

Understanding hormonal growth promotants

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Introduction

In animal species, the female ovaries and male testes produce hormones that play vital roles as animals grow to maturity. The ovaries produce mainly the hormone oestrogen, plus some progesterone, and the testes mainly produce the hormone testosterone.

In beef cattle production, castration removes the testes and the source of androgen from male calves. Because of the commercial need to continue to castrate male calves, researchers began to look at the use of naturally occurring and synthetic hormones to improve growth rates in cattle. This journey has seen the development of hormonal growth promotant products (HGPs) that target cattle based on sex and that can be used at specific times in the animal's growth and development stages.

HGPs were first used in the USA beef industry in 1947 and in Australia their use began in 1979.

In Australia the chemical compounds used for growth promotion that are registered with the APVMA (Australian Pesticides & Veterinary Medicines Authority) are:

- naturally occurring steroids
 - oestrogens (oestradiol 17 β , oestradiol benzoate)
 - progesterone
 - testosterone (androgen)
- trenbolone acetate – a synthetic steroid (androgen)
- Zeranol – a synthetic, non-steroidal oestrogen, originally discovered in fungus-infected corn; it belongs to a class of compounds known as β -resorcylic lactones.

Oestrogens

Oestrogens are most important. Comprehensive worldwide research has identified oestrogens as the major class of growth promoting hormones.

Consequently they are the base hormone in most HGP implants registered for use in cattle in Australia. There are two oestrogen hormones: oestradiol 17 β and oestradiol benzoate. Since they have the same activity they are used individually or in combination with a progesterone or androgen hormone, in implants.

The oestrogenic implants increase protein deposition by increasing the concentration of growth hormone (GH) secreted. It is the GH that stimulates the anabolic process of cell division, skeletal growth and protein synthesis (all growth promoting activity). At the same time the GH increases the oxidation of fat and inhibits the transport of glucose to the body tissues. This makes the glucose and fatty acids available as an energy source to the animal to build muscle.

Zeranol is a non steroidal compound which mimics the role of oestrogenic hormones. It is used alone in one product formulation.

Progesterones

Progesterone is a female hormone that prepares the uterus for the fertilised ovum and helps to maintain pregnancy.

Progesterone is used in 'combination' HGP formulations with oestradiol benzoate, specifically for use in steers.

Hormones derived from one sex, when used in the opposite sex, produce additional growth in that animal.

Androgens

Androgens are not as decisive growth promotants as oestrogens. Research work has shown clearly that at the dose rates delivered by current implants, response to androgens depends on average daily weight gain more than with oestrogens.

- Testosterone propionate requires more than 0.8 kg/day average daily gain (ADG)
- Trenbolone acetate (TBA) requires more than 0.8 kg/day ADG on pasture

Testosterone propionate is used in combination with oestradiol benzoate, specifically for heifers.

TBA is used in combination with oestradiol benzoate for use in finishing both steers and heifers.



Synthetic androgen (TBA)

The synthetic androgen trenbolone acetate (TBA) has 3–5 times the androgenic activity and 8–10 times the anabolic activity of testosterone. Research has clearly shown TBA to promote growth alone at high growth rates (above 0.8 kg ADG) and when combined with an oestrogen at all growth rates.

Hormone formulation

Manufacturers use the oestrogen and androgen hormones (singularly or in combination) to target specific grazing conditions, level of nutrition, sex, and market end points of cattle.

Compressed pellet implants

Most HGP products are compressed pellet implants. The exceptions are the Compudose 100, 200 and 400-day products.

Compressed pellet implants are made by compressing the active ingredient with a carrier. Dose rate and payout of the hormone is controlled by the number of pellets in the implant.

The payout period (functional life) of these pellets is 60–120 days while most label directions state re-implant periods of at least 70 days after the first treatment.

Pellets containing oestradiol plus androgens have a slower and more sustained release of the oestradiol than pellets containing only oestradiol.

Silicone rubber implants

These are used for the Compudose 100, 200 and 400-day range of products. The only growth promoting hormone used is oestradiol 17 β .

The oestradiol is impregnated into the silicone rubber, which has an inert rubber core. The payout period is determined by the thickness of the silicone rubber. The amount of oestradiol delivered each day is dependent on the implant surface area. Research has shown that silicone rubber implants have a longer functional life than compressed pellets.

Anabolic activity

Anabolic activity is the period of bone and muscle growth increase. Research results indicate that compressed pellet implants do not stimulate anabolic activity beyond 140 days after implantation.

USA research using high energy feedlot diets shows response variation to be determined by hormone. Implants containing TBA gave 30–60% responses during the first 28–35 days after implantation, diminishing over 120 days for a 15–20% response. Oestrogen-based implants gave a 5–10% response over the first weeks.

For grazing cattle, the period of anabolic activity is solely dependent on the level of nutrition, measured as digestibility, total herbage mass and percentage green.

Product registration in Australia requires scientific evidence to support weight gain claims made on labels.

Fat cover

HGPs have an action that causes a greater proportion of metabolisable energy intake being partitioned towards protein vs. fat deposition. The increase in carcass leanness at any given liveweight varies from 5% to 8%.

Actual measurable differences in carcass composition will depend on the implant used, the length of the program, stage of growth at which the cattle were implanted and the maturity type of the cattle.

Meat eating quality

The last 10 years has seen research interest in the effect of HGP treatment on the eating quality of beef. The 'balanced' view on HGP treatments, especially repeat implantations, is that they lead to small reductions in tenderness and eating quality.

There is no research work that differentiates between different growth promoting hormones and eating quality. Untrained panellists do not detect eating quality differences between treated vs. untreated cattle. Trained panellists do detect small differences.

Treating females

HGPs registered for use in heifers carry the warning that the product should not be used in breeding females. The reason for this warning is that both oestrogenic and androgenic growth promoting hormones impair (temporarily or permanently) ovarian development and function, and mammary gland development.

Producers should follow the manufacturers' label directions.

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