Australian Government

DELIVERING SUSTAINABLE AGRICULTURE AND BIOSECURITY

Across America's Deep South, farmers are growing Australian-derived cotton and, as a result, slashing their use of pesticides. It's part of a global drive to increase production and sustainability involving Australian and American researchers, and agritech giants such as Monsanto, Dow Chemical and DuPont. **All these companies have agreements with Australian researchers helping to develop the next generation of smart crops.** The underlying technologies are being applied to dozens of crops and even to medical research. **Meanwhile, US and Australian scientists are working side by side to enhance biosecurity—fighting deadly new killers such as Nipah virus, ancient plagues such as malaria, and emerging threats to agriculture and the environment.** American scientists working in Brisbane are testing biological controls to fight against invasive plants that threaten the Florida Everglades, while NASA technology is helping Australia cope with its locust plagues and teams across both countries are trying to understand what is killing frogs worldwide.

Smart, sustainable crops

The southern US states are famed for their cotton fields, but what many of the farmers there might not realize is that their plants are likely to be derived from Australian varieties developed by CSIRO. These varieties are high yielding, water efficient, disease resistant and produce high-quality fiber, and with the incorporation of GM technologies, are pest resistant. CSIRO-derived varieties account for more than 35 per cent of the US cotton crop, and over 60 per cent in Texas. In Australia these varieties have resulted in an 85 per cent reduction in pesticide use.

US companies are already investing in one of the more promising next steps towards improved crops with Hexima, a biotechnology company in Melbourne.

Hexima is based on the discovery of two families of genes that help protect plants from fungus and insect attack. Hexima scientists, led by plant molecular biologists Professor Adrienne Clarke and Professor Marilyn Anderson, have found a third gene complex that plants use to make, package and release a set of protective proteins that help them to fight off invaders. The team has found a way to hijack this system, inserting genes so that the plants will produce any set of proteins the researchers want. Their work is considered so important for future agriculture that Hexima has concluded agreements with the three largest US agrichemical businesses, DuPont, Dow and Monsanto.

Meanwhile, underlying tools developed by CSIRO, such as gene shears and gene silencing in plants, have become part of the molecular biology tool kit for researchers worldwide.

Fighting back against emerging diseases

When the Hendra and Nipah viruses emerged, killing people and animals in Australia and Southeast Asia, the virologists at CSIRO's Australian Animal Health Laboratory (AAHL) were thrown into the front line. With support from their colleagues at Centers for Disease Control in Atlanta and the US Department of Agriculture's (USDA's) Plum Island facility, they quickly identified the new viruses, and showed that bats were the carriers.

AAHL is one of the world's most sophisticated biological containment facilities, capable of working with large animals at the highest biosecurity levels. It's been kept busy in recent years responding to emerging threats such as SARS (severe acute respiratory syndrome), chikungunya virus, and the chytrid fungus currently devastating frog populations across the world. At the same time, it continues to develop better tools to fight ancient threats such as foot-and-mouth disease.

Protecting grapes and fighting locusts

Through the Cooperative Research Centre for National Plant Biosecurity (CRCNPB), Australian researchers are working with Cornell University to trial a new pruning regimen for grape vines to control the destructive black rot caused by the fungus *Guignardia bidwellii*. CRCNPB also is testing NASA's Terrestrial Observation Predictive System as a way to assess the growth stage of crops and predict where plague locusts are most likely to spread.

Saving the Everglades

Many invasive weeds in the US, particularly in Florida, originated in sub-tropical and tropical Australia or Southeast Asia. So, since 1985, the US has maintained an Australian Biological Control Laboratory as a base for searching the region for useful biological control agents and testing them. The laboratory currently is based at CSIRO's Brisbane facility and operated by the USDA.

People

A vision for smarter crops

A Foreign Associate of the US National Academy of Sciences and former head of CSIRO Plant Industry, Dr Jim Peacock is a passionate advocate for the power and potential of genetic manipulation of plants as a means of improving agricultural production while reducing its environmental impact. Under his direction, CSIRO has developed many new plant varieties and a range of tools for improved plant breeding.

Dr Peacock is also a former Australian Chief Scientist, former President of the Australian Academy of Science and an Australian Prime Minister's Science Prize winner.

Plants that do their own weeding

Professor Leslie Weston holds patents for bioherbicides in grass and is working toward turf and pasture grasses that would directly suppress weeds—a lawn that weeds itself. Previously based at Michigan State University, Professor Weston is the Strategic Professor of Plant Biology at Australia's rural Charles Sturt University. She has become an expert on the ecology and biology of invasive weeds and their long-term impact on Australian ecosystems.

Fighting mosquitoes with bacteria

An entomologist from Queensland, Ms Bodil Cass was part of a team led by Professor Scott O'Neill at the University of Queensland that showed the bacterium *Wolbachia* could be introduced into and shorten the lives of the mosquitoes that carry yellow fever and dengue fever viruses. This restricts the capacity of these mosquitoes to transmit disease. Because of this potential, the project has received funding from the Bill and Melinda Gates Foundation. Ms Cass is studying for her PhD at the University of Arizona, investigating the interactions of symbiotic bacteria living inside insect pests and their impact on biocontrol programs.

IMAGE CREDITS: PHD STUDENT ELENA VIRTUE AT THE AUSTRALIAN ANIMAL HEALTH LABORATORY, CSIRO; COTTON FIELD READY FOR HARVEST IN VIRGINIA, ISTOCKPHOTO; RED-EYED TREE FROG, ISTOCKPHOTO; EVERGLADES NATIONAL PARK, ISTOCKPHOTO.