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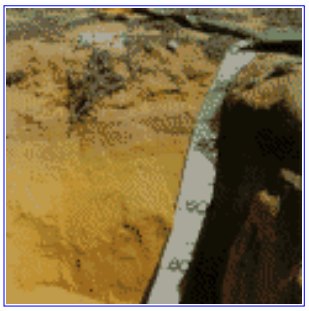

Figure 1. Deep yellow sand has poor nutrient and water holding capacity, which must be taken into acount when selecting plant species for revegetation.

Figure 2. Don Bennett using an EM/38 to measure soil salinity

Farmnote

SITE ASSESSMENT FOR SUCCESSFUL REVEGETATION FOR AGRICULTURAL REGIONS WITH LESS THAN 600 MM RAINFALL

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Good growth and survival of revegetation depends on five factors:

- Assessing and understanding the site conditions.
- Choosing the correct species.
- Using the best planting design and layout.
- Preparing the site appropriately.
- Establishing the plants using the best techniques.

All the factors are inter-related, meaning an integrated approach will provide the best results.

This Farmnote concentrates on site assessment for revegetation in agricultural regions in the 350 to 600 mm rainfall zone. Other Farmnotes in this series focus on site preparation (37/98) and on weed control (47/98).

Summary

Sites should be assessed for factors that could limit plant growth or restrict the particular species. These limiting factors can then be managed by treating them directly (e.g. drainage to alleviate waterlogging) or choosing plants with suitable tolerances (e.g. Flat topped yate (*Eucalyptus occidentalis*) for sites with salinity and waterlogging, or sandplain mallee (*Eucalyptus ebbanoensis*) for sites with acidic soils).

There are four principle factors that influence the survival and growth of trees and shrubs in Western Australian landscapes. These are:

. soil conditions;

b. exposure;

c. weeds; and

d. pests.

Soil conditions

Critical factors are the availability of moisture, rooting depth, salinity, waterlogging, acidity/alkalinity, and soil nutrient status.

Availability of moisture

The availability of moisture is a crucial element in seedling survival and further growth.

Soil type and depth

The critical features for soil moisture availability are depth and texture. Deep loams generally have the best seedling survival and productivity due to good moisture storage and availability, and good conditions for root growth. Sands have good conditions for root penetration, but have poor nutrition and water holding capacity. Clays, especially sodic or dispersive clays, prevent rapid root growth, and limit the availability of soil moisture to trees and shrubs, even though moisture storage is good. Shallow sand over clay (duplex soils) can have the worst of both sandy and clay soils with the added problem of perched watertables in winter, restricting root growth to above the clay layer. Both drought and waterlogging deaths are common on these soils.

Soil depth can be assessed using a post hole auger. Soil texture is assessed by using soil field texture cards (available from Agriculture Western Australia District Offices).

Moisture gaining sites

Moisture gaining sites (e.g. break-of-slope, drainage lines or seeps) can generally support more plants per given area than the surrounding landscape and have better productivity depending on the water quality. If the water is *fresh* (i.e. less than 500 mS/m, or 2700 ppm), water use of trees and shrubs may be several times the annual rainfall.

Freely draining sites

Freely draining sites (deep sands and gravels) generally have good conditions for deep root growth, but poor water storage, and in low rainfall areas this may limit growth. Poor storage capacity means trees and shrubs generally use less than the annual rainfall, unless the watertable is accessible. Planting density needs to be lower than in the surrounding landscape and drought tolerant species such as brown mallet (*Eucalyptus astringens*) or jam (*Acacia acuminata*) are recommended.

Rooting depth

The depth of root penetration is very important to a plant's survival because it determines how much water the plant can gain access to. If root penetration is sufficiently restricted, drought death will occur. Dense clay soils and the presence of hardpans, as described below, are the major obstacles to root growth.

Hardpans and dense clays

These form an impenetrable layer to roots, may cause seasonal waterlogging, and often lead to drought deaths. The depth and thickness of the compacted layer can be measured by assessing the degree of difficulty with which a penetrometer (a steel rod 6 mm in diameter with a handle at one end and pointed at the other) can be pushed through the ground. Ripping through compacted layers (common in deep sands) can improve growth conditions.

Watertable depth

For maximum tree growth, the watertable should be between 2 and 6 m below the surface and the salinity less than 1000 mS/m. Deep watertables limit water availability to trees and shrubs; while growth can be limited by waterlogging or salt (or a combination of the two) if the watertable rises into the root zone. If the watertable is near these extremes (shallow or deep), plant species should be selected with rooting depth and tolerance to these conditions in mind.

Soil salinity

Soil salt can affect plants through a direct toxic effect, and by reducing the availability of soil moisture. On very saline soils, although it may be possible to grow tolerant plants, water use is likely to be very low.

Soil salinity (EC1:5) can be measured by placing 10 g of soil and 50 mL of distilled water into a small container and shaking it for two to three minutes. After the contents have settled, a hand held EC metre will give a measurement which, when compared against soil type in Table 1, gives a salinity rating.

Table 1. Soil salinity measurements using EC1:5 (weight/volume) in mS/m

Salinity rating	Sand	Sandy loam	Loam	Clay loam	Sandy /medium clay	Heavy clay
Non-saline	< 13	< 17	< 20	< 22	< 25	< 33
Slightly	13-26	17-33	20-40	22-44	25-50	33-67
Moderately	26-52	33-67	40-80	44-89	50-100	67-133
Very	52-106	67-133	80-160	89-178	100-200	133-267
Extremely	> 106	> 133	> 160	> 178	> 200	> 267
An EM/38 will also give salinity readings for the top 2 m of soil. (Contact your local Community Agricultural Centre or Agriculture Western Australia District Office to see if one is available in your area.)						

Waterlogging

Occurs when the soil in the root zone is seasonally saturated (all soil pores fill with water). Waterlogging is most common on flat valley floors

with heavy textured soils, areas that become inundated from drainage lines and seasonally on shallow duplex soils (even on slopes). Drains, banks, mounding and using waterlogging tolerant plant species can help solve the problem.

Soil acidity and alkalinity

Acidity and alkalinity is measured by the pH scale, with fourteen the most alkaline and one the most acidic. Neutral is seven. pH readings of less than 4.5 and greater than nine may limit the availability of some nutrients to plants, and cause others to become toxic. The most common pH problem in Western Australia is acidic sands. Acidic sands can be treated with lime, but this will take time to raise the pH of the subsoil. Therefore the soil pH should be taken into consideration when selecting plant species for a particular site.

Soil nutrient status

Lack of nutrients is rarely a problem on revegetated paddocks on farms. An exception may be sites for growing commercial timber species. Most Australian native species will grow faster with higher nutrient levels than found in native soils. However, Banksias are sensitive to high phosphate levels. Soil nutrient testing is recommended to determine if any action is required.

Exposure

Exposed windy sites generally restrict plant growth by the combined effect of sandblasting, battering and increased evaporation leading to less available water. Wind erosion can also remove significant amounts of topsoil and nutrients. Exposed sites need to be protected (cover crop or wind break), and may require nutrient application.

Weeds

Sites with high weed burdens will require good weed control to prevent competition with seedlings for light, water and nutrients. Weed competition is the most common cause of seedling death in the first year of planting, because weeds deplete the soil water store, leading to drought death over the first summer.

Pests

Pest problems often come from an adjoining land use, or from problems on the site in the previous year. Examples are: rabbits and parrots coming in from bushland, or Rutherglen bug from nearby canola crops. Good management of the revegetation site, and of other enterprises on the farm, will reduce or correct these types of problems.

Conclusion

In any successful revegetation program, site assessment and species selection go hand in hand. Species can be chosen for different reasons such as timber production, erosion control or nature conservation, with

the right plants in the right place for the right purpose. With adequate site assessment, advice on species selection can be obtained from your local nursery, revegetation consultant, revegetation literature or REX revegetation software program.

This publication is funded by the Revegetation on Farms Project of Agriculture Western Australia, which contributes to the Western Australian Salinity Action Plan.

Further reading

- Farmnote no. 37/98 'Site preparation for successful revegetation : for agricultural regions with less than 600mm rainfall'
- Farmnote no. 47/98 'Weed control for successful revegetation : for agricultural regions with less than 600mm rainfall'

Prime Notes Index

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