

## Natural defences

The power of pyrethrum

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THE MORNING AIR IS COOL and fragrant as we lift off in a light aircraft from Burnie Airport, near Wynyard on Tasmania's north-west coast, and rise above a glittering Bass Strait. Below us, a placid, steel-grey sea laps at rocky coastal battlements, and an undulating landscape of subtle hues stretches to a mountainous horizon. Extending into the water, like a bubble clinging to the land, a perfect semicircle of rock embraces a patchwork of paddocks, partly obscured by irrigation spray. "That's Table Cape," pilot and farmer Andrew Roberts-Thomson shouts over the throb of the aircraft's engines. "It's the remains of an ancient volcano, and contains some of the most fertile soil in the world."

This is a land of onions, potatoes, beans and peas, its rich, red soil watered by pure rivers from the wilderness to the south. Tulip bulbs and pharmaceutical poppies also thrive here; but in the agricultural chequerboard that extends along the north-west coast, one colour is predominant: white. Below us lie scattered paddocks of blooming daisies, like unseasonal patches of snow. These are not just ordinary garden daisies, but special pyrethrum daisies, the mainstay of an innovative, high-tech industry that exports a rare commodity throughout the world.

Compared to some of its spectacular cousins, such as the giant chrysanthemum, the pyrethrum daisy could seem plain, even dull. But this flower has valuable properties: it's deadly to insects. Tightly packed into the yellow centre of each white flower head are precious oil-producing glands, each one a minute package of a natural – and powerful – insecticide.

"It's an odd crop, when you think about it, but it's certainly been good to me," Andrew tells me once we're back on the ground. "I think a lot of people were sceptical about it initially, but the results speak for themselves." From experimental beginnings only 20 years ago, 2000 hectares of the flowers now carpet the picturesque coastline of northern Tasmania, between Scottsdale and Rocky Cape, giving Australia 30 per cent of the global pyrethrum market, and making it, after Kenya, the second largest pyrethrum producer in the world.

### **A complex chemical code**

HAVING GROWN UP IN THE TROPICS, I'm all too familiar with aromatic green mosquito coils that smoulder through sultry summer nights, especially after rain. These often have pyrethrum as their active ingredient, as do many of the aerosols and ointments I've used against mozzies and other insects. Household and gardening sprays; shampoos for head and body lice; and flea powders, washes and collars for pets also frequently contain pyrethrum, manufactured from a miraculous combination of six molecules the pyrethrum daisy has evolved over aeons to protect itself against insect attack.

Together, these six molecules form complex chemical compounds called pyrethrins, which are non-toxic to birds and mammals, but attack insects' nervous systems, knocking them down within seconds. What's more, the chemistry of these molecules is so complex that insects have been unable to crack their code to develop defences – as they have with most synthetic insecticides.

Pyrethrins leave little residue, breaking down rapidly to harmless materials when exposed to light and air. This isn't to say that pyrethrum products can be treated in a careless manner. While pyrethrum is safe for warm-blooded animals, it's poisonous to cold-blooded creatures, such as fish and reptiles. It's also sometimes combined with other chemicals that make it last longer than it normally would, and these can be toxic to humans.

The commercial use of pyrethrum extends to restaurant kitchens and food warehouses, where slow-release "foggers" keep unwanted bugs at bay. It's also used for controlling ticks and flies on livestock, and combating locust plagues; it's especially popular with grape-growers, wine-makers and organic farmers because it leaves no residue.

"That's the beauty of it," says Ian Folder when we meet at the Tasmanian pyrethrum industry's Hobart headquarters. "In billions of correct applications of pyrethrum-based products worldwide, there's been no recorded harm to people or other mammals." Ian is the managing director of Botanical Resources Australia (BRA), which has produced Tasmanian pyrethrum since 1996.

A hardy herb, the pyrethrum daisy thrives at both high and low altitudes. It's grown at 1500–3000 metres in the tropics, and at sea level further away from the Equator. In both cases, the plant gets a fortnight of temperatures below 15°C, which is essential for budding. "Pyrethrum also needs water: a metre of rain a year, as well as extra irrigation," Ian explains, "and it mustn't get too hot". Flower production suffers if average maximum temperatures rise above 24°C for two weeks or more during spring – an unlikely event in Tasmania. Add to all this the fertile soils of the island's

north-west and you have pretty perfect conditions. “But it’s our human resources that are the greatest,” Ian insists.

One of these is veteran farmer Col Daking, whom I meet on his idyllic Table Cape property, Ntabazinduna, named after a place near Bulawayo, Zimbabwe, where he trained as a pilot during World War II. A “retiree” who wryly admits he still works 18-hour days during the irrigation season, Col shows me his prize paddock, a weed-free swath of glaring white, sloping west towards the azure waters of Boat Harbour and Rocky Cape National Park.

“I’ve been in pyrethrum since the beginning – since its infancy in Tasmania,” he says. “Back then I knew next to nothing about it, but I could see it had terrific possibilities.” After decades of vegetable cropping with prices constantly falling, Col, like many others, wanted to escape the stranglehold of the supermarkets. “We needed an alternative and I could see pyrethrum could be it, so I agreed to give it a go.” Today, with 80 ha of daisies, Col is one of the biggest growers in the State.

“You can’t just grow pyrethrum everywhere,” he tells me. “It’s got to go where you put your best stuff. It thrives on well-drained, iron-rich soils and a good deal of water. We irrigate up to four times when the crop’s in flower.”

In return, a paddock of pyrethrum needs little attention and is good for the land. “It can stay in the ground for five years,” says Col, “and some people have had decent yields after seven. That’s good for the soil: it reduces erosion and increases organic matter; and it’s good for the farmer because apart from irrigation, weeding and disease control, it’s relatively labour-free. And the views are terrific too! In the end, you have a big paddock of flowers and money in your pocket. What could be better than that?”

### **Gathering the harvest**

A FEW MONTHS LATER, in January, I’m back at the pyrethrum industry’s Ulverstone nerve centre for the harvest, which eventually yields 6400 tonnes of flowers. “It’s amazing how things have changed,” says Bill Casey, BRA’s Planning and Logistics Manager, pointing to the busy scene around us. As trucks queue up to unload their aromatic contents, Bill is barely able to suppress a wide grin. “You should have seen our first harvest,” he says, “it looked like a heap of wilted lawn clippings!”

Standing at the entrance to BRA’s cavernous warehouse, I’m greeted by evidence of how far the industry has come since its first harvest. Even from a distance, the smell is overpowering. It’s something between the sweetness of sundried hay and the bitterness of strongly brewed tea, with an acidic, medicinal edge. In the gloom of the warehouse I can see great khaki mounds rising

towards the ceiling. At one end, a front-end loader labours, lights blazing, in a swirling cloud of dust, while nearer to me workers move as if in slow motion through the hot, heavy air. Dressed in head-to-toe protective clothing against the irritant dust, they seem to me like adventurers in the strange landscape of another planet.

Bill then explains how, once the daisies have reached maturity, and have an ideal pyrethrin content, the flowers are cut and laid out to dry in rows. After the crop has lain in the field for a week, the harvest can begin. But that's not all there is to it. The entire pyrethrum harvest in Tasmania is managed by BRA in a complex and intricate operation. "We've got 32 headers operating this year, which makes this the biggest single crop harvest by a single contractor anywhere in Australia, if not the world," says Bill. "Guys bring their headers across by boat from Victoria, New South Wales and even Queensland. They'll harvest other crops on the mainland for six months at a time, and then end up here on pyrethrum." It's quite a family affair: some bring their spouses and children for a Tasmanian seaside break.

Late that afternoon, after the sun has burnt off all traces of dew, I ride with Queenslander Bill Macdonald in his \$280,000, 265-horsepower (200 kW) rotary header. "It's hard being away from home," Bill tells me as we trundle along, sucking up the dusty rows of dried flowers. "I've had three nights in my own bed since October and I miss the kids a lot. But I meet a lot of good people, and see some great parts of the country." Bill, from Dalby, 180 kilometres west of Brisbane, is in Tasmania with his wife Tori and their three young children. Also here is Tori's sister Kate, married to fellow Queensland farmer and harvest contractor Peter Butler. It's difficult with the men away during most of the harvest season, both sisters agree, which is why they've accompanied them to Tasmania. And because work only starts in the afternoon, or not at all if conditions are damp, the families spend some valuable time together. "It's great for the kids to be with their dads – that's really why we're here," says Kate.

Mainland harvesters, I'm told, find that Tasmania's steep terrain takes some getting used to; so, too, do the views. As Bill Casey tells me, "Harvesters can have mountains at their backs and sea cliffs in front. That must be quite a change!"

Not nearly so pleasant is the way ultra-fine pyrethrum dust irritates the skin when it mixes with sweat. It also has a tendency to combust spontaneously, so the headers have to stop regularly to have the accumulated dust blown off them with compressed air. "One year we had a header smouldering," Bill Casey says. "Now we're pretty careful."

Even so, there are enough attractions about working in Tasmania to bring the harvesters back. As the mainlanders agree, there aren't many places in rural Australia where you can order a pizza by mobile phone and have it delivered to the paddock: you're usually too far away from a

town with such a service. In a paddock swept clean of pyrethrum daisies, we end that day with a feast of chicken supreme, washed down with a well-earned beer under a fiery southern sunset.

### **Extracting the oil**

BACK AT BRA HEADQUARTERS at Ulverstone, chief chemist Helen Faber works with pyrethrum under very different conditions. In a state-of-the-art laboratory, she and her team of seven industrial chemists have responsibility for ensuring that each grower's daisies are harvested at exactly the right time to achieve the best concentration of pyrethrins for export. The chemists are busiest during harvest time, when they have to process thousands of analyses of plant material brought to them from the field. "It's a great job," Helen tells me. "There's always something new happening. It's satisfying to have seen the industry grow from virtually nothing, and to know that the results of work in this lab soon wing their way across the world."

Before they can do this, though, the precious pyrethrins must be extracted from the mountains of flower heads I'd seen earlier in the warehouse. To understand how this happens, I set off on a guided tour with director of manufacturing, John Boevink, a biochemist by training, who emigrated from the Netherlands in 1968.

First stop is a roaring, dusty hammer mill where the flower heads are compressed into pellets, making them easier to transport. At Scottsdale, 45 km north-east of Launceston, the pellets undergo the first stage of processing, in which hexane (a type of paraffin) is used to dissolve the pyrethrins. The hexane is then evaporated off, leaving behind a crude oily resin containing 20–25 per cent pyrethrins, and a fibrous residue that's ideal as garden compost.

Stage two takes place in a fully computerised refinery, which John has operated over the internet from Europe. "I can't tell you exactly how it works," he said, "that's an industrial secret, but it's a refining technique that was fairly novel when we adopted it." The result is a clear, straw-coloured oily liquid containing 70 per cent pyrethrins. This is the final product that will end up in insecticides around the globe. Once they reach an aerosol, pyrethrins can be worth up to \$1 million per tonne.

During my last days in north-western Tasmania, I revisit a few of the growers I met on my first trip. Some hover anxiously in their paddocks during harvesting, keen to see the outcome of a year's labours. It's a bit like waiting for exam results, they say anxiously, though it looks as if everyone has passed well.

At North Down, a property 15 km east of Devonport, I chat with Owen Thomas and his father Snow, whose family has farmed here since 1828. Standing in a paddock I'd last seen in full, vigorous bloom, we watch as the headers swallow the remains of the harvest. "Py hasn't been all

plain sailing,” says Owen, “but we never hesitated in supporting it fully. We’ve been in it from the word go, so it’s satisfying to see it come to fruition.”

That evening, I stay until the sea grows glassy and a bloated pink moon rises above the horizon. In the distance a header works on into the night, gathering in the daisies and their load of precious oil.

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