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New large-scale woody plant crops for WA

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Introduction

Revegetating the Wheatbelt of Western Australia with perennial plants at the scale needed to reduce the adverse effects of salinity is an enormous task. Estimates of the area that would be required range up to 80% of all farmland or 12 million hectares of new perennial vegetation.

Farmers cannot afford to replace this much of their conventional agriculture with perennial plants, unless those plants are at least as profitable as their current agriculture. Some of the change can be taken up by improving and promoting the adoption of existing perennial pasture species such as lucerne. This might be comparatively easy to achieve given the considerable knowledge about pasture plants and the fact that they feed into already established industries. However, it is clear that the wool and meat industries will not be able to carry all the load and that it is imperative to develop new woody plant crops and new industries. The challenge of finding new woody crops has been taken up by farm foresters, but the terms 'tree', and 'forestry' need panel-beating into new shapes to work in drier areas:

- 'tree' may come to include a wide variety of perennial plants – including quite small shrubs.
- 'forestry' may include rotations as short as two years, and use harvesting machinery more like a mower or a forage harvester than conventional forestry gear. Handling of these new 'forestry' products is more likely to use bulk handling technology than conventional stick by stick handling.

To make our jargon as clear and relevant as possible we use the term 'woody plant crop'. Both agriculture and forestry will need to be modified to successfully adopt new woody plant crops for farmland in drier areas on the necessary scale.

What needs doing

Some of the tasks are:

Find suitable perennial crops

The current list of tree crops developed for southern WA is very short and the few we have are mostly of the traditional forestry type. There are no large scale ones suited to medium and low rainfall areas. Mallee and melaleuca are the only potentially large scale crops that have been subject to some development. Mallee is most advanced but is not yet in commercial operation. Given the scale

on which we need these new crops we should speed up the current developments and initiate several more.

Getting the R&D right to get new crops established

Much work will be needed on:

- Genetic selection and improvement
- Growing techniques
- Harvesting and transport techniques

Developing new farming systems

Perennial crops could be grown in many different ways, including:

- long term timber trees in wide-spaced plantations or belts (see illustration 1).
- alley farming layouts with grazing or cropping between belts of perennial trees or shrubs. This system suits perennial plants which resprout after harvesting at ground level (see illustration 2).
- phase farming of perennial plants with cropping. This system suits plants that do not resprout after harvesting, so that they can be replaced easily by annual crops (see illustration 3).

Starting new processing industries

This is not an easy task. Some native plants may produce raw materials which can be used immediately in existing industries without much new technical development. But others will need extensive testing and process development before they can be used. For example, some acacias have been found to make high quality MDF (at the laboratory scale). However, to bring them into full scale production, much new work would be needed to develop suitable adhesives, to optimise the manufacturing process, and to bring them successfully to market.

Selling the products

Major challenges are to:

- gain acceptance for new raw materials in existing markets
- develop new products and markets
- beat the competition

For example, cineole (the major component of eucalyptus oil) will be produced in the proposed integrated treatment plant for oil mallees at Narrogin. But new markets need to be developed for cineole to take it beyond the low volume, high value market which currently exists, into new industries which can use large volumes at a lower (but still profitable) price.

Now lets look at these new crops from a marketing perspective

Opportunities

- Large volume of material will enable new industries to be major players in markets in our region. If 6 million ha of new woody crops are established, some 90 million tonnes of green material would be produced each year.
- Low cost of production due to the economies of large scale production, and the use of efficient bulk handling methods
- Demand for wood fibre is likely to be strong. Three reasons are:
  - ⇒ reduction in traditional supplies of timber from native forests (through exhaustion, degradation, conversion to agriculture, or restrictions on their management and harvesting).
  - ⇒ an increase in the value of wood products relative to other products if greenhouse gas policies are adopted (that is, policies that place a value on the carbon contained in wood products, or place a value on the fossil fuel saved by substituting them with fuels derived from wood).
  - ⇒ increasing global wealth. Demand for wood products is related to economic growth, which is growing at about twice the rate of the world's population, (so demand for wood products should grow faster than demand for food).

Risks

- New industries are not yet developed.
  Their feasibility is not yet demonstrated. However, the oil mallee industry, which is the first of these new industries, is a fair way down the development path and looks very promising.
- Competition from other regions.
  Other countries and regions are also looking at ways of making profits from tree crops, so there will be lots of competition.
- Competition from other raw materials.
  The use of non-wood materials and recycled wood products is increasing, especially for reconstituted products such as paper, packaging materials and panel boards.
- Competition from other tree crops which are subsidised by taxation deductions or government-sponsored credits (carbon credits, salinity credits, etc). For example - if markets for paper pulp are unable to use all the plantation timber being grown for that purpose, then any surplus timber will be competing in other fibre markets with other farm-grown tree crops.

Desirable characteristics of potential new perennial crops

Let's look briefly at some of the characteristics which new perennial plant crops and processing industries will need to be successful.

Grow quickly

Plants which grow quickly will produce more saleable material in a shorter time.

Easy to grow

This covers a range of issues, such as availability of seed, ease of propagation, tolerance to a range of environmental conditions (especially soil and climate) and tolerance to pests and diseases.

Short rotation

Short rotation crops giving early and regular returns will enable farmers to finance their own tree crops, or make them more attractive to external investors.

Native species

Native species have some significant advantages as potential new perennial crops. They are well adapted to local conditions, they are less likely to become weeds, and we can gain a competitive advantage by exploiting our own genetic resources.

Compatible with agriculture

Annual cropping and grazing industries will probably be with us for a long time yet; so new crops need to be compatible with them. Issues to be considered are competition for light, water and nutrients, and palatability or toxicity of the new crops.

Suited to extensive production systems

Australian farmers are world leaders in producing grain crops in large volumes at very low cost of production. Suitable tree crops would be suited to this style of production, with high volume harvests, mechanised materials handling, and bulk transport.

Large market for their products

Revegetating one third of the cleared agricultural land in southern WA could produce some 90 million tonnes of green plant material each year. Processing this material and selling it into domestic and export markets will be a major task, and will require our new industries to be important players in South East Asian markets for all major product types.

Unless plant biomass captures a large slice of the electricity generation market in WA, and becomes a major source of liquid fuels used in WA, it will be difficult to sell all the biomass produced.

Products can be processed locally

Most bulk wood products will have values per tonne of only 10-20% of that of grain crops. Therefore it is not possible to cart them from the wheatbelt to the coast without eroding most of their value in transport costs.

To maximise returns to farmers from new crops, and minimise the cost of raw materials to processors, it is desirable to process them close to where they are grown, and then export high value products.

No residue

Crops for which all parts can be used will be favoured because they do not generate waste material, which could be a pollution risk, or an added cost to dispose of.

Ideal scenario

Our ideal scenario would be to develop a number of new industries that can accept a wide range of raw materials, and can produce a number of different products.

Then, several different species could be grown to feed a single processing plant, maximising the environmental benefits of diverse plantings. Similarly, if many different products are produced from a single processing plant, then there should be little or no waste.

The Search project

This project is managed by CALM with funding from the federal government's Bushcare and Farm Forestry Programs. The aim of the project is to identify native woody species and processing options with good chances of commercial success, then start the pre-feasibility work needed to prove up new industries. Search can be seen as the first step of developing new large-scale industries that might drive large-scale planting and new industries in the wheatbelt.

The key steps in the search project are:

1. Identify products with commercial potential

The amount of feedstock that could be produced by large-scale planting of woody crops dictates that the product have large, accessible markets. Products

must have sufficient value to allow transport from the wheatbelt after being produced from cheap feedstock.

Products that fit this description include:

- Wood composites
- Paper products
- Solid and liquid fuel
- Chemicals by transformation
- Chemicals by extraction
- Food and fodder

2. List their desirable feedstock characteristics

For each product group feedstock characteristics need to be defined and prioritised. For example, wood dimensions, wood colour, wood density and fibre length.

3. Develop a short list of species suitable for incorporation into farming systems

The process of short listing the species consists of three stages:

- Select species on general characteristics using the SIFT database for example in the genus Acacia the following criteria can be used to stepwise to "sift" out likely taxa:

Criteria	Remaining taxa
All native WA taxa	13,190
Acacias	799
Non-priority taxa	592
Occur in at least one of the four IBRA regions included in the wheatbelt	377
At least 4m tall (as an indicator of productivity)	88
Occur in three of the four IBRA regions included in the wheatbelt	23
Occur in all four of the IBRA regions included in the wheatbelt	7

- Seek expert advice to trim the species lists
- Use extra data where it is available or can be collected easily

4. Test feedstock characteristics of promising species

Use the characteristics developed for each industry in a stepwise manner to eliminate species from the list developed in step 3. As a general rule characteristics that are cheap to test will be tested first eliminating most species before running the more expensive tests.

5. Design potential new industries around the most promising species and products

This stage is crucial. Systematically identifying the best commercial prospects is probably not enough for commercial operations to emerge. Unless the prospect is quite outstanding there will be too many uncertainties and too much risk for entrepreneurs to invest. Also we need to be working towards very large-scale industries. Therefore, public investment is required to explore and develop the prospect within a whole industry context. This involves building the technical, environmental and commercial practices and structures for the industry.

The technical steps span the whole gamut from genetic improvement, establishment and management of the growing crop, harvest, processing and product/market development. The environmental aspects include ways to make the industry compatible with our aspirations for the environment – salinity control, biodiversity protection, flood control and amenity. The commercial development includes building up a committed base of growers and resource and making a commercial prospect that will attract investors.

If this work is done well enough the entrepreneurs will start showing interest. They will conduct feasibility investigation, raise investment capital, undertake operational scale testing of processing options and the industry is away!

6. Progress in Search

The current major activities in Search are:

- finalising the list of best bet native species as described in step 3 above.
- laboratory testing of wood properties and potential products made from feedstocks taken from the most promising species (step 4 above).
- Initial large-scale planting of *Melaleuca* species. Because of its obvious promise *Melaleuca* was selected as a prospective group of species to fast-track into the industry exploration phase (step 5 above). *Melaleuca* has the advantage of similarity with mallee in being an oil-rich, coppicing species. It has the added advantage of potential to occupy more difficult

sites beyond those on which mallee will prosper, i.e. some species have good waterlogging and salinity tolerance and other species will grow on shallow upland sites where mallee will fail. This project selected high oil containing *Melaleuca* and will plant 2 million seedlings in the current winter. Recent investigation shows that the yield and coppicing vigour of *Melaleuca* is unlikely to be competitive with mallee and that its use is likely to be confined to the poor sites. This section of Search will continue next year but with a greater selection of prospective species coming from the wood testing work.

Conclusion

Days like this provide a good opportunity to discuss the potential range of crops and products, with different market sizes, different marketing methods, and different industry development pathways. The good news is that there is room for all - the revegetation task needed to revitalise Australian agriculture is so large that there is more than enough room for a large number of new industries.