



UC Davis Strawberry Breeding Program

A collaboration between Tasmanian strawberry nursery JCLM Farming and the University of California, Davis (UC Davis) strawberry breeding program is driving the commercialisation of exciting world-class cultivars set to benefit Australian strawberry growers and the industry alike.

UC Davis has been breeding public strawberry varieties since the 1930s. It investigates key issues in strawberry production (chiefly the genetic basis of disease resistance, aroma and yield) and leverages the discoveries to develop new varieties that address the needs of growers around the world. To ensure the highest success rate for its advanced varieties globally, it strategically licenses qualified nurseries in different territories.

JCLM Farming plays a crucial role as Australian ambassador and partner for the UC Davis program, successfully propagating and distributing globally renowned, disease-tolerant and high-yielding cultivars nationally.

A partnership cultivating success

As UC Davis strawberry licensing representative Isaac Rainwater explains: "UC Davis has master licensees that represent their strawberry varieties in different countries. Our master licensee in Australia is Global Plant Genetics and JCLM is a sub-licensee of Global Plant Genetics. Global Plant Genetics identified JCLM as a qualified nursery that would be beneficial for developing new UC Davis cultivars as well as benefitting the Australian strawberry industry.

"We identify the most qualified nurseries in the different territories where our strawberry varieties are grown and pursue licenses with them in order that our varieties will have the highest rate of success. JCLM was one of three we identified – we are very excited to be working together.

"As we are not able to be present in every country around the world, licensees and sub-licensees play a vital role in connecting with growers and distributing information about the program and its varieties. Without the partnerships we have with nurseries such as JCLM we would have difficulties getting our cultivars into the hands of the growers who will ultimately decide the success or failure of new strawberry cultivars," Isaac says.

The relationship includes direct engagement with JCLM Farming's founder Jack Beattie visiting California to tour UC Davis test plots, meeting with growers and visiting breeding plots and breeders at Wolfskill Ranch.

Established in 2016, JCLM Farming is a relatively new entrant to the Australian strawberry industry. However, in its first 10 years, it has cultivated and expanded a grower network in all key Australian regions including Queensland's Sunshine Coast and Granite Belt regions and Western Australia's Southern Forests region. It holds the licence to propagate UC Davis cultivars UCD Royal Royce, UCD Moxie, UCD Valiant, UCD Victor, UC Surfline, UC Monarch, UC Golden Gate, UC Keystone and UC Eclipse and is developing a key relationship with a major grower group for Australia-wide pre-release trials.

Isaac Rainwater says JCLM Farming's location in Central Tasmania is a key operational advantage.

"As it is the most southern of our licensed nurseries, it receives adequate chill hours needed in order to promote the ideal vigour in UC Davis varieties when planted," he says.

"All UC Davis varieties are bred in the different coastal zones of California which means they are very adaptable to many different climates around the world except those that are extremely hot.

"Our day-neutral varieties have long been staples for production due to outstanding flavour, shelf life and quality. Our day-neutral varieties are also the highest-yielding cultivars in the day-neutral market. Our short-day varieties are not the earliest producers in the industry but due to high yields and fruit quality they are also widely grown.



"The most impactful reason UC Davis cultivars are popular is due to their tolerance to various soilborne diseases. This is something that the breeding program has been heavily focusing on over the past seven to 10 years and all the new varieties have higher disease tolerance than older varieties.

"Over the years, day-neutral varieties have proven to be the most well-suited for the Australian growing conditions. Historically, varieties such as Monterey and Cabrillo have been very successful in Australia, and the newest day-neutral cultivars UC Golden Gate and UC Eclipse are poised to continue that success due to their production windows and fruit quality aspects." Isaac says.

All UC Davis varieties available in Australia are now in the development stage of production with JCLM Farming, having passed through the arduous path to commercialisation from crossing to selection to testing and quarantine, spanning more than seven years.

The logistics of early access for testing potential new cultivars is an ongoing discussion point between JCLM Farming and UC Davis, as bringing new varieties into Australia requires a quarantine period using in-vitro meristem plants (or tissue culture).

Developing the roadmap for identifying strawberry genes



The UC Davis breeding program has led the evolution of strawberry genetics for some 80 years. During the past 10 years, there has been a particular focus on developing more disease and pest resistant varieties due to the rise of various challenges facing growers worldwide.

“The need for genetic resistance has become paramount,” UC Davis strawberry breeder Glenn Cole says.

“We started with four main soilborne problems common in California – fusarium wilt, macrophomina crown rot, verticillium wilt and phytophthora. We have expanded the list of culprits to include many other fungal, bacterial and insect pests. An emerging fungal disease in Australia is neopestalotiopsis (NPT), however, our program has a resistance to that unlike other programs.

“One of the most important tools our program has developed is the mapping of the octoploid strawberry genome (eight copies of chromosomes). This has provided the platform to identify genes

and complexity of genetic inheritance for the traits we are working on to speed up improvements and identify best strategies for moving forward with each trait. This has been a major accomplishment of the program and industry as a whole,” he says.

Top 10 countries growing UC Davis varieties

1. USA (500 million plants per year)
2. Mexico
3. Chile
4. Australia (35 million plants per year)
5. European Union
6. Argentina
7. South Africa
8. Brazil
9. New Zealand
10. Ecuador

The program is targeting specific varietal traits by testing in regions that grow field-grown different flowering types including early season, short day variety, day-neutral, Northern Hemisphere Fall and frigo-planted (cold storage) extreme day-neutral environments.

“We are proposing to trial frigo planting in places like Argentina and see if there is a market for that in Australia too,” he says.

“With each of these growing environments comes a particular set of disease and pest problems to assess our genetics for performance against. Learning the underlying causes and genetic resistance inheritance drives our product selection and advancement.

“We look at multiple and diverse traits. There are some 350 aromas for example, and this is becoming an important consideration from a consumer perspective. One of the traits with both UC Golden Gate and UC Monarch is that they have a more expressive fruit display – where the trusses are spread out – which make picking easier and will influence a farmer’s bottom line.”

The program also needs to identify varieties resistant to salt tolerances, heat and drought stresses and rain tolerances as the world encounters increasing pressures such as climate change, he says.



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