

## RESEARCH NEEDS IN ANIMAL PRODUCTION

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### ABSTRACT

Growth-promoting implants are a safe, efficacious, and economically important tool for use in beef cattle production. Despite decades of use, however, the mode of action of implants is not understood. Further research designed to delineate the modes of action of implants on both protein and lipid metabolism of ruminants is needed. In addition, data are needed to define threshold levels of growth-promoting compounds in the blood, particularly as related to the length of time that a particular type of implant will provide an efficacious performance and(or) metabolic response. Effects of implant type on maintenance requirements need to be determined, as do the potential effects of various implants on efficiency of conversion of metabolizable protein to net protein deposited in tissues. Relationships between response to various types of implants and feed intake also need further study. Development of research models that will allow critical study of the factors associated with dark-cutting beef and "bullers" would further our understanding of how implants impact these conditions.

### INTRODUCTION

This Oklahoma State University/Plains Nutrition Council Implant Conference provided a forum for experts to review virtually all aspects of the use of growth-promoting implants in the beef cattle industry. My charge was to assess the information presented to determine potential gaps in our research knowledge on implant use and to suggest areas of needed research. In the subsequent section, general areas of research are noted in italics; more specific topics are listed under each general area. The research areas I have suggested should not be viewed as either all-inclusive or top-priority; they clearly are affected by my own biases and research interests. Readers no doubt will glean additional ideas for needed research by reading individual papers on the various topics presented at the conference.

#### Summary of Research Needs

*Understanding the mode of action of implants:* Although the beef cattle industry has been using growth-promoting implants since the mid-1950's, their mode of action is not completely understood. Initial hypotheses regarding effects of estrogenic implants being mediated directly through growth hormone have been largely discarded. Further research on the effects of various types of implants on IGF-1 concentrations, IGF-1 binding proteins, and IGF-1 receptor activity in liver and muscle tissue

is needed. Moreover, data on the effects of implants on other hormonal systems (e.g., catecholamines, serotonin, dopamine, melatonin) are needed. Although increased protein accretion is the touchstone of implant activity, efforts to understand the mode of action of implants should include studies on both protein and lipid metabolism because effects of implants on lipid metabolism (e.g., changes in intramuscular fat deposition) are economically important.

*Determining the threshold level for activity and the optimum release pattern:* Research to determine the level of growth-promoting compound in the blood that provides for an efficacious production response should lead to more effective application of implants in practical beef cattle feeding. To determine this "threshold" level, research may be needed to first establish the appropriate response criteria (e.g., nitrogen balance, protein synthesis and degradation) for determining efficacy. Threshold levels for various implant types would be useful for deciding how many days a given implant should be used in multiple implant programs. Pattern of release of implants into the bloodstream might be related to the threshold level. Is an exponential decrease in release optimal, or is a steady release over time at or near the threshold level more desirable? Do spikes in growth-promoting compounds that are well above the threshold level have positive or negative effects on production responses to implants? How might previous

implants impact the threshold level and efficacy of subsequent implants?

*Determining effects of implants on nutrient requirements and feed intake:* Limited data suggest that estrogenic implants tend to increase maintenance requirements; in contrast, trenbolone implants may have little effect, or even decrease the maintenance energy requirement. Further research in this area is needed, particularly with animals fed high-concentrate diets. Effects of estrogen-trenbolone combination implants need to be considered, as well as effects of the ratio of estrogen to trenbolone in combination implants. Data were presented at the conference to suggest that estrogen plus trenbolone implants may have a marked effect on the efficiency of conversion of metabolizable protein to net protein deposited in tissues. To accurately apply metabolizable protein systems (e.g., NRC, 1996), we will need more research designed to evaluate efficiency of net protein deposition by cattle of various body weights as affected by different implant programs. Might effects on maintenance or efficiency of nutrient use be related to changes in

feed intake that occur with implants? Data are needed to determine the role of feed intake changes in responses to growth-promoting implants, as are data to determine optimum implant strategies for cattle that a limit- or program-fed at lower rates of gain.

*Effects of implants on carcass quality and animal behavior:* In addition to concerns about decreased quality grade with aggressive implant programs, research is needed to determine the effects of various implant types on meat tenderness and on the incidence of dark-cutting beef. For the dark-cutting beef issue, it may be necessary to develop a model system that will allow detailed studies of the factors related to this condition. Similarly, model systems might be useful to determine effects of implants on animal behavior, particularly "buller" animals that exhibit submissive behavior and "rider" animals that exhibit overly aggressive behavior. These conditions typically occur at very low rates in the feedlot cattle population; however, even these low rates of occurrence have a sizable economic and management impact.

#### LITERATURE CITED

NRC. 1996. Nutrient Requirements of Beef Cattle (7<sup>th</sup> Ed.). National Academy Press, Washington, DC.