

# Healthy Country

managing the land for healthy waterways

## FarmFLOW

growth through good practice

## Why erosion is a problem in macadamia orchards

Erosion in macadamia orchards is a widespread problem in South East Queensland orchards. Of the 24 macadamia farms benchmarked for the FarmFLOW project, 22 (or 92%) experienced tree row erosion.

Erosion can impede the nut harvest and cause nut loss, reduce water quality in storages, increase pre-harvest clean up work and increase nutrient loss. Three factors combine to cause erosion along the tree line in orchards:

- lack of groundcover
- tree trunks funnelling and concentrating water flow
- sweeping and blowing harvest equipment.



### Groundcover

Most erosion occurs where a dense canopy prevents light reaching the orchard floor, making it difficult to maintain groundcover. Groundcover is known to provide the best protection for soil as it absorbs the impact and erosive power of raindrops and flowing water.

Maintaining groundcover on the floor of macadamia orchards has been difficult because:

- There are only a few plants that provide adequate groundcover and can flourish in the low-light conditions under the trees.
- Growers have traditionally maintained a bare strip along the tree row to avoid mowing in this difficult area and to make harvesting easier.

### Soil health issues—groundcover benefits

Groundcover is the key to reducing erosion and also provides several soil health and farm management benefits including:

- protecting fertile topsoil
- increasing soil organic matter
- improved water infiltration
- reduced compaction
- better trafficability around the orchard during wet conditions
- reduced nut loss from surface, or overland, water flow.

### Erosion facts

Soil loss from a bare macadamia orchard (slope 5%) has been measured at 1.9t/ha/yr (rainfall 1320mm/yr).

Sweet smother grass groundcover reduced erosion by 99% (Reid, 2002).

Macadamia trees funnel water down the trunk, concentrating flow in the tree line. Water flow down the stem has been measured at 732 litres over a 24 hour, 105 mm rain event (Cox, 2008).

## Preventing erosion

Follow this 3-step approach to prevent erosion and maintain a stable orchard floor.

- land surface profiling to channel water into the inter-row
- manage the canopy to allow light to penetrate to the orchard floor
- establish perennial groundcover plants.

## Step 1—Profiling

Soil profiling is an earthmoving operation to redirect water flow away from the trunkline and into the inter-row.

Successful profiling will result in a broad, shallow v-drain that channels water away from the tree line.

When preparing to change the profile of the orchard floor consider:

- the importance of having a smooth orchard floor for other operations
- the quality of the soil shifted
- that it may be a one-chance only operation
- the current water flow around the orchard and where water may concentrate
- it as a chance to use soil from the inter-row to 'fill in' around the tree roots.

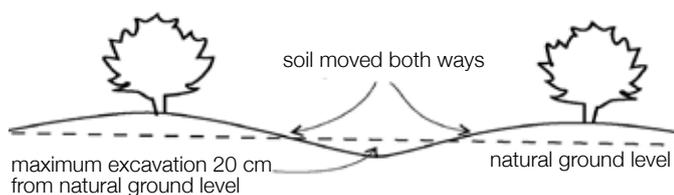
It is best to have some moisture in your soil when profiling. Dry soil tends to crumble, making it difficult to throw, and will wear the blades out rapidly.

Take time to set the profiler up to best suit your situation. Profilers can be adjusted to take more or less soil with each pass, change the angle of the cut and vary the throw.

Deliver the soil directly to the tree row and leave a shallow v-drain in the inter-row. The actual depth of the v-drain will depend on your soil type, topography and the amount of erosion in the tree row.



There are two types of soil profiler—Soiljet (top) and Superior.



V-drains for down slope rows (cross-section view)



*Once profiling has been completed it is imperative to establish groundcover as quickly as possible (see back page).*

## Step 2—Canopy management

An important step in ensuring adequate and healthy groundcover is to increase the light reaching the orchard floor. This is done by managing the orchard canopy. Currently there are two accepted practices for canopy management – mechanised pruning or hedging and manual selective limb removal.

Mechanised pruning or hedging is frequently used and this technique provides for a corridor of light reaching the centre of the row. Selective limb removal is performed manually and this technique allows light to filter through the tree and into the inter-rows.

Canopy growth will require regular assessment to determine when re-pruning is required. Due to vigorous growth and a reduction in light transmission to the orchard floor, selective limb removal usually occurs on a 3–5 year cycle; and hedging generally occurs on an annual or biennial cycle.

On-going research into hedging methods suggests that November/December and June/July are the best times of the year to perform the operation if yield loss is to be minimised. Foliage removal of 0.3–0.6 m is recommended.

When performing selective limb removal it is important to have in mind the tree shape you want to develop and from where light will enter the tree. Different macadamia varieties have different growth habits and require different pruning strategies.



Left: Canopy allowed to close over, restricting ground cover. Right: Selective limb removal allows more light to penetrate, encouraging ground cover.

There are two general strategies that can be applied to all trees.

- **Single central leader** – multiple leaders compete with each other for light. If allowed to persist multiple leaders will cause the tree to grow taller without adding additional fruiting wood. Remove secondary leaders as low as is practical.
- **Layering** – where limbs are laying on top of each other the bottom limb will usually be shaded and yield poorly. Removing the lower limb will remove its drain on the tree's stored nutrient resources. The upper limbs will droop down into the space left.

### Production benefits

Initial yield reductions will occur with both methods of canopy management, though a yield increase is expected in subsequent years. Complete economic analyses for these two approaches are not currently available, however the yield response from undertaking selective limb removal is less than the cost of the operation. Associated benefits from canopy management include:

- improving spray efficiency through better penetration
- improved trafficability in wet conditions
- increasing harvest frequency in wet conditions reducing 'shot' nut
- reduced loss of nut in heavy run-off events.



## Step 3—Establish groundcover

Immediately after profiling, establish ground cover to prevent soil loss in rainfall events. Fast establishing annuals such as millet or forage sorghum will provide short term protection.

For the longer term, a perennial cover is needed. Sweet smother grass (*Dactyloctenium australe*) has proven to be the best groundcover for lowlight situations in macadamia orchards (Firth, 2003). The benefits of sweet smother grass (SSG) are:

- soil holding ability
- reduced velocity of overland flow
- improved water infiltration
- increased organic matter
- shade and traffic tolerance
- low growing habit
- reduced nutrient run-off.

### Establishing SSG

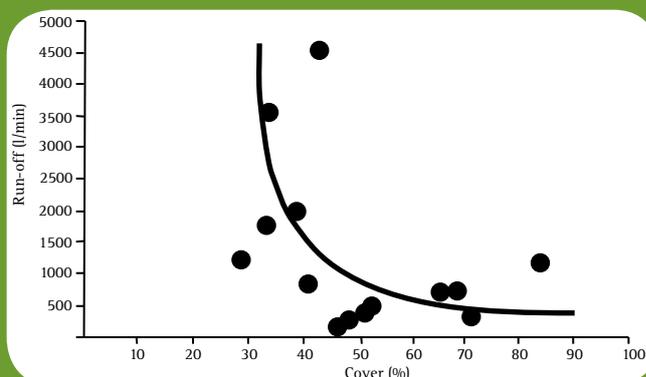
- SSG grows vegetatively so plant sprigs or jiffy pots into moist soil
- make sure it is well watered until established
- plant in Spring, as soon as possible after harvesting the crop
- plant off-set to normal tyre tracks
- mow frequently to help the grass spread.

### Managing SSG

- keep SSG short so it does not interfere with harvest operations
- mow immediately after each harvest round
- maintain a canopy management program to allow sufficient light for SSG growth
- maintain a narrow (60 cm) bare strip along the tree row for ease of harvest
- other grasses e.g. broadleaf carpet will dominate in centres of inter-rows if there is sufficient light.

### Further information

- Quinlan, K, Wilkie, J and O'Hare, P 2008, *Establishing and managing smothergrass on macadamia orchard floors*. NSW DPI.
- Firth, DJ 2003, *Reducing erosion and other soil degradation in macadamia orchards*, Agnote DPI-331, 2nd ed, NSW Agriculture.
- Reid, G 2002, *Soil and nutrient loss in macadamia lands: A Pilot Study*. Horticulture Australia, NSW Department of Agriculture.
- Cox, J 2008, *Improving soil and orchard floor management in macadamia orchards*. NSW DPI.



Increasing groundcover reduces run-off and increases infiltration.



A Gympie orchard 12 months after profiling and planting sweet smother grass (SSG).

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