

Using Mulches In Saskatoon Orchards

Types Of Mulches

A mulch is any artificial modification of soil surface using organic or inorganic materials. A wide variety of such materials may be used for mulching. These include dried grass, sawdust (spruce or poplar in particular), chopped plant refuse (wood chips, bark, straw), flax shives, waste hay, manures, gravel, polyethylene sheets, and fabric sheets. The most useful materials absorb little moisture, do not pack down or shed water, and allow rainfall to move rapidly downwards.

Effects Of Mulches On The Soil Environment

Conservation Of Soil Moisture

Mulches will help retain soil moisture because they are a barrier to evaporation. Thin layers of organic mulch reduce soil moisture loss by 10%, while thick layers of organic mulch, or plastics, reduce soil moisture loss by 50%. Soil moisture loss is also reduced by the inhibition of weed growth.

Modification Of Soil Temperatures

Mulches will reduce the extreme fluctuations between daytime and nighttime soil temperatures. Mulches may either increase or decrease average soil temperatures, relative to bare soil. Black plastic mulches increase soil temperatures by 2 to 4°C, and clear plastic mulches increase soil temperatures by 6 to 10°C. On the other hand, white or reflective mulches decrease soil temperatures by 4 to 6°C, and organic mulches usually reduce soil temperatures by 2 to 3°C. Organic mulches also act as insulation, preventing the soil from warming up as quickly as bare soil in the spring, thus delaying root growth, but at the same time slowing developmental events such as flowering.

Weed Control

The use of mulches will help suppress weeds, between plants within the row. Most mulches reduce weed germination and growth, therefore directly controlling weeds. Mulches also help indirectly in weed control by allowing for an increased efficiency of irrigation water and use of fertilizer.

Soil Composition And Structure

Mulches will help to prevent soil erosion, will decrease nutrient leaching, will prevent soil crusting and will enhance soil aeration. Organic mulches add organic matter to the soil, but may up soil nitrogen and therefore can negatively affect plant growth.

Crop Responses To Mulches

Mulching may result in more vigorous plant growth (including root growth), earlier canopy formation, earlier heavy yields, improved stem caliper, the development of uniformly distributed, wide-angled branches, the promotion of shallower, more fibrous root systems, and the promotion of suckering.

The use of mulches may also result in increased yields because of more favourable soil moisture levels and temperature, improved crop quality because of more uniform crop development, larger fruit because of less moisture stress, and earlier maturity because of an increased rate of crop development.

Disadvantages Of Mulches

The main disadvantages of mulches include the initial expense of the materials, and the costs of application, removal and disposal. Mechanical application of plastic mulches is usually necessary, as is the ability to fertigate (apply fertilizer through the irrigation system).

Organic mulches can be difficult to obtain in large quantities and their application is laborious. Organic mulches create a damper, cooler soil environment and therefore result in reduced plant growth. The use of organic mulches on heavier soils appears to be correlated with heavier infestations of the woolly elm aphid. The introduction of weed seeds is another possible side effect of the use of organic mulches.

Which Type Of Mulch Is Best?

Black plastic mulches appear to be the best compromise in terms of cost, ease of management, effects on soil environment and crop response. Black plastic mulches on average increase soil temperatures while reducing weed growth. In comparison to organic mulches, black plastic mulches result in greater fruit plant growth and earlier fruiting. Woven plastic mulches are permeable and stronger than a simple plastic mulch, but are substantially more expensive. UV-stabilized, polypropylene or polyethylene mulches are recommended. These mulches have a lifespan of 5 to 10 years and come in 460 m long rolls, 1.25 m wide.

Application Of Mulches

Organic mulches should be from 10 to 30 cm in depth. A maximum of 30 cm of mulch should be applied (greater thicknesses may not be economical). However, wood chip mulches greater than a depth of 10 cm may reduce root development. Organic mulches should be kept 20-30 cm from the

plant stems to discourage mice. The width of the mulch should be at least 60 cm on both sides of the plants. Organic mulches are probably best removed in fall to prevent rodent problems during the winter.

The orchard site must be well-prepared prior to the application of plastic mulch. Black plastic mulches must be applied in conjunction with a trickle irrigation system and fertilization must be done via the irrigation system (fertigation). Plastic mulch must be applied mechanically. Commercial mulch applicators cost between \$1,500 and \$2,000. Planting sites must be well prepared by pre-working the soil to a depth of 15 to 20 cm prior to planting. The transplants are placed in the ground first and then pulled through an X-shaped slit in the plastic immediately after the mulch is laid. A 15 cm wire staple will need to be placed near the plant to ensure that the plastic stays in place. Plastic mulches either may have to be removed, or slit open lengthwise after the first 3 or 4 years to allow for suckering.

Alternative Mulches

The use of sand, gravel and pebble mulches may seem peculiar, but in fact, such mulches are well-suited to perennial crops such as fruit trees. In the process of cooling during the night, moisture evaporating from the soil condenses on the lower surfaces of the mulch, instead of being lost to the air. Such mulches also allow the re-radiation of the soil's heat at night, increasing the air temperature around the plants, thus providing some frost protection. However, some experimentation is advised if using sand, gravel or pebble mulches. On some

soils, the mixture of these mulches with the soil and water may result in the production of a concrete-like surface.

Another variation of mulching is the use of vertical mulches. These provide water a pathway to the root zone and reduce the area of soil surface that is wet. Narrow trenches (15 cm wide, 30 cm deep) running the length of the orchard rows can be filled with stalks of millet, corn, sunflower, Jerusalem artichoke, or amaranth. The air spaces created by these stalks conduct water quickly down to the root zone where it is less likely to evaporate than when it is spread on the soil surface and infiltrates slowly. Vertical mulches are suitable for use only on a small scale such as in conjunction with a shelterbelt.

Grass Covers For Saskatoon Orchards

A permanent grass cover may be planted in the alleys of an orchard as an alternative to cultivation and may help reduce the use of herbicides. Grass covers are aesthetically pleasing, prevent disruption of the root systems of the fruit plants, reduce soil compaction, and generally help reduce orchard maintenance. A grass cover will increase the absorption of rainfall and at the same time minimize runoff, thus may be important for the control of erosion from wind and water. Grass covers create cooler soil temperatures thus decreasing soil moisture loss. A grass cover will help control some weeds, and enables mechanical harvesting even in wet conditions. Grass covers also may help increase winter hardiness because they will compete with

the fruit crop for moisture in early to late-fall.

Grass covers will have to be mowed and may require some irrigation, otherwise they may compete to some extent with the fruit crop, especially on light, sandy soils. Grass covers may also allow increased damage from rodents, especially if they are not mowed sufficiently.

Suitable grasses must not be invasive (weedy, like quack grass), must produce only one seed crop per year, must be hardy and resistant to snow mold, and should form a resilient turf capable of withstanding the use of a mechanical harvester during wet weather. Bunch grasses have a number of desirable characteristics. They are short, relatively drought-tolerant, shade-tolerant, slow-growing, and require little maintenance (2 mowings per season).

Recent trials by the PFRA's Tree Nursery at Indian Head, SK, have evaluated a number of bunch grasses for use as grass covers in orchards. These grasses included Sheep's Fescue (cv Nakiska), Hard Fescue (cv Aurora), Alpine Bluegrass, and Parkland Mix.

Sheep's Fescue is a densely-tufted, low-growing, shade and drought-tolerant, and hardy grass attaining a mature height of 30 to 45 cm if left unmowed. The approximate price is \$7 to \$8.00 per kilogram. Hard Fescue is a low-growing, shade and drought-tolerant grass with fine leaves. The approximate price for seed of this grass is \$5 to \$6.00 per kilogram. Alpine Bluegrass is a low, dense grass with high resistance to traffic. It grows well in

shade and full sun and is somewhat drought-tolerant, but is hard to establish and expensive (approximately \$16 to \$17.00 per kilogram of seed). Parkland Mix is comprised of the following mixture of grasses: Sheep's Fescue (20%), Hard Fescue (25%), Alpine Bluegrass (20%) and Canada Bluegrass (30%). This mixture costs approximately \$9 to \$10.00 per kilogram of seed.

In the trials that the PFRA made, Sheep's Fescue was rated as the best grass cover for orchards. Sheep's Fescue formed a dense, short groundcover that required little if any mowing or irrigation.

Grass covers may be established in fall or early-spring. Row alleys should be tilled and rotovated, and the grass seed broadcast using a Gandy applicator at a rate of 45 kg per hectare. The alleys may then be lightly harrowed. The depth of seeding is important because buried seeds will not germinate. Grass seed should not be spread closer than 45 to 60 cm to the fruit plants. Once the cover is established, additional seeding may be required to fill in any barespots. Grass covers should be kept mowed at a height of 5 to 10 cm. It is not necessary to establish a grass cover until fruit production begins, if intercropping is desired. However, the cover should be well-established prior to mechanical harvesting.

An alternative method to establishing a grass cover is to sow the entire orchard site with a suitable grass prior to transplanting. Once established, an application of Banvel and 2,4-D at recommended rates will destroy most broadleaved weeds. Subsequently, the

grass can be killed in 60 cm wide strips on 6 m centres using glyphosate plus a surfactant. The entire orchard site would then be mowed, and mulch laid on the 60 cm wide strips of killed fescue, prior to transplanting.

Green Manures & Other Cover Crops For Saskatoon Orchards

Most orchards will benefit from some form of cover crop. Cover crops are grown in the alleys between the rows of fruit plants. They may be used prior to orchard establishment to improve soil organic matter levels and to reduce weed populations. They may be established at the same time as the orchard to provide more immediate cash returns. Cover crops may also be established following orchard establishment in order to aid longterm orchard management. A wide variety of cover crops may be planted, including permanent sod covers, green manure cover crops, or alternative food or forage crops. Cover crops are especially advantageous when compost and manures are not available. They are important in areas where orchard soils are susceptible to erosion, where drainage of water is poor, where soil nutrient levels or organic matter content are low, where weeds are a persistent problem, or where moisture conservation is important.

An ideal cover crop will reduce weed levels, improve soil nutrient status and organic matter content, be simple and inexpensive to establish. The primary advantages of using green manures include: a) the maintenance of soil organic matter content; b) the prevention of erosion; c) the suppression of weeds; d) the addition of

nitrogen to the soil; e) the reduction of soil temperature and temperature fluctuations; f) an improvement of the physical structure of the soil; g) an increase in water infiltration and a decrease of soil crusting; h) a possible increase in populations of beneficial insects such as predatory mites; i) the enhancement of nutrient retention by a reduction of leaching; and j) the reduction of soil compaction, dust and mud.

Cover crops are especially important on lighter soils. If planted in late-July, cover crops will absorb water & nutrients therefore slowing fruit plant growth. They provide for the protection of fruit plant roots over the winter, and trap snow. If used for site preparation, a cover crop will add organic matter to the orchard site.

However, some cover crops may increase irrigation requirements, require more intensive labour for weed control, may harbour diseases or pest insects, or provide increased cover for rodents. Consequently, the choice of cover crop is important.

Guidelines For Using Green Manures

Cover crops should be planted in mid- to late-July, however, adequate moisture must be available for the germination of the seed. A 45 to 60 cm bare space should be left between the cover crop and the row of fruit plants. The seed should be applied with a drill, or broadcast, and then the orchard alleyways harrowed or dragged to just cover the exposed seed. Some examples of typical seeding rates for white and crimson clover are 22 to 33 kg/ha

and for perennial ryegrass, fescues, and bent grasses, 44 to 66 kg/ha.

Leguminous cover crops include pea, mungbean, lentil, fenugreek, various clovers and vetches, birdsfoot trefoil and alfalfa. Fall rye, oats, barley, winter wheat, or a combination of crops may also be used. Fall rye appears to release substances that inhibit weed germination and growth. Other possible cover crops include creeping red fescue, red top, canola, and marigolds.

Cover crops must be incorporated into the soil before the seed matures. Surface, or shallow incorporation will provide an acceptable release of nitrogen with the added benefit of surface trash that will help reduce erosion. Otherwise, the crops may be ploughed and disced; one or more passes with the discer may be required.

Intercropping With Alternative Food Crops

Because perennial fruit crops take a few years to produce their first crops, fruit growers will not receive any immediate returns. Intercrops can be grown between the rows of fruit plants. Intercrops might include certain grains, vegetable (tomato, peppers), or spice (coriander) crops, but may also include quick-growing and early-bearing fruit crops such as strawberry. It is important that intercrops not deplete the soil too much. Intercrops that grow very tall or spread rapidly should not be used (squashes, for example). The timing of fertilization and irrigation should coincide as much as possible with those of the primary fruit crop.

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