any garbage should be brought out of the forest and recirculated.

Remember also personal garbage such as milk cartons, bottles, containers (empty smoke packs, candy wrappers etc.) and newspapers. Check if there is something left in the forest when you leave the area.

Main points

- Do not plant on/inside of cultural monuments and their safeguarding zone. This zone is usually five meters from the outer edge of the cultural monument.
- Do not plant inside of buffer zones to waters, waterways, streams, wetlands and marches. If you are unsure about where the buffer zone limits are, contact the forest owner or certificate holder.
- All waste and garbage shall be disposed of in garbage bins or containers. This also includes plant boxes and the plastic wrapped around the plants.
- Do not plant inside of key biotopes, if this is not approved by the certificate holder.
- Do not plant close to trails and tracks.

Planting distance

The planting distance when you know the planting density per decare.
(Quadratic)

Planting density per decare	Planting distance in meter
250	*2,0*
230	*2,1*
210	*2,2*
190	*2,3*
170	*2,4*
160	*2,5*
150	*2,6*
140	*2,7*
120	*2,9*

Planting distance when soil scarification

Planting density per decare	**Row space** (soil scarification)					
	1,8	**2,0**	**2,2**	**2,4**	**2,6**	**2,8**
	Planting distance in meter along the row					
150	*3,7*	*3,3*	*3,0*	*2,8*	*2,6*	*2,4*
180	*3,1*	*2,8*	*2,5*	*2,3*	*2,1*	*2,0*
200	*2,8*	*2,5*	*2,3*	*2,1*	*1,9*	*1,8*
220	*2,5*	*2,3*	*2,1*	*1,9*	*1,7*	*1,6*
240	*2,3*	*2,1*	*1,9*	*1,7*	*1,6*	*1,5*
260	*2,1*	*1,9*	*1,7*	*1,6*	*1,5*	*1,4*

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