Building flock environmental fitness

By Dr. Jim Watts

Environmental fitness is defined as the ability of the animal to thrive and rear healthy progeny in climatic conditions that span from drought to flood. SRS® breeding is focused on improving the number of healthy progeny reared by each dam throughout its lifetime. Fitness Figure 1. This is the key driver, along with improving fibre density and length, of our stud breeding programs.

“Survival of the fittest”
One of the key elements of environment-

Fitness Figure 1: Maximising lamb numbers whilst minimising lamb losses, Photo: Eric Chandler.

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tal fitness, and the survival of the subspecies (or breed), is to have its population similar to near identical in appearance. Fitness Figure 2. It is the same in the wild as it is in domesticated animals.

And it needs to be the right appearance. In the case of the Merino sheep, it is a plain-bodied and open faced animal with good body reserves of muscle and fat.

The progeny of the plain bodied Poll Merino ram shown in Fitness Figure 3, and the ram itself, fit this description. The progeny recorded the best performance across most traits measured in the wet years of the Longreach sire evaluation trial (2010-2011) and the drought years of the Bollon sire evaluation trial (2012-2013) in central western Queensland.

A wrinkly Merino sheep is the wrong phenotype, and these animals often vary greatly in appearance. It is unable to control its body temperature and hydration as efficiently as the plain-bodied sheep in hot environments. It spends more time walking to water and grazing, and less time resting in the shade.

**Lamb survival**

Merino lamb losses, as foetuses and neonates, can be extraordinarily high, circa 40%, when joining occurs "out of season" (spring and summer) rather than in the breeding season of autumn (Howe and Watts, 2016a). And most concerning, 75% of the Merino sheep matings in Australia are out-of-season.

Howe and Watts (2016a) have shown that when both rams and ewes are in a physiological state equivalent to the natural autumn breeding season (treated with Regulin®, melatonin, Ceva Animal Health),

**Fitness Figure 2**: Near identical phenotypes of Merino sheep, angora goats, alpacas and in nature.

**Fitness Figure 3**: The plain bodied SRS ram, WellGully M1005, after a deluge of rain.

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single foetuses are 55% less likely to be lost and twin foetuses 60% less likely to be lost. When just the rams, and not the ewes, are so primed, the risk of single foetuses and twin foetuses being lost is reduced by 35% and 40% respectively. The hallmark of neonatal survival, long birth coats of the progeny, was greatest when the rams were in peak reproductive physiological states.

Howe (1989) and Howe and Watts (2016b) also showed that by artificially inseminating Merino ewes with the semen of Merino rams collected either in the autumn or the spring, 19% of the ewes inseminated with spring collected semen lost their embryos and foetuses within 68 days of conception whereas only 4% of the ewes inseminated with autumn collected semen failed to hold their pregnancies.

**Day length impacts ram fertility**

Semen quality alters dramatically in small ruminants in response to day length changes. These alterations are linked to seminal plasma protein changes in the male and these, in turn, marked affect the normality of the spermatozoa.

Huge increases in the numbers of spermatozoa that are ROS (reactive oxygen species) stressed and subsequently DNA damaged occur with out-of-season matings and semen collections (Howe, 1989).

Clearly, foetal deaths resulting from semen produced or collected out-of-season (spring and summer) represent a major loss to the sheep industry.

At the SRS Merino stud, Karbullah, in the challenging environment of south western Queensland, the lamb loss in the last two drought years has averaged 14%, with the best ram at less than 4% lamb loss, Fitness Figure 4.

This is an important achievement, and ongoing. Key factors have been autumn joining, the excellent genetic reserves of muscle and fat in the parents and progeny, and the calm temperament of the dam and lamb.

And there other important factors to be considered such as birthing ease and milk supply of the dam.

**Gene expression**

Howe and Watts (2016b) showed that post-implantation foetal death is 3.5 times less likely in autumn conceptuses giving better lambing percentages, and better phenotypes.

Autumn conceived sheep were twice as likely to be free of facial pigment. 29% of autumn conceived sheep had high density and length fleeces compared to 8% of spring conceived sheep in one case study and 34% versus 22% in the second. Autumn conceived ewes were 1.8 times more likely to be classed as studs compared to those conceived in spring and were 80% less likely to be culled.

They suggested that the phenotypic differences are epigenetically influenced via semen quality. They also indicated that that this source of production loss is huge and potentially a concern from an animal welfare perspective.