



## CHAPTER 4 - AGROFORESTRY



The concept of two-tier forestry, in which trees are combined with livestock, is appealing in theory. It can cause problems in practice, however, and has largely fallen from favour. Blackwood appears to hold considerable promise for agroforestry because its bark is usually resistant to stock damage. As a nitrogen-fixer, it can also benefit pasture growth. On most farms trees and livestock are separated by a fence. However, there are circumstances where blackwood and livestock can be combined.

The case for agroforestry:

- As a nitrogen-fixing tree blackwood has the potential to increase soil nitrogen levels, and therefore enhance understorey pasture yield.
- Erosion control.
- Shelter for stock.
- The bark is relatively resistant to stock damage.

### Management

The first principle in blackwood management is site selection. Avoid ridge tops and exposed areas.

- Juvenile foliage is highly palatable to livestock. The phyllodes are often chewed, but with less enthusiasm.
- Stock should be excluded until the crowns are securely out of reach.
- Blackwood bark contains tannins, and is normally unpalatable. Occasional bark stripping occurs and cattle have been known to attack the bark at the stem-root junction in older trees (about 15 years), causing significant damage.
- Cattle can disturb the surface roots, particularly on steep wet slopes, and stimulate shoot formation. The risk of damage to the surface-feeding roots of trees by cattle is always of concern.

- Sheep can normally be introduced among blackwood after about two years, when the leading shoot is comfortably out of reach.
- Cattle can normally be introduced after 4 or 5 years. Bulls and dairy heifers should be kept away from trees at all times.
- When blackwood has been planted in regenerating scrub, access can be difficult for future pruning visits. Periodic stocking with cattle, provided it is carefully supervised, can be useful in maintaining access to the trees.
- Careful stock management is essential to avoid tree damage.

### Agroforestry trials

Blackwood has been subjected to extensive agroforestry studies (see box at right). The main effects of blackwood on pasture can be summarised as follows:

#### N fixation

Blackwood provided an increase in soil nitrogen levels and in pasture yield. This contrasts with other species that have been studied (*radiata* pine and *E. nitens*), which are not nitrogen-fixing trees.

#### Shading

Increased shading caused a reduction in understorey pasture yield. This effect is related to planting density and canopy structure.

Pasture reduction is less pronounced under lower levels of shade than under other non nitrogen-fixing tree species that were studied. This may be a result of increased nitrogen production.

Pasture quality was reduced over 9 years, with a reduction in ryegrass and pasture legumes, and an increase in less palatable pasture species.

#### Moisture

Throughout the year, soil moisture under the trees was greater than in the surrounding pasture, including the summer months. The trials were located on naturally moist sites, so it is possible that a different result might occur on dry sites.



Figure 14: Cows grazing under 12 year old blackwood on Te Kuiti site used for agroforestry analysis.

#### Agroforestry Trials

The information summarised in this chapter has been obtained from AgResearch Ltd. studies on the interaction of blackwood plantations with pasture production on five separate stands of nine year-old blackwood. Four of the stands assessed are Forest Research regime trials established in 1987 at Te Kuiti (Fig 14), Lake Okareka (near Rotorua), Hunua Ranges, and in Rotorua's Whakarewarewa Forest, (see chapter 10). The latter site has not been grazed but provided material for biomass production. The fifth stand is an agroforestry planting near Whangarei which was established in 1982 and has been pruned to six metres.

## Key Points

- Blackwood is a useful agroforestry species, provided it is properly sited and careful stock management is undertaken.
- As tree-stocking rate and tree green-crown length increase, understorey shade also increases.
- Pasture yield decreases with increasing shade, but not as much as with other non nitrogen-fixing tree species, particularly at low shade levels.
- Total soil nitrogen and nitrogen availability increases with higher tree-stocking rate. This differs from non nitrogen-fixing tree species, where total soil nitrogen and nitrogen availability decrease as tree-stocking rate increases.
- Pasture legume content decreases as tree-stocking rate increases.
- Tree litter fall and nitrogen return increases with an increase in tree-stocking rate.
- On moist sites, understorey soil moisture is unaffected by tree stocking rate. This indicates that the trees are not competing with understorey pasture species for moisture.

## Suggested reading:

Power, Dodd, and Thorrold 1999.

Power, Dodd, and Thorrold 2001.

Power, Thorrold, Balks, Dodd, and Nicholas 1998.

Thorrold, Knowles, Nicholas, Power, and Carter 1997.

Thorrold, Power, and Dodd 1997.

Power, Thorrold, and Balks 2003.

