

Biotech Bulletin 6

Biotechnology for Livestock, Pests and Aquaculture

Welcome to this edition of Agrifood Awareness Australia Limited's (AFAA) Biotech Bulletin. This edition of the Biotech Bulletin entitled "Biotechnology for Livestock, Pests and Aquaculture" focuses on the use of gene technology and biotechnology in animal production.

There is a considerable amount of research under investigation globally using gene technology and biotechnology in animal production. Australian research in this area is contributing significantly and aims to increase the production and efficiency of livestock by:

- Managing pest animals;
- Increasing the nutrition levels of animal feed;
- Prevention, treatment and disease diagnosis;
- Genetically modifying animals to be more productive.

MANAGING PESTS

Pest animals are a major concern in Australia destroying the biodiversity and impacting agricultural grazing and cropping industries. Researchers are using gene technology to investigate the control of four major pests, the carp, fox, mouse and rabbit.

Carp

A program entitled "Daughterless Carp" aims to develop a biotechnology solution for carp control in Australia. Carp cause significant damage to waterways and are becoming increasingly dominant over native fish species.

Researchers aim to use gene technology to interrupt the sex determination process which would result in only male offspring. Over many generations, fewer females are produced, eventually driving the overall population down. Potentially, the "daughterless" technology could also be applied to other pest species.

Fox

Australia's number one predator, the fox, threatens native wildlife and poses as a potential host of exotic diseases. Researchers are working on developing a fertility controlled vaccine that is spread using a non-toxic bait specific only to foxes. This will be achieved using gene technology to genetically modify a bacteria or virus that includes a fertility control gene in the bait.

Mice

Mouse plagues in south-eastern Australia's grain belt cost growers millions of dollars in losses. Within a decade, farmers may be controlling plagues with a genetically modified (GM) virus that prevents mice breeding. The GM virus being investigated occurs naturally in mouse populations and only infects wild house mouse.

Researchers have added a modified gene to the virus to block sperm from fertilising eggs, so the animal becomes sterile. The virus is a herpes virus and spreads only by sexual contact. Female mice, under laboratory conditions, exposed to the virus for six months have become infertile, and produced no young. Tests so far confirm that the virus cannot infect native animals.

Rabbits

Rabbits are still Australia's most widespread and destructive pest animal despite the successful introduction of biological control agents such as myxomatosis and rabbit calicivirus.

Rabbits compete with native wildlife for food and shelter and are estimated to cost farmers more than \$600 million in lost production each year, causing considerable soil erosion by removing plant cover.

Researchers are using gene technology to control rabbits through limiting their reproduction. They are working on developing fertility a control vaccine that will be delivered to rabbits using the myxoma virus – the virus that causes myxomatosis. The myxoma virus will be genetically modified to include a fertility control gene.

For further information on the management of pests see the Pest Animal Control CRC www.pestanimal.crc.org.au and CSIRO at <http://csiro.au/pubgenesite/>.

INCREASED NUTRITION IN ANIMAL FEED

Lupins

In Western Australia researchers have developed GM high sulphur lupins. The GM lupins contain a sunflower seed gene that increases levels of sulfur amino acids in the seed. Increasing the levels of these acids in seed should increase the nutritive value of seed for animal feed. Sheep fed the previous GM lupin lines from field trials gained live weight faster and grew wool faster than those fed conventional lupins.

Lucerne and white clover

Researchers at CSIRO are working to genetically modify lucerne and white clover so that these pastures do not cause bloat. Bloat is caused by foaming in part of the cow's gut. Foaming automatically closes a muscle in the throat of the animal, preventing gas from escaping. This pressure on internal organs crushes them and causes death. The results of animals eating pastures like lucerne and white clover can be disastrous.

Researchers are working to identify the genes for producing tannins, the possible answer to bloat. White clover and lucerne are a very nutritious component of a cow's diet, so taking them off the menu is not an option. However, using gene technology researchers are modifying the pastures to produce tannins. When tannins are present in pasture, foaming does not occur, therefore preventing bloat.

For further information visit http://csiro.au/pubgenesite/research/crops_fruit_pastures/bloat_short.htm

Pasture

Genetically modified pastures could also help cattle absorb more of the protein contained in their feed, increasing productivity and efficiency in both livestock and milk production. Prime lambs could also benefit from the GM pastures, with an estimated 10 per cent increase in growth rate.

For further information visit http://csiro.au/pubgenesite/research/crops_fruit_pastures/bloat_short.htm

DISEASE PREVENTION, TREATMENT AND DIAGNOSIS

Cattle

Researchers are developing a vaccine using gene technology they believe will protect cattle in Australia's tropics against the potentially fatal tick. The tick transmits a parasite disease called anaplasmosis, which causes severe anaemia and even death.

An existing vaccine developed by CSIRO only protects cattle from ticks, but not anaplasmosis. The new vaccine could save thousands of cattle exposed to the tick disease each year, by reducing producer's costs and losses.

Mosquito

Another area of research CSIRO researchers are considering involves genetically modifying mosquitoes. Researchers are working to control the spread of mosquito-borne diseases like malaria, Murray Valley encephalitis and Ross River fever using GM mosquitoes.

Pigs

Researchers at CSIRO are developing animals that are disease resistant and better adapted to farming, improving their health and productivity.

Stress caused by environmental conditions and mild infections, with no obvious symptoms, is believed to be the fundamental reason for growth rates to fall in pigs. Stress impairs the immune system making animals more susceptible to infection, therefore reducing production.

Researchers are identifying genes involved in resistance to disease and stress. Knowing how animals respond to stress and disease should help producers develop better management systems that will improve animal health and welfare while lifting productivity.

Poultry

A major concern for the poultry industry in many countries is the infectious bursal disease (IBD). A test has been developed by CSIRO to distinguish between different strains or forms of the virus, and to provide early warning of potentially lethal strains. The virus is transmitted in the birds' droppings, and once present on a farm, it is almost impossible to eliminate. CSIRO scientists have now developed a test that can be used on farms to identify the disease.

Prawn

Australian farmed prawns are in demand internationally. One of these, the Kuruma, is the most valuable and is in high demand by Japanese markets. CSIRO researchers using gene technology have pinpointed a sex-determining gene in Kuruma prawns. Female prawns grow a lot faster than male prawns. Using this technology prawn farmers will be able to increase their productivity by growing more females than males.

Sheep and Cattle

Johne's disease, a bacterial infection, causes heavy losses in sheep and cattle. Johne's disease is a difficult infection to diagnose and fight. Sheep and cattle usually pick up the disease very early in life. CSIRO researchers are developing tests to diagnose the disease early in the development stage of young sheep or cattle, so that infected animals can be culled to limit the spread of the disease.

The disease is caused by a bacterium and may not produce obvious signs of infection for several years. If researchers are successful the test kit for Johne's disease could be on the market within a few years.

For further information visit http://csiro.au/pubgenesite/research/animals/johnes_finalsum_short.htm

INCREASED PRODUCTIVITY – GM ANIMALS

Cattle

Australia's first cloned and genetically modified calves were born in 2002. The calves contained an extra gene for milk protein production. The aim was to produce animals which produced more nutritious milk. Conventionally bred cows have about three-and-a-half per cent protein in their milk. With the extra cow protein gene, the protein content of the milk from the calves could be increased by 10 per cent.

Unfortunately due to difficulties in the early stages of development, only one of the four calves has survived. With cloning still a reasonably new technology in Australia, researchers are determined to fully understand and investigate the genetic makeup of the cow to refine the cloning technology for the future.

For further information visit

http://www.dairycrc.com/html/getFile.asp?table=tbl_TCA_Article_Files&field=image&id=110

Sheep

Genetically modified sheep which contain an extra copy of a sheep growth hormone gene have been produced by CSIRO researchers. The first GM sheep were born in 1987.

The GM sheep grew faster and were leaner and larger than conventionally bred sheep and in some breeds produced more wool and more milk for a prolonged period. However, some of the sheep suffered side-effects from excess growth hormone, such as diabetes, hooves which required regular trimming and overgrown knuckles. The sheep were also more susceptible to internal parasites. This research has now concluded.

For further information see

<http://www.csiro.au/index.asp?type=mediaRelease&id=prgmsheep&style=mediaRelease>

In other research, CSIRO researchers using gene technology have developed a system that is being used to determine paternity reliably. It involves taking a small blood sample from the animal and analysing its DNA. Researchers will also use the system to identify genes for rapid wool or meat growth and detect rams carrying undesirable characteristics like coloured wool.

Salmon

Researchers in North America have genetically modified salmon to grow faster than conventional salmon. The salmon contains an additional salmon growth hormone gene, and an antifreeze gene from an ocean pout fish which will allow it to produce growth hormone all year-round, rather than just producing growth hormone in the warm months like conventional salmon. The GM salmon is still awaiting final regulatory approvals from US regulatory agencies.

For further information visit www.aquabounty.com

Agrifood Awareness Australia Limited has recently compiled a new fact sheet, entitled "Gene technology and animals in agriculture" available under "What's New" at www.afa.com.au.

We look forward to your feedback on this newsletter.

For further information, please contact the AFAA office on (02) 6273 9535 or via email – info@afa.com.au

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