Growth, maturity and carcase specifications

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Session 2a

Introduction

The aim of this session is to set a simple foundation for understanding the main principles of growth and maturity. This is the basis for deciding how to find the best combination of frame size, muscling, breed type and nutrition to meet market specifications for weight and fat depth.

A general growth curve

Let's imagine Figure 2a-1 is the growth curve for a typical steer from birth to maturity, with adequate nutrition to meet his basic needs:

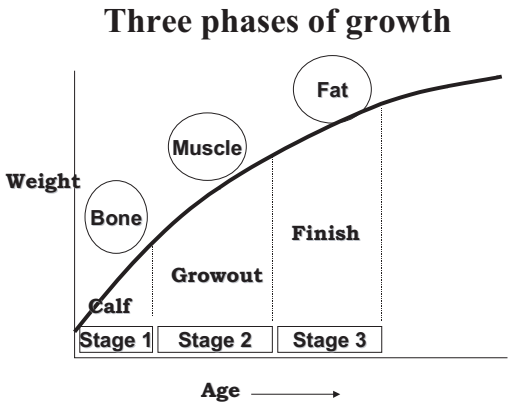


Figure 2a-1. General growth curve

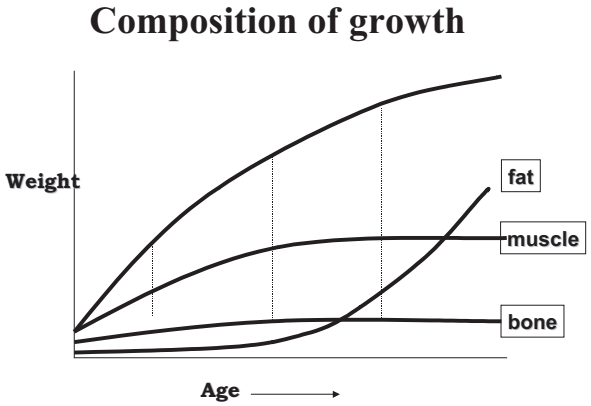


Figure 2a-2. Composition of growth

As the animal grows from birth to maturity, there are changes in the proportion of fat, muscle and bone (Figure 2a-2).

Stage 1 - Birth to weaning (say 6-7 months)

After birth, bone growth is first priority, to establish frame for future body growth. New muscle cells are being formed and muscle weight increases rapidly. Fat is only deposited in small quantities.

A calf requires nutrition of very high *quality* to develop bone and muscle, and this is mainly ensured by milk from its mother. Inadequate nutrition at this stage affects future development.

The carcase at this stage has a high bone content, high muscle, low fat, with low gut weight.

The meat from calves is tender, has little hard connective tissue, and not much flavour.

Stage 2 - Growing out

In mid growth (say after weaning at 6-9 months) bone growth continues but the animal's main priority becomes muscle growth. Normally, fat is only deposited in small quantities. This is the "backgrounding" or "growing out" phase.

The growing animal requires high quality protein-rich diet, and the rate of development during this phase is very sensitive to feed *quality*.

After weaning, gut weight increases markedly to cope with digesting roughage diets – this keeps dressing percentage down. The carcase itself has an increasing ratio of muscle to bone, and very little fat, so generally has a high yield (percentage of saleable meat).

Meat is tender at this vealer/yearling stage,

and has more flavour. Fatter animals generally have better eating quality, with less risk of cold shortening and enhanced juiciness from small amounts of marbling.

Stage 3 - Finishing/maturing

When growth of bone is largely completed and all muscle cells have been established, all that is left is for muscle cells to fill out, and after that, surplus energy is stored as body fat.

As animals mature, they can exist on quite poor quality feed, but if feed quality is good, they can express their muscle potential and accumulate fat very quickly.

As fattening takes place, fat is deposited in the gut and carcase depots (subcutaneous or selvedge fat, intermuscular or seam fat, and intramuscular or marbling fat). The carcase becomes an increasing proportion of the total body, so dressing percentage rises. The yield of saleable meat in the carcase falls as the need for fat trimming rises.

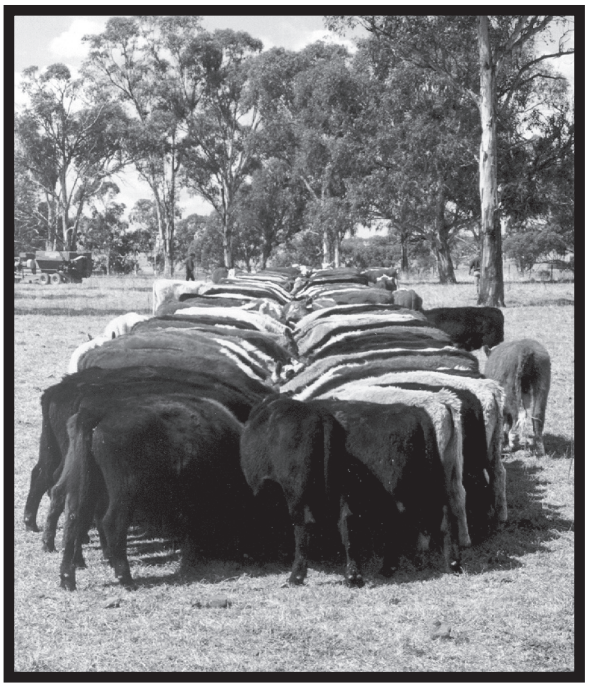
Meat flavour reaches its maximum in the prime cuts of a mature, finished steer, but as connective tissue increases with age, there is a decline in tenderness, especially in the secondary cuts.

Cattle with different growth curves

Sex

Heifers – given the same access to nutrition as steers, heifers grow a little less bone, considerably less muscle, and put on considerably more fat. They follow a "flatter" growth curve with an earlier end point i.e. are *earlier maturing.*

Bulls – they grow more muscle and bone, and are less inclined to put on fat. They have a longer period in Stage 2 and greater amount of muscle in Stage 3 – they are *later maturing.*



Frame size

Large framed cattle grow to a higher mature weight and take a little longer to reach mature weight (later maturing).

Small framed cattle grow to a lighter mature weight and get there earlier (earlier maturing).

Muscling

Heavily muscled cattle at the same frame size take a little longer in Stage 2 to fill out their muscling, and carry more muscle and less fat later in life. They are heavier, and effectively later maturing than average-muscled cattle of the same frame size.

Lightly muscled cattle are like heifers, and finish their muscle growth earlier and at a lighter weight, putting the surplus into extra fat.

Cattle that are BOTH large framed AND heavily muscled, such as most European breed types, can be very late maturing. This means they are very difficult to fatten at lighter weights, and need to be carried to very heavy weights to finish adequately.

Maturity and market specifications

Market specifications are mainly described in terms of age, sex, weight and fat depth. As most of our target markets focus on young growing steers, *weight* and *fat depth* are the two main factors to think about.

It is therefore important to know what makes cattle put on fat faster or slower as they grow. This will determine whether they are "finished" and meet the target specifications for any particular market.

Changing the growth curve for a particular animal

There are many factors which can change the actual growth path of a particular animal, and therefore arrive at different combinations of weight and fat depth, to determine market suitability. The main factors are nutrition and genetics.

Nutrition

Nutrition in Stage 1

If nutrition is better than adequate, it allows full development of potential bone and muscle, and may even allow some surplus to be deposited as fat. Such calves are highly sought after for slaughter as vealers at 7-10 months. If they have adequate frame size and muscling, they still have the potential to grow on and mature at heavy weights.

On the other hand, severe restriction in Stage 1 results in impaired bone and muscle development – these calves don't catch up when they are put on good feed later, and will produce carcases with lighter weight, less muscle and more fat. Be wary of buying lightweight weaners (say under 180kg) to finish, and be aware that early weaned calves requires special attention to their nutrition, to ensure they retain their potential.

Nutrition in Stage 2

Cattle receiving better than their basic requirements for growth in Stage 2 can produce plenty of muscle and deposit some fat. Most of our table beef quality domestic and export cattle are slaughtered in this stage of life, around 50-70% of mature weight. High quality pasture, forage crops or feedlots will provide the good nutrition required to finish cattle while they are still actively growing.

Restriction of nutrition in Stage 2 affects the size of muscle fibres, but if they have had a good start in life this will be temporary and reversible. On returning to good feed they will recover, expressing compensatory gain. Fat deposition will be delayed a little, resulting in leaner, higher yielding carcases. These benefits are used by cattle finishers to enhance their profit.

Nutrition in Stage 3

In Stage 3, cattle finish the development of their bone and muscle structure. They can gain or lose weight according to available nutrition, with the main effect being on the proportion of body fat.

Recovering from poor condition, they fill out their muscles first – this happens quickly when they have finished growing - and then put the surplus back on as fat.

Mature cattle are very easy and quick to finish, once relieved of their breeding responsibilities, provided of course that they are sound (especially teeth) and healthy.

Virtually all steers are slaughtered before Stage 3, so the main cattle in this group are cull females and bulls.

Genetics

Breed effects

The main breed effects on maturity and carcase composition can be explained in terms of muscling and frame size. Be aware that generalising is dangerous - there is a wide (and growing) variation between animals within each breed in frame size and muscling.

Some breeds generally have larger frame size e.g. Charolais, Simmental. These are later maturing and finish at heavier weights

The British breeds tend to have a more moderate frame size, and finish at moderate weights. Some British breeds have increased their frame size and mature weight significantly in recent years.

Breeds which are strong in muscling (high muscle to bone ratio) produce higher yielding carcases and are often prominent in carcase competitions. The Limousin is a heavily muscled breed with a moderate frame - it produces high yielding carcases at heavy weights, while the Murray Grey has a smaller frame, and produces high yielding carcases at more moderate weights.

Breeds which are BOTH large framed AND heavily muscled will be very late maturing.

Selection within breeds

It is very difficult to breed to a maturity type if you select your bulls by eye, because what you see - their frame, muscle and fatness - are strongly influenced by non-genetic aspects of their upbringing.

In most breeds, BREEDPLAN produces EBVs which producers can use to select sires which will fine-tune carcase yield, fatness and muscling and mature size.

Final comments

Matching genetics, nutrition and market suitability is a three-dimensional challenge, especially as all of them are dynamic. Cattle with moderate frame size and medium to heavy muscling are most versatile, because with reasonable nutrition they can produce high-yielding, modern carcases, which fit nearly all of our mainstream markets.