3-1-2002

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Extension Extra

ExEx 2011
Updated March 2002
F&F: 4

COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SOUTH DAKOTA STATE UNIVERSITY / USDA

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Innovations and new technologies tend to create apprehension among consumers who are not familiar with the technologies and their mode of action. This case currently exists regarding the use of hormones, antibiotics and other feed additives in livestock production. The purpose of this fact sheet is to familiarize consumers with some of the products of technology that are currently utilized in the production of meat animals and to provide an evaluation of how these products impact the safety of meat and meat products.

DEFINITIONS OF TECHNICAL TERMS:

Feed Additive: Non-nutritive compounds that are added to livestock rations. These compounds generally do not supply essential nutrients but exert their effect by altering the digestion or metabolism by the animal.

Antibiotics: Products produced by living organisms, such as yeast, which destroys or inhibits the growth of other microorganisms, especially bacteria. Antibiotics are used in livestock and poultry production in relatively large (therapeutic) doses to treat sick animals or in smaller (subtherapeutic) doses as feed additives to reduce the incidence of infectious diseases or improve feed efficiency and animal growth.

Ionophores: Type of antibiotic that inhibits or depresses the growth of specific micro-organisms in the digestive system. Ionophores increase feed efficiency in cattle and sheep by 8-12%.

Implants: Small, compressed pellets or small, silicone rubber devices that are placed under the skin of the ear. Implants contain a growth stimulant which is slowly released into the circulatory system.

Anabolic Agents: Compounds that act as growth promotants to increase the rate of gain and improve the efficiency of conversion of animal feed into meat. Anabolic agents are administered as both implants or feed additives, depending on the compound.

Hormones: Chemical compounds that are synthesized and secreted by ductless glands in the body and carried by the blood to other parts of the body where they have specific effects on other organs. Six hormones are currently approved by FDA (Food and Drug Administration) as growth promotants for livestock. These are estradiol, testosterone and progesterone (all naturally occurring steroid hormones); trembolone acetate (TBA) and melengestrol acetate (MGA, synthetic steroid hormones); and zeranol (a naturally occurring compound produced by plants that is similar to steroid hormones).

Somatotropins: Somatotropins are naturally occurring hormones that play an important role in the metabolism of proteins, fats and carbohydrates in all mammals. Since somatotropins are protein, they must be injected to be effective. If they are fed, they are digested like any other protein. Somatotropins are often referred to as pST, porcine somatotropin, or bST, bovine somatotropin for swine and cattle, respectively. Recombinant (or man-made) somatotropin has been shown to improve growth rate, feed efficiency and lean tissue deposition by 33% in swine. When administered to dairy cattle, milk production has been substantially increased. At this time, somatotropins are not approved for livestock use pending further investigation by FDA.

Repartitioning Agents: These compounds increase the proportion of lean meat to fat in the carcass by redirecting the available nutrients to the production of muscle instead of fat.

Beta Agonists or Beta Adrenergic Compounds: These compounds are used in human medicine to treat asthma and other respiratory problems. Certain beta agonists, such as ractopamine and clenbuterol, have been shown to act as repartitioning agents when fed to pigs. At this time beta agonists are not approved for livestock use pending further investigation by the FDA.

Withdrawal Time: This is the period of time required from the administration of a compound prior to slaughter. Withdrawal times are established by FDA for each compound to allow clearance from the body and prevent residues in the meat. Withdrawal times vary from one compound to another and range from zero up to 60 days.

MEAT SAFETY

FDA Approval: New compounds that are developed for the livestock industry are thoroughly evaluated by FDA prior to approval. This evaluation includes (1) an environmental impact assessment, (2) a long-term safety assessment, (3) a residue assessment and (4) an assessment of efficacy. In the environmental impact assessment, residue life-span is determined and the effects on other organisms that are exposed to these compounds are evaluated. The long-term safety assessment involves exposing several generations of laboratory animals to the test compound and evaluating any long-term effects on health, genetics or reproduction. In addition, levels of toxicity are determined for the various species of animals. The pathway of metabolism for the compound is determined in the residue assessment. Any potential residues of the compound or its metabolites in the meat or organs are evaluated. Finally, the compound is evaluated for efficacy or the effectiveness to elicit the proposed response. While this is the data that most producers and consumers see, these tests are conducted after the compound has passed the other assessment procedures. Typically, it requires about 10 years and a minimum of $10-12 million to get a new compound approved by FDA.

Monitoring for residues: The Food Safety and Inspection Service (FSIS) of the USDA conducts the National Residue Program to help prevent the marketing of animals containing unacceptable levels of animal drugs, based on the tolerance levels set by FDA. FSIS tests for the synthetic and plant derived hormones. No monitoring is done for the naturally occurring hormones because the increased exposure to the hormones is far below concentrations considered to be unsafe. The following table demonstrates this minimal increase in exposure by comparing the estrogen content from servings of implanted and non-implanted beef to other foods and to the daily estrogen production in the body.

A concern with the use of antibiotics in animal production is the possibility of a residue causing a reaction in an antibiotic-sensitive person. FDA has established maximum allowable amounts of antibiotic that can be fed and the minimum withdrawal time required to avoid a residue. FSIS records show that

less than 1% of meat and poultry products contain residues of antibiotics higher than the approved levels.

Antibiotic-resistant Bacteria: Antibiotics have a beneficial effect because they eliminate or reduce sensitive bacteria. The antibiotics that result in an enhancement of feed efficiency and animal growth reduce undesirable bacteria that compete unfavorably with bacteria that are beneficial to the animal. Some bacteria develop resistance to the antibiotic that is fed. These resistant bacteria may contaminate meat products but are killed by proper cooking. Cases of antibiotic resistant bacteria from meat causing human health concerns have resulted from eating raw or improperly cooked meat products. Cooking meat products to an internal temperature of 160ºF (medium doneness) is more than adequate to kill all bacteria.

Since 1977 the FDA has commissioned studies of the efficacy of antibiotic use in livestock and poultry production. Most recently in 1987 the National Academy of Sciences, Institute of Medicine studied the question of human health consequences associated with subtherapeutic use of antibiotics in animal production. Their study was unable to find direct evidence to establish that there is a human health hazard from the use of subtherapeutic levels of antibiotics as feed additives.

Comparison of Estrogen Levels in Beef and Other Foods to Daily Production in Humans.

Item	Estrogen, ng[a]
3 oz beef from non-implanted steer	1.3
3 oz beef from implanted steer	1.9
Egg	993
Cabbage, 4 oz	2,700
Daily production, prepuberal girl	54,000
Daily production, adult man	136,000
Daily production, pregnant female	20,000,000

[a]ng = 1 nanogram which is one billionth of a gram.

BENEFITS

Livestock producers utilize the products of technology to enhance their production and economic efficiencies while still producing a wholesome, safe, nutritious product. Many of the products enhance the rate of gain and the efficiency of converting livestock feeds to high quality, meat protein by as much as 10-15%. New products of biotechnology could conceivably double or triple these improvements. Other products enhance the nutritional value of meat and meat products by repartitioning the animal's energy intake to increase the production of lean meat while avoiding excessive fat deposition.

It is important to realize that livestock producers do not use technological developments as a substitute for good management. However, by incorporating new technological developments, that are proven safe and effective, into their management programs, many producers are able to improve the economic efficiency of their livestock enterprise. With a strong agricultural and livestock economy, producers are better able to stay profitable at levels of production that provide an affordable supply of meat and meat products to the consumer.

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ExEx 2011- PDF by CES August 1990; updated April 2002.