



Straw mulch prevents the germination of weeds only for the first year after planting

Mulching for healthy tree seedlings

www.agforward.eu

Successful tree establishment depends on minimising competition from other vegetation for water and nutrients.

Mulching is one of the most beneficial practices a farmer can use to establish healthy tree plants.



The closer the grass is to the tree seedling, the slower the tree grows



Using sawdust for mulch can be an economical choice



Gravel mulch becomes a permanent element in landscaping

Weeding requirement for young trees

Trees and grass compete for water and nutrients. The majority of feeder roots of both trees and grass occur in the top 30 cm (12 in), and the high root density of grass species means that they are particularly competitive until the tree is fully established [1, 2].

- The closer the grass is to the tree seedling, the slower the tree grows [3].
- Controlling competitive herbaceous species within 1-2 m around newly established tree seedlings, and then for 2-3 years after planting, enhance tree survival and growth.

What is mulch?

Mulching consists of laying on the soil surface an organic or inorganic material (called mulch) which forms a barrier to weed growth. Some mulches can be used to enhance soil conditions and improve tree growth.

Organic mulches are made of natural substances such as leaves, pine needles, straw, hay, tree bark, wood chips, sawdust, and compost. They decompose over time, more or less rapidly, according to their lignin content. They improve soil structure and nutrient availability.

Inorganic mulches, such as crushed stone, gravel, pebbles, plastic films and landscape fabrics (geotextiles), offer the advantage of low maintenance. Typically, however, they do not decompose and do not improve soil properties.

Available mulches on farms

Plastic films

Black polyethylene-based (PE) plastic film is commonly used because it is relatively cheap, and is readily available. It reduces weed growth, conserves soil moisture and increases soil temperature.



Disposing of used plastic films, which cause pollution, has led to development of biodegradable mulches

Despite these benefits, PE films can create a considerable waste problem. If not properly collected, treated and recycled, plastic materials can pollute rural areas and release harmful substances into the environment. Dumping, open-air burning, burying, stockpiling and abandonment are prohibited.

The non-polluting, but time consuming, solution is to use hand labour to collect the film. Because PE mulch films become dirty during use, they cannot be recycled. Their removal and disposal is therefore an economic and environmental constraint and, consequently, encourages the illegal disposal methods [5].

Biodegradable plastic mulch films

Developed successfully over the last few years for the organic sector, biodegradable films can function in a similar way as conventional PE, but without the environmental drawbacks. The main advantage is that, after a period of time, they degrade into the soil [6] where microflora transforms them into carbon dioxide, water, and non-toxic biomass.

Bioplastic sheet is typically accredited (*) with the «OK Biodegradable Soil» conformity mark by Vinçotte (an international certification organisation). This verifies that the film will completely biodegrade without adversely affecting the environment.

A biodegradable plastic mulch film of 0.08 to 0.10 mm thickness can save on maintenance work for up to 18-24 months, depending on the climate and soil conditions.



This logo indicates the film can be left to break down in situ after used
(* The finished product and all its raw materials)

Other

Traditional weeding techniques

Chemical and manual weeding can be considered but they have drawbacks that limit their use.

Chemical weeding allows localised intervention before competition starts. However, this approach requires knowledge of the weeds and of the activity, selectivity, and conditions of herbicide use. Herbicides often give the best weed control relative to costs, but some people are wary of their use [7] [8] [9]. Repeated application is usually required, and appropriate operator training is also needed.

Manual weeding consists of uprooting grasses and other weeds mechanically (typically with a hoe). As with chemical weeding, the process may need to be repeated. Operators need to be skilled to avoid damage to the seedlings, and unless limited to very small areas, it is likely to be costly and laborious.



Pre-cut 1 m² bioplastic sheet squares are flexible, lightweight and resistant for easy placing as required



Mechanizing the mulch film laying saves working time

Wood chips

Wood chips represent one of the best biodegradable mulch choices for trees and shrubs. Raw materials can come from sources such as hedgerow and farm woodland biomass, or even recycled wood pallets. A wood chipper can reduce branches and trunks to small loose pieces. The materials vary in their size (a typical thickness: 3 mm; width: 15 mm, length: 35 mm).

Wood chips are slow decomposers (if they do not contain leaves), as their tissues are rich in lignin and tannins. If possible, aged material should be used so that the chips decay slowly thereby releasing nutrients over a long period; at the same time the chips can absorb significant amount of rainwater that is slowly released to the soil.

Straw

Straw is one of the most economical mulches. Unweathered, unchopped wheat, oat or barley straw is best. It can be obtained loose (40-50 kg/m³), or in round (50-70 kg/m³) or compressed rectangular bales (140-170 kg/m³). Straw decomposes more rapidly than wood chips, so an annual replenishment will be needed to control weeds. For optimal protection, wheat straw from compressed rectangular bales is preferred (higher density and lignin rate) because it does not decompose as rapidly as loose oat straw.

Comparative benefits of organic mulches

When applied correctly, coarse textured mulches have many beneficial effects on saplings and soil [10] :

- Moderate the temperature of the root zone: by providing insulation, mulches keep the soil warmer during winter and cooler during summer. This helps protect fine tree roots from drying and temperature extremes.
- Prevent loss of water from soil surface by evaporation: by acting as a protective blanket over the ground area, mulch can increase water availability and decrease moisture fluctuation in the root zone.
- Help control weeds: mulch prevents light penetra-



Wood chips mulch is one of the best performers in term of weed control, soil moisture retention and temperature moderation



Straw mulch prevents the germination of weeds just the first year after planting

tion to the soil and this can reduce the germination of weeds. Weeds that do germinate are smothered, and the lack of weed growth minimises the loss of soil water through transpiration.

- Prevent soil surface splashing and crusting: mulch restrains raindrop erosion, allowing rainwater to penetrate into the soil.
- Improve soil structure: as the mulch decays and moves down into the soil, it improves the fertility of the topsoil.
- Enhance tree establishment: roots grow whenever and wherever environment conditions are favourable. Conservation of soil moisture and moderation of soil temperature under the mulched zone maximize initial tree root and shoot growth.

How to apply organic mulch ?

- Begin mulch application just after planting, as weeds are best controlled when they are small. Bare soil should be mulched as soon as practical, especially in the spring and autumn when weed seed germination is at its peak.
- Apply organic mulch to the desired depth: weed control and tree performance are directly linked to organic mulch depth. Shallow mulch layers [5-7 cm (2-3 in) or less] can promote weed growth. A layer of 10-15 cm (4-6 in) thickness is recommended. An excessive depth [>15 cm (6 in)] can decrease water penetration in soil and increase plant stress.
- Mulch is not typically recommended on heavy soils, where drainage is a problem: it may prevent the adequate drying of the soil (especially during spring). This may create anaerobic (without air) conditions which promotes root rot diseases.
- Keep mulch away from tree stems: placing organic mulch up against a tree stem creates a moist, low oxygen environment which can promote fungal or insect damage, such as collar rot. Aim for a distance of at least 5-10 cm (2-4 in).
- Replace mulch as needed to maintain the desired depth: the replacement rate will depend on decomposition rate.



Begin mesh tree guard positioning and mulch application just after planting



A wood chips layer of 10-15 cm (4-6 inch) thickness is recommended



Take care not to pile the mulch around the trunk of trees, as this can encourage rot

List of references

- [1] de Kroon H, Visser EJW (Ed) (2003). *Root Ecology*, vol. 168. Berlin, Heidelberg: Springer.
- [2] Nambiar ES, Sands R (1993). Competition for water and nutrients in forests. *Can. J. For. Res.* 23(10): 1955-1968.
- [3] Davies RJ (1988). Sheet mulching as an aid to broadleaved tree establishment II. Comparison of various sizes of black polythene mulch and herbicide treated spot. *Forestry* 61(2): 107-124.
- [4] Davies RJ (1987). Trees and weeds: weed control for successful tree establishment. London: Forestry Commission.
- [5] Kasirajan S, Ngouajio M (2012). Polyethylene and biodegradable mulches for agricultural applications: a review. *Agron. Sustain. Dev.* 32(2): 501-529.
- [6] Scaringelli MA, Giannoccaro G, Prosperi M, Lopolito A (2016). Adoption of biodegradable mulching films in agriculture: is there a negative prejudice towards materials derived from organic wastes? *Ital. J. Agron.* 11(2): 92-99.
- [7] Wagner RG, Flynn J, Gregory R (1998). Public perceptions of risk and acceptability of forest vegetation management alternatives in Ontario. *For. Chron.* 74(5): 720-727.
- [8] Guynn DC, Guynn ST, Wigley TB, Miller DA (2004). Herbicides and forest biodiversity - what do we know and where do we go from here? *Wildl. Soc. Bull.* 32(4): 1085-1092.
- [9] Fortier J, Messier C (2006). Are chemical or mechanical treatments more sustainable for forest vegetation management in the context of the TRIAD? *For. Chron.* 82(6): 806-818.
- [10] Chalker-Scott L (2007). Impact of mulches on landscape plants and the environment-a review. *J. Environ. Hortic.* 25(4): 239.

Philippe VAN LERBERGHE

The Institute for Forestry Development (IDF)

philippe.vanlerberghe@cnpf.fr

www.agforward.eu

Special thanks go to Kevin Waldie (Organic Research Centre) for his work as technical editor and translator

23 October 2017

This leaflet is produced as part of the AGFORWARD project. Whilst the author has worked on the best information available, neither the author nor the EU shall in any event be liable for any loss, damage or injury incurred directly or indirectly in relation to the report.