

Pharmacology for Cowboys

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Bovine Dynamics

Review of Australian feedlot data (Bovine Dynamics, 2011) identify that combined feedlot induction and therapeutic costs sum to \$7.13 and \$5.10 per head fed, respectively. This represents a total feedlot animal management investment of approximately 24.5 million dollars annually. Clearly, from the perspectives of animal welfare and treatment success, societal responsibility of oversight of the food supply chain and feedlot economic health, we have a responsibility to assure this expenditure is effectively managed.

The heavy stuff:

In Australia, veterinary chemicals that are supplied for use in the prevention and treatment of animal disease must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA). This registration process ensures that animal treatment agents on the market have been rigorously assessed and meet high standards for safety, quality and efficacy. The assessment, registration, manufacture, importation, promotion and supply of veterinary agents are regulated by laws comprising the national registration scheme for veterinary chemicals (NRS), with the centre piece of this scheme being the Agricultural and Veterinary Chemicals Code (or AgvetCode).

Under the Agvet Code, allowances are made for Veterinarians to make professional judgements about the most effective treatment for a particular animal. These may allow treatment recommendations which are inconsistent with the instructions, and/or prepare veterinary chemicals that do not require registration, provided these comply with relevant state and territory laws.

Importantly, under state and territory laws, treatment rights generally require veterinarians to have 'animals under their care,' whereby the veterinarian is engaged by the client and accepts responsibility for the health, welfare and treatment outcomes of the animal in question. The later includes the legal responsibility the full application of treatment procedures and critically the residue responsibly.

This means that the therapeutic decisions that are made in a feedlot that utilise these agents are largely the legal responsibility of the veterinarian. Therefore, detailed therapeutic treatment schedules must be maintained, and agents should not be utilised in a manner that deviates from these schedules. More simply; "Don't write out *therapeutic decision* cheques that your body cannot afford to cash," should an adverse treatment outcome or residue issue arise!

Therefore, the utilisation of these agents to successful therapeutic and legislatively safe and responsible outcomes is a feedlot-veterinary animal management partnership (The Partnership).

The important stuff – Therapeutic principles

A range of biologically active vaccines and therapeutics are utilised in feedlot animal management systems. These include;

Vaccines (killed and modified live)

Endoparasitacides

Ectoparasitacides

Antibiotics

Anti-inflammatories

Immunomodulators

Antihistamines

Vitamins and minerals

Implants

Effective utilisation of therapeutic agents commences with early identification and treatment. Moreover, treatment protocols should be based on evidence from controlled randomised studies and then fine-tuned with outcomes from treatment records.

Assuming an animal or group of animals are identified by 'appropriate selection criteria' that will benefit from a particular treatment or therapeutic application, a series of questions that need to be addressed by '*the Partnership*' before anything is applied or placed into an animal;

- i. What is the treatment goal?
- ii. What route are you going to use?
- iii. What form of drug is the best to use?
- iv. Is it registered for this purpose?
- v. What is the dosage (Units/Kg; Units/head)?
- vi. What is the dosage interval?
- vii. What is the duration of therapy?
- viii. What is the Withholding or Export Slaughter Interval (WHP or ESI)?

Further questions that require addressing include;

- ix. What is the drug cost per treatment and duration of therapy?
- x. What special precautions should be taken to enhance efficacy or safety?
- xi. What are the contra-indications for use of the agent?
- xii. What adverse reactions may we observe?
- xiii. What plans do you have to evaluate the results of your therapy? Treatment protocols should be consistent, with case definitions, such that treatment outcomes can be reliably evaluated.

The answer to these questions and much of the basis behind the feedlot therapeutic strategy will rely on *the Partnerships* understanding of pharmacodynamics—The study of biochemical and physiological effects of drugs and their mechanism of action; and pharmacokinetics —The study of

rate of drug rate processes within the body. Collectively, these involve an appreciation of the processes of the drugs;

- a. Absorption into the body
- b. Distribution within the body
- c. Metabolism of the active agents; and,
- d. Excretion of the agent or its modified components from the body.

With a drug broadly describes as any chemical substance that affects living processes, modification of physiologic function or a biochemical process induced by a drug generally results from interaction between the drug and a component called a receptor. As most drugs exert their characteristic effects at comparatively low concentrations, it can be anticipated that the sites with which they interact exist in minute mounts. Only the initial consequence of the drug-receptor action is termed the 'action of the drug,' however, the drug may cause succeeding events. It is therefore obvious that no drug can exert an effect on a tissue to which it is not naturally capable (i.e., a receptor does not exist). However, some drugs do not exert their actions without combining to receptors. The actions of these are more attributable to their physiochemical properties. In contrast to drugs that act on receptors, these compounds are usually only effective at higher concentrations.

The rate and manner of this drug distribution and excretion directly affect the methodology of drug administration, its duration of therapeutic activity, and its withholding or export slaughter interval.

Not all animals will respond similarly to the same therapy. Typical of most biologic systems; Most cattle will respond well to efficacious treatment that is administered in a timely manner and continued for an adequate period of time. There will be outliers, i.e., some cattle that appear to respond completely and appear as though they would have recovered without any treatment; and, Similarly a percentage of cattle that do not respond well to treatment, regardless of therapeutics used because of a poorly functioning immune system. Duration of treatment and adequate time to recover are two factors important to achieve disease recovery.

The Simple stuff – frequently overlooked items and opportunity

Passionate management of application

As an industry, we would consider success from our major product purchase and administration investment as;

1. Respiratory vaccination - as 100% protected seroconverted cattle,
2. Ectoparasiticide and endoparasiticide administration as zero worm counts, larval culture and lice re-infestations,
3. Implant administration -100% audit compliance, and;
4. Bovine respiratory disease treatment success (as zero case fatality rate);

If this were the case, we would have near zero feedlot health and continuous extraordinary feedlot performance. While obviously this is fanciful, and negates the further obvious capability (discussed previously) of animals to respond to therapies it does represent a considerable industry opportunity.

Presently industry audit data of these parameters clearly indicates significant opportunity to improve the response outcomes from our huge investment in these therapeutic categories.

Vaccine management

Vaccines in Australia are manufactured to high standards under significant regulatory scrutiny. However, frequently they are blamed for ineffectiveness at the high of a disease challenge. While the success of effective vaccination strategies are dependent on administration timing and animal response factors, the capability of vaccines to assist feedlot disease security is significantly reduced or negated if the vaccine is not correctly handled.

- Keep vaccines refrigerated at all times. This may necessitate using a cooler and out of the sun at all times.
- Mix only the amount of vaccine that will be used in a timely period (preferably 1-hr)
- Reconstitute modified live vaccines (e.g. Rhinoguard) with clean transfer needles
- Don't mix two products together, or in the same syringe
- Use only new needles to fill and refill syringes. i.e., don't put dirty needles back into bottles
- Use the proper needle gauge and length (SC 16-gauge x 5/8 or 3/4 inch; IM 16-gauge x 1 – 1 1/2 inch)
- Always use sharp needles, discard every 20 injections or immediately if any burr or bent. Burred needles increase tissue damage and increase needle bacterial load 7-fold.
- Always use subcutaneous route of administration where a choice is available between SC and IM routes. All infections are to be administered in the neck area.
- Space multiple vaccinations at least 10-cm apart in the neck of the animal

Improper dosing

Because many products are administered on an animal bodyweight, obtaining an accurate weight is critical or inaccurate dosing will occur. This frequently occurs during induction, where averages are used, or worse a 'guestimate' is made. This has response and or residue ramifications;

- Under dosing will contribute to poor therapy responses and possibly increased insensitivity in the case of antimicrobial agents
- Under dosing will increase requirements for additional therapy, labour, performance loss, need for retreatment and potentially death
- Overdosing will contribute to extended withholding periods and export slaughter intervals
- Overdosing will contribute to poorer feedlot economic outcomes

Syringe cleaning

Don't use alcohol or any chemical disinfectants on syringes and power vaccinators used for modified live viral vaccines (i.e., Rhinoguard). Use distilled hot water as a rinse, dry on clean paper towels, use silicone oil and store in a clean dry area.

How is the health of your refrigerator?

The refrigerator can be one of the most important aspects of the animal health program. A kitchen refrigerator frequently has a hundred dollars of food, while the old refrigerator in the feedlot hospital or office may contain thousands of dollars of vaccines and therapeutics. Products should be

stored to label instructions, but generally 2 to 7°C. While many products are inactivated by heat, freezing can cause vaccine destruction, and contribute to significant endotoxin insult if administered. A US survey of 191 refrigerators identified only 27% reliably maintained temperature between the targeted 2 and 7°C. Other refrigerator considerations include;

- Units placed where good air circulation
- 'Do not unplug' sign next to the units wall outlet
- Door gaskets maintain a good seal
- Units maintains temperature 2 – 7°C
- Thermometer is regularly monitored
- Food and drinks are not in the unit
- Products centred where possible and not in door

In summary, a plethora of biologically active agents are utilised daily by feedlots to enhance animal welfare and feedlot economic outcomes. As an industry we are able to utilise these agents under a regulatory framework and trusted responsibility afforded by a partnership. This partnership is critical to meet societal expectations with regard to livestock management and food safety. Effective utilisation of these chemicals and therapies results from targeted protocols developed with detailed scientific scrutiny, oversight and review with regard to qualification for treatment and outcome review criteria. Success of this partnership further depends on quality of local feedlot management and an attention to detail to maximise treatment responses.