

focus on

TEA TREE OIL

Research & Development



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An R&D program managed by the Rural Industries Research and Development Corporation



At a glance

Australian native flora is rich in plants capable of producing biochemically potent essential oils. Tea tree oil (TTO), distilled from the leaves of *Melaleuca alternifolia*, is one of the most commercially successful examples. As a natural product, it is being applied to an ever expanding range of uses.

The medicinal value of TTO was first confirmed scientifically in the 1920s by Australian Government chemist AR Penfold, who demonstrated antifungal and antibacterial activity. These properties subsequently led to TTO's use in personal care products including acne-control face washes, hand washes, dental care products, and as a topical antiseptic on cuts, abrasions and insect bites.

More recent research has demonstrated anti-inflammatory, anti-viral, wound-healing and insecticidal properties.

Australia remains the world leader in TTO production, despite increasing competition from international producers. In northern NSW and Queensland, more than 100 growers distil some 500 tonnes of TTO annually from a combined 3000 hectares of plantations. Of the oil produced, 85 per cent is exported, with half going to Europe.

Underlining this success is a long-standing partnership between the Australian Tea Tree Industry Association (ATTIA) and RIRDC. The partnership and co-investment has allowed growers to take a native plant out of the bush and – in just over a decade – create a highly regarded and productive industry whose access to scientific resources enables it to continuously improve and innovate.

Despite its fledgling status, the farm-gate value of the Australian TTO industry was more than \$21 million in 2012.

Research and development

RIRDC's involvement with the Australian tea tree oil industry has ranged from the breeding of higher-yielding cultivars that boost plantation productivity, to research-backed submissions to help the industry meet regulatory requirements in Europe.

The program is funded by voluntary contributions from industry participants, with RIRDC matching the funds. Overall, research activities fall into several categories:

- Production systems. These projects seek to increase profits, through increased oil yields, without significantly increasing production costs. Innovations include the establishment of a tea tree breeding program, integrated pest and weed management systems, and a response to the incursion of the exotic disease myrtle rust.
- Proof-of-concept studies and safety and efficacy studies. These projects support the development of novel TTO applications across medical, veterinary and industrial sectors.
- Regulatory regimes, quality assurance and proactive attention to market barriers.
- Communication to foster grower productivity.

In an industry in which growers bear the brunt of developing and marketing new applications and products, RIRDC's support has been welcomed by industry.

INDUSTRY CASE STUDY

The ripple effect of good breeding

Before the 1990s, tea tree oil was sourced either from bush-harvested leaf material or from plantations sowed from bush-harvested seed. A tea tree breeding program was established in 1993, and higher oil-yielding varieties were first released in 1997.

The program has improved plantation profitability ever since, driven by rapid genetic gains in oil yield and quality. Oil yields have increased 69 per cent from average yields of 148 kilograms of TTO per hectare in the 1990s, to about 250 kilograms per hectare in 2010.

An industry review of the breeding program has detected benefits to producers that include: greater profitability per unit land area through higher yields; significant increases in efficiencies of the harvest and distillation processes through increased oil content from similar biomass levels; and greatly reduced variability in yields and oil qualities.

From its inception, the breeding program was a collaborative effort between Gary Baker, from the NSW Department of Primary Industries, and John Doran (formerly with CSIRO and now a consultant).

“The cost of seed is a minor component to establishing a plantation, yet its genetic quality is a major determinant of both oil yield and quality,” says Gary Baker. “Use of improved seed maximises profits and market access, especially in the face of growing international competition, particularly from China.”

Progressive genetic improvement is achieved through a recurrent breeding strategy, which began with a broad collection of tea tree seed that sampled the genetic biodiversity of the species. Oil yields were found to be highly

heritable and a cost-effective selection technique was developed based on measuring oil concentration in leaves.

In seedling seed orchards, strong selection pressure is applied by culling poor performing trees. Now in the third generation of seedling seed orchards, the best performing material is also being crossed or cloned as a complementary strategy to the release of improved seed.

The RIRDC tea tree breeding program’s success has seen it recently extended to select for greater frost tolerance, resistance to the main plantation pest (the pyrgo beetle), and for survivability in climatic extremes.

“ **The cost of seed is a minor component to establishing a plantation, yet its genetic quality is a major determinant of both oil yield and quality.**” -
Gary Baker, NSW Department of Primary Industries.

Collaboration with ANU researchers Bill Foley and Carsten Kullheim has meant the latest molecular approaches are incorporated into the program.

The breeding program committee is chaired by Richard Davis, a grower who also hosts a seedling seed orchard in West Wyalong, NSW. He says that without RIRDC’s involvement, the breeding program could not have continued unabated for the past 20 years.



Gary Baker of the New South Wales Department of Primary Industries has helped the tea tree industry grow into an efficient and profitable plantation-based industry

“It provided a huge increase in oil yield over standard seed, which translated into huge productivity and financial benefits to growers who were quick to adopt the improved seed,” he says.

Many other plantation owners have played important roles in the breeding program, providing sites for orchards, progeny and genetic gain trials and in the maintenance of project plantings. The project has especially benefitted from the participation of Australian Plantations, Richard and Geoff Davis, Rob Dyason, David Martin, John Murtagh, Peter and Rodney Rose, Walter Dal Santo, Craig Chapman and John Seccombe.

Economic analysis has found that increasing the productivity of high quality oil through the use of improved seed and clones is the most cost-effective way to maximise grower profits and market access. A 2010 review of the breeding program found it returned \$5 worth of benefits for every dollar spent.

Growth in the tea tree oil industry, 1982 to 2010:

175% annual production

4900% total production

147% annual export value

4110% total export value

Source: ATTIA submission, Productivity Commission Review of Rural Research & Development Corporations, June 2010.

Facts and figures

- The farm-gate value of the Australian tea tree oil industry in 2010 was more than \$21 million.
- About 85% of Australian tea tree oil is exported.
- Scientists are still uncovering medicinal, veterinary and industrial uses for tea tree oil.
- There have been more than 1000 scientific reports published since 1904 on tea tree oil and its biological activities. These are available at the Australian Tea Tree Industry Association website (www.attia.org.au).

Visit www.rirdc.gov.au to see all of RIRDC's tea tree oil research projects.

- Return on total R&D investment (2010):

COST = \$1.2 million >>> NET VALUE = \$6.1 million

Benefit cost ratio = 5 to 1.

**Annual benefit to growers =
\$10.8 million (oil priced at \$35 per kilogram)**

Source: *Economic Evaluation of Investment in the Tea Tree Oil R&D Program*, RIRDC Publication No 10/212.