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Issues in the commercialisation of wattle seed for food

ANTHONY HELE

Principal Consultant, Australian Native Crop Development Service*

*previously Industry Development Consultant – Native Food

Primary Industries and Resources South Australia/Australian Native Produce Industries Pty Ltd

SUMMARY

Wattle seeds are a versatile product with a range of potential uses in the food industry. Small amounts of mostly wild-harvested seed are currently used in baked goods and other products. In common with many other Australian native food crops, the expansion of uses and markets is currently constrained by the inconsistent quality and quantity of wild-harvested supplies.

Commercial cultivation of acacias has commenced and further expansion is likely. To date, most plantings for wattle seed are young and small in scale and tend to have taken a more-or-less horticultural approach to establishment and management. There is also interest in growing wattles as a dryland crop to replace shallow rooted annual crops in lands currently affected by salt (or likely to be so) in the Western Australian wheatbelt and the Murray-Darling Basin.

With this expansion comes normal new industry issues such as market requirements, suitable production areas, input management and pest and disease control. However, with wattle seed a whole set of new crop questions arise alongside these new industry issues.

Crops new to cultivation require the development and testing of production system models that consider a range of interlinked management components, including species selection, planting layout, canopy management, harvesting and rejuvenation methods.

As yet, the most efficient or even the 'best-bet' model for wattle seed production has not been determined and it is likely that a range of approaches may prove successful, depending on markets, geographical area, species, complementary and existing farm management practices and specific production targets. Testing and comparison of current and proposed production system models should be a priority.

INTRODUCTION

Wattle seeds are a versatile product with a range of potential food industry uses, and small amounts of mostly wild-harvested seed are currently used in baked goods and other products. In common with many other Australian native food crops, however, the expansion of uses and markets is currently constrained by the inconsistent quality and quantity of wild-harvested supplies.

Commercial cultivation of acacias has commenced and further expansion is likely. With this expansion comes normal new industry issues such as market requirements, suitable production areas, input management and pest and disease control. However, with wattle seed a whole set of ***new crop*** questions arise alongside these ***new industry*** issues.

This paper focuses on these new crop issues which, at a fundamental level, resolve to the modelling and testing of crop production systems.

INDUSTRIES, CROPS AND SYSTEMS

Several new perennial crop industries have developed in Australia in recent years, including avocado, blueberry and kiwifruit, but these industries have been established with the benefit of existing cultivation knowledge and experience, recently acquired in the case of kiwifruit, (1900s – New Zealand)(Wood ***et al***. 1994). They were new industries but not new crops and came with well-developed production systems which covered planting layout, establishment, canopy management and harvesting.

Most of our present crops and their production systems have been developed over hundreds or thousands of years by incremental processes of change and interaction in genetics and technology. Perennial tree crops, in particular, tend to have a long history of cultivation. Relatively few tree crops have entered cultivation in the last 200 years and developed into commercial crops: they include pecans in the USA in the 1840s (Smith 1976a) and quinine in the Dutch and British East Indies in the 1850s (van Harten 1976). In Australia, macadamias were first cultivated in the 1860s, though commercial development occurred in Hawaii from the 1930s and the crop was not 'commercially reintroduced' into Australia until the 1950s. (Smith 1976b; Shigeura and Ooka 1984). Examples of Australian crops commercialised in Australia include duboisia in the 1940s (Wood ***et al***. 1994) and tea tree in the 1980s. Currently the quandong, sandalwood and lemon myrtle, all Australian natives, are in the early stages of commercial cultivation in this country.

Crops new to cultivation require the development and testing of production system models and their components, such as layout and establishment, canopy management and harvesting. In many cases production models readily suggest themselves, either due to the inherent nature of the crop or by analogy with similar crops. A new nut tree crop suggests horticultural production approaches, where long life, canopy management requirements and the relatively high crop value imply intensive management. A new cereal grass suggests a field crop suited to extensive, mechanised production systems. What then is a wattle seed crop?

MANAGEMENT ANALOGIES

The closest crop management analogies to wattle seed production are probably those employed in tree nuts.

In common with tree nut crops, wattles produce edible seeds on a woody perennial plant. Production systems in similar nut crops, such as pecan, almond and macadamia, commonly involve clonal varieties, planting established trees in precise layouts, irrigation, canopy management (basic structural training in macadamia, more intensive annual pruning in almond) and mechanical harvesting (tree shaking and ground pickup in pecan and almond, natural drop and ground pickup in macadamia).

Cereals, usually grasses, also involve the harvest of an edible seed crop, albeit from a structurally very different and short-lived plant. These production systems may commonly involve selected or bred seed, mechanical seed planting, large-scale dryland production, mechanised or no canopy management and one-pass mechanical harvesting.

Hybrid systems and crop exceptions also exist or have been proposed. A notable example is the meadow orchard system, where deciduous fruit tree are grown at ultra high plant densities and harvested (and pruned) biannually by mowing the growing shoots, with the fruit attached. Separation of fruit from vegetative material occurs post harvest.

WATTLE SEED PRODUCTION MODELS

With wattles for food any production model has to account for the harvest of seed from a single or multi-stemmed woody plant that, though perennial, may have a relatively short life in comparison to many tree crops. While wattle seed production models have been proposed and several have been implemented in the field, so far none seems to have been comprehensively tested and evaluated over a full plantation life cycle, nor has comparison of models been undertaken.

To-date, most wattle seed plantings are young and small in scale and tend to have taken a more-or-less horticultural approach to establishment and management. This so particularly in the Riverland of South Australia where the crop is grown under irrigation, using orchard layouts with pruning and trees are trained where necessary to produce single-stemmed trees in anticipation of tree-shaker mechanical harvesting. In some cases the trees have been planted as a crop-producing host plant for quandongs.

There is also interest in growing wattles as a dryland crop to replace shallow-rooted annual crops in currently lands affected by salt (or potentially so) in the Western Australian wheatbelt and the Murray Darling Basin (Maslin ***et al***. 1998; Simpson and Chudleigh 2001). Such a field crop approach implies production system models that aim to contain costs, while perhaps accepting lower yields and quality, compared to a horticultural approach.

As yet, the most efficient or even the ‘best-bet’ model for wattle seed production has not been determined, and it is likely that a range of approaches may prove successful, depending on markets, geographical area, species, complementary and existing farm management practices and specific production targets.

PRODUCTION MODEL COMPONENTS

Production models should incorporate a range of interlinked management components, including species selection, planting layout, canopy management, harvesting and rejuvenation methods.

Harvesting: Because the cost of harvesting is likely to have a large impact on the economic viability of wattle seed production and has fundamental interactions with other management areas, an assessment of likely methods is one of the key decisions for any production model.

Currently, wild harvesting commonly involves spreading tarpaulins or shadecloth beneath trees to catch seed pods, which are dislodged by striking or shaking the limbs with poles.

Given the success of these manual techniques and that many of the main species of interest, including ***A. victoriae***, present their pods on the ends of branches and drop readily, mechanical harvesting or mechanically-aided harvesting appears to be a feasible proposition.

Hand-held petrol-driven limb shakers or pneumatic rakes, similar to those used in small scale olive production, may be options for mechanically-aided harvesting. While relatively slow and labour intensive compared to fully mechanised harvesting, these techniques are likely to handle a range of growth habits, planting densities and layouts.

Tractor-mounted or self-propelled tree shaker-style machines, similar to those used in some nut crops, may also be a feasible option. These harvest systems may utilise shaker integrated catching frames or other catching technologies for concurrent crop collection, or may drop the crop on the ground for later collection by pickup machines. Shaking and collection machines are likely to require plants with single stems and a raised canopy to work effectively, which implies an interaction with species selection and / or canopy management techniques. Some machines also require significant room to manoeuvre, with resulting implications for planting densities and layouts.

Over-the-row harvesting technologies, similar to those employed in grapes, but which utilise a variety of methods for dislodging crops, are currently undergoing rapid development and may be a potential future technique. These machines may be able to handle multi-stemmed growth habits while requiring specific and well defined planting layouts.

The economic impact of various harvesting techniques in wattles has been recently examined by Simpson and Chudleigh (2001), who used a cost of $3,125 / ha for tree shaker harvesting and $750 / ha for 'finger' mechanical harvesting (equivalent to the 'over-the-row' technology, discussed above). Using these figures they found systems incorporating tree shaking unprofitable, due to the high cost of harvesting. However, these figures and conclusions warrant further analysis, as tree shaker harvesting of almonds in the Riverland of South Australia has been estimated as costing only $526 / ha (Anon. 2001), roughly one-sixth of the figure used by Simpson and Chudleigh, while grape 'over-the-row' harvesting is costed at $1,313 / ha, almost twice that assumed for a similar system in wattles.

A further harvesting technique termed biomass harvesting, which takes a very different approach to crop removal, is also examined by Simpson and Chudleigh. In this technique harvesting occurs once every four years or so by removing the whole tree, back to a stump, and then separating the seed from the leaves and stems. The stump is then allowed to regenerate for harvesting in another four years. This technique is similar in concept to the meadow orchard system proposed for high-density deciduous fruit crops. While overall seed production levels would be low with this system, it is likely to be low-cost and tolerant of a range of growth habits, planting layouts and plant densities. Simpson and Chudleigh have estimated a cost of $500 / ha for this harvesting technique, based on experience in tea tree.

Species, provenance and cultivars: Since ***Acacia victoriae*** seed is the current industry 'standard' for food use and has a relatively well developed market, this species would likely be the first production choice in many situations. However, other species may have potential as an addition to an ***A. victoriae*** main planting or, in certain environments or with particular management systems, as an alternative to ***A. victoriae***. As the production and use of wattle seed expands, growing user experience and sophistication are likely to mean that a number of species are likely to find particular market niches.

While on-farm experimentation with a range of species could provide valuable information and perhaps uncover a useful species, for individuals it also poses a higher degree of production and marketing risk.

Beyond simple species choice, the genetic diversity of Acacias means that the provenance (i.e. geographic source) of planting material may prove important. Among the factors that may be influenced by provenance are growth rate and form, spininess, yield and adaptation to soils and climates. In the longer term, cultivars (i.e. cultivated varieties¾clonally propagated selections) may become the norm for planting material, as is the case in many other crops.

As different species and provenances have different growth habits (such as multi-stemmed versus single stem) the choice made has potential interactions with production factors such as harvesting techniques, canopy management and rejuvenation methods.

Canopy management: Canopy management is likely to be governed largely by harvesting system requirements. Commercial trials in the South Australian Riverland indicate that pruning and training to achieve a single straight stem and raised canopy, suitable for tree shaker-style mechanical harvesting, appears to be a feasible practice for the normally multi-stemmed species, ***A. victoriae.*** However, the technique requires more than a simple once-only removal of multiple stems and considerable detailed hand pruning is required to progressively reduce and remove shoots, so as to suppress the plant's normal multi-stemmed habit.

The need for canopy management in multi-stemmed species could be reduced or removed completely with different harvesting techniques, such as over-the-row or biomass harvesting. Single-stemmed species or varieties are also likely to be more amenable to a number of harvesting techniques, without the need for significant modification to tree architecture.

Rejuvenation: Because Acacias may be relatively short lived, methods to rejuvenate plantings may be an important aspect of commercial production. Coppicing (cutting trees back almost to ground level to stimulate further growth from dormant trunk buds – although this may also result in multiple stem development), pollarding (cutting trees back to a point some distance above ground level, to stimulate growth and particularly the development of a bushy crown) and / or shallow ripping to induce regrowth through suckering, have been proposed, although these methods have yet to be trialed and perfected.

Input management: The management of inputs, such as water and fertilisers, is likely to have an impact on tree growth rates, yields and plantation longevity, as well as interacting with other practices, such as canopy management. Optimum programs and strategies have yet to be determined.

Other considerations: As in any crop, the wattle seed production unit has to mesh with other on-farm systems, in areas such as labour requirements and operation timing, machinery and input usage. Any system also must be able to meet desired production targets, which may be more than simple seed yields or returns per hectare in the case of a potentially multi-use crop such as acacia. For example, production targets may encompass the performance of other crop or livestock systems, as when acacias are used as a host plant for root-parasitic quandongs or sandalwoods or when acacias provide a fodder source, or may encompass often hard to measure environmental benefits.

CONCLUSION

Probably the biggest issue for an expanded wattle seed industry is the development of suitable production systems, which integrate harvesting, species, canopy management and rejuvenation approaches, among others. Testing and comparison of current and proposed production system models should be a priority, and it is likely that several systems may prove suitable, depending on markets, geographical area, species, complementary and existing farm management practices and specific production targets.

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