How this researcher is transforming the goose industry one ‘artificial day’ at a time

**Domestic geese** are economically important waterfowl that supply eggs, meat and feathers to many parts of the world. The goose industry is particularly lucrative for China, which, as of 2015, supplies over 90% of the world’s geese.

However, seasonal breeding behaviours restrict the production of goslings and commercial meat goose production to a certain time of year. This causes large price fluctuations for the birds throughout the year and discourages goose consumption. Through their research, Professor Shi and his team hope to induce continuous, year-round breeding in geese, leading to improved economic efficiency, sustainability, growth and modernisation of the goose industry.

Over the last 15 years, Professor Zhendan Shi of Jiangsu Academy of Agricultural Sciences and his team have sought to turn the goose industry on its head by changing hormone creation and secretion in the pituitary gland underneath the brain (as explained in Figure 1). These hormones, called gonadotrophins, stimulate gonad growth and development and sexual behaviour. Likewise, the photoreceptors can trigger the production of another set of hormones that lead to gonad regression and end the breeding season.

**NATURE OF SEASONAL BREEDING**

Seasonal breeding is a physiological mechanism that helps animals living in the wild to cope with the seasonal light cycles and food availability. Wild birds living in cold or temperate regions rely on seasonal breeding to ensure their offspring have maximal chances of survival. The timing and duration of their breeding season is based on seasonal changes in environmental conditions. In the case of geese, this is the extended breeding season of type 2 geese (Yangzhou geese) is attributed to milder temperatures experienced in the temperate zones and less extreme changes in daily photoperiods. Meanwhile, the milder winters experienced by type 3 geese (such as Magang geese) living in subtropical zones allow them to continue their breeding season for most of the year. However, unlike the long day breeders, these geese do not fare well in summer.

**A MATTER OF TIME**

In practical production of the goose industry, the lack of eggs laid in summer interrupts geese hatch ing and commercial goose production. This sends the prices of meat goose and goslings skyrocketing. Farmers therefore wish to be able to breed goslings out-of-season in the summer months. Professor Shi first started to help farmers solve this seasonal breeding problem by changing the breeding Magang goose in Guangdong Province. Treating birds with a very long photoperiod of 18 hours of light per day in winter months allowed them to stop egg laying. After the geese rested for two and a half months, and were ready for laying eggs again, a shortening of the daily photoperiod to 11 hours from early spring induced the geese to lay eggs again. This short 11-hour photoperiod helped to maintain good secretion of the pre-reproductive hormones, gonadotrophins, but depressed secretion of the reproduction-inhibiting hormone prolactin. Geese were able to manifest full egg laying activity. With this photoperiodic system, the egg laying capacity of Magang geese could be increased from the norm of 35–40 by 30% to 50–55.

The story on the long day breeding Yangzhou geese is more complicated. In opposition to that used for the Magang geese, a simple photoperiod program
While domestic geese don’t have to worry about harsh winters or long migrations, they continue to display seasonal breeding behaviours.

(8 hours per day in winter, and 12 hours per day from spring to summer) was used to induce egg laying in summer months. However, the egg production performance following this regime is not very long, only yielding 45 eggs per bird. An additional treatment of a very long photoperiod of 18 hours for one month prior to the 8-hour short days, can prime the geese to synthesise higher amounts of pro-reproductive hormones or gonadotrophins, FSH and LH, and enhance the egg-laying capacity to 55 eggs per bird. If the daily photoperiod is further shortened from the previous 12 hours to 11 hours, secretion of prolactin is decreased for much shorter periods, and the reproductive system remains fully active accordingly, so egg production is further increased to 70–75 per bird.

While this may not sound important, it has huge implications for goose productivity and profit margins within the Chinese goose industry. As a result, farmers using the out-of-season laying technique have achieved net profits four to six times higher than those using natural reproduction of goslings and almost double those naturally producing commercial meat geese.

The ability to produce geese out-of-season using artificial photoperiods has significantly improved productivity and profit margins within the Chinese goose industry and caused farms to grow exponentially. In fact, annual production of commercial geese has increased at a rate of three to four percent per year since the technique was developed in 2000. Currently, there are 87 million commercial geese produced each year in Guangdong Province alone, compared to 41 million in 2000.

The goose industry’s rapid growth has helped foster year-round consumption and encouraged enterprises to invest in goose production in anticipation of increasing market demands – particularly in north and east China.

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This has helped change farmers’ lives considerably. Where goose raising used to be a small-scale family side practice, it has now become a specialised, lucrative business. High earnings have helped farmers to not only improve their living standard, but also to educate themselves, as well as their younger generations.

The latter are now more attracted to farming and developing agri-business, which adds new impetus to rural development. Professor Shi expects this trend to continue with widening adoption of his out-of-season breeding technique and modernisation of the goose industry.