Managing for Antler Production:

Understanding Age, Nutrition, and Genetic Influences

Searching for the "magic bullet" in white-tailed deer management often leads people to "gimic" solutions for complex management problems. Unfortunately, gimic solutions rarely produce meaningful results. Yes, many deer management problems are complex, but the solutions often involve application of several fairly simple, straightforward biological principles. It is the application of these "simple" principles to the complex reality of real-world management that often results in frustration for eager landowners and hunters.

The most effective approach to any deer management problem is to identify the biological and social factors that are limiting fulfillment of management goals. These limiting factors should be ranked in order of importance and addressed with management actions, emphasizing the most important limiting factors. Reliance on manipulation of any one limiting factor to increase the prevalence of larger antlered bucks, without understanding its relationship to other important factors dooms many efforts to frustration, if not failure. Antler production is clearly regulated by *age*, *nutrition*, and *genetics*. The solution to most antler production management problems usually incorporates all three factors, with an emphasis on age and nutrition.

Research often forms the basis for management solutions. Educated hunters and landowners may get frustrated by apparently contradictory results, particularly from nutrition and genetics studies. However, it is unrealistic to expect that all research projects on antler development will generate the same results and conclusions. Nutrition and genetic research projects usually involve a relatively small sample of deer confined within experimental pens. Differing results may be related to the natural variation of white-tailed deer and may need to be applied only to management situations that correspond to the circumstances of the research. Often, only a trained wildlife biologist can properly apply research results to a particular management situation.

The goal of this publication is to clarify the basic influences of age, nutrition, and genetics on antler development and then discuss how these fairly simple biological principles may interact in the ultimate expression of management success on your property. The outcome should be an appreciation for the fact that significantly improved antler development is the result of coordinated management decisions which integrate a thorough understanding of biological principles adjusted to local conditions. Later publications in this series will address specific management issues and actions.

FWRC RESEARCH ADVANCES

Forest & Wildlife Research Center

AGE

The first set of antlers typically are grown at 1.5 years of age. However, in Mississippi up to 20-30 percent of buck fawns may develop hardened antlers (usually only hardened buttons) at about 8 months of age. This phenomenon is not usually seen by hunters because it happens after the hunting season. In these cases, nutrition is adequate enough and birth dates are early enough to allow fawns to reach the critical body mass needed to initiate antler growth.

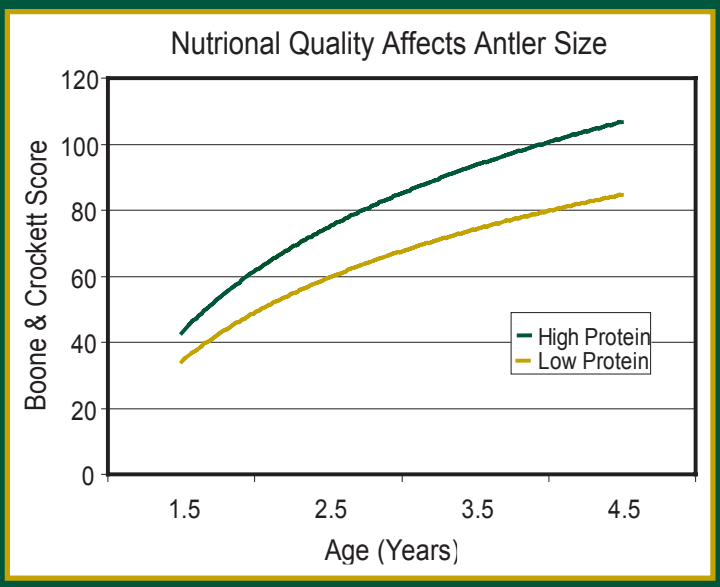
Antler size increases annually, in sometimes dramatic fashion, until maximum antler development is reached at about 5-7 years of age. Based on averages of 23 bucks measured through 7 years of age in a Mississippi State University (MSU) study, 1 year old bucks grew the equivalent of about 26 percent of their ultimate maximum gross Boone and Crockett score. The percentage increased each year, to about 63 percent at 2 years, 77 percent at 3 years, and 92 percent at 4 years of age. Using antler weight as a measure of antler size tells a similar story, although with different values. Antler weights were 10 percent at 1 year, 44 percent at 2 years, 71 percent at 3 years, and 80 percent at 4 years of age. These particular animals developed maximum antler size at 5 years of age, but many do not reach full potential until 6 or 7 years. Bucks consuming less than optimal forage quality would be expected to reach their maximum antler size at an older age and would be more susceptible to annual variation in forage quality.

NUTRITION

Antler development is affected greatly by nutritional intake prior to and during antler growth. This basic relationship has been known as far back as the Medieval Ages when King Edward II's huntsman declared, "The head grows according to the pasture, good or otherwise." Modern day research began quantifying the impact of nutrition on antler development in the 1950s. We now know that a number of nutritional components interact to generate the boney matrix of antlers, most importantly protein, energy, and minerals. A variety of experimental approaches have been employed to unravel the nutrition-antler mystery. Most experiments compare antler characteristics between an "optimally" fed group and one or more "sub-optimally" fed groups.

Early studies in Pennsylvania showed that whitetail buck fawns fed 4.5 or 9.5 percent protein from weaning until 1.5 years of age grew smaller antlers than buck fawns fed 16 percent protein. This effect could have been due to retarded development of the pedicle (the base from which the antler grows) or due to negative effects on growth of the first antler. More recently, red deer fawns in New Zealand raised on low quality winter and summer forage had delayed pedicle development and also grew lighter, shorter antlers. Red deer fawns having unlimited access to high quality forage initiated pedicle development much earlier than those with access to only 70 percent as much forage. Whitetail fawns in Michigan fed a diet simulating an early green-up with access to acorns had about double the number of antler points at 1 year of age as fawns fed a diet simulating late green-up. This relationship between diet quality and a buck's first set of antlers is important in management decisions as well as in understanding the nutrition and birth date interaction to be discussed later.

The minimal level of protein in forage required for maximum antler development varies with age. In a

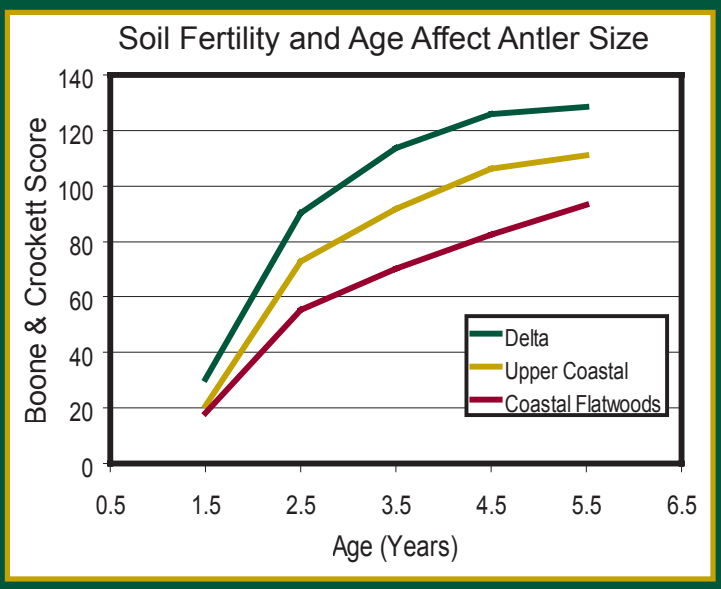


NUTRITION

Texas study, 2 year old whitetails fed 16 percent protein grew antlers almost twice as heavy as bucks fed 8 percent protein. Recent research in Texas indicates that as little as 10 percent protein fulfilled the requirements for antler development of adult bucks. However, younger animals that are actively growing require much higher levels of protein than adult animals. For example, weaned fawns require up to 20 percent protein for optimum growth.

Typically, biologists recommend that an average intake of 16 percent protein will allow for maximum antler development. However, that doesn't mean that protein in excess of 16 percent is not of value. On many properties, protein content of prevalent forages declines below 16 percent, especially during summer and winter. When this happens, forages exceeding 16 percent can help bring the average protein intake level to within the optimal range. Active management of native vegetation and an effective food plot program (cool and warm season annuals and perennials) can insure the availability of forages exceeding 16 percent protein.

Very little is known about the mineral requirements of white-tailed deer. Research has emphasized the "macrominerals," such as calcium and phosphorus. Early work in Pennsylvania indicated a diet of 0.7 percent calcium and 0.6 percent phosphorus was required for antler growth, and recent work in Texas indicates that adults may require much less. We know very little about the specific requirements for "microminerals," such as magnesium and cobolt. Whitetails make up for limited mineral content of their diet by eating soil, creating "deer licks." Mineral requirements will likely be met by vegetation and soil on most properties, but specific minerals may be limited, especially in the southeastern portion of the state.



GENETICS

A buck's potential for antler development is contained within his genetic material. In other words, his antler potential is determined by the combination of DNA from both his sire and dam. The buck's environment, or quality of his habitat, and his age affect the physical expression of his genetic potential for antler development.

Genetic potential for antler development is only a management concern if you are involved in selective harvest of bucks. Selective harvest decisions can be used to manipulate the "genetic composition" or the "standing crop" of a population.

Management for "genetic composition" of the population involves altering gene frequencies in a breeding population such that there is an increase in genetic potential to grow larger antlers. Genetic composition can be manipulated only if you can judge the genetic potential of bucks and then increase the reproductive success of the superior animals. These are significant challenges under any management scenario. Our inability to judge a female's genetic potential for antler development is another significant problem. Given the severe limitations to success, manipulation of population-level genetics may not be a viable management option.

Management of the "standing crop" of a population can provide both positive and negative effects, depending on the approach to selective harvest. Standing crop can be manipulated to improve antler development of surviving bucks if there is an excess of bucks within a population and you have the luxury of selectively removing "inferior" animals. Removing these animals leaves more forage resources for bucks that have greater potential to grow larger antlers. Standing crop can be managed effectively only if you can evaluate future antler development based on current antler development. A hunter must be able to accurately judge antler development within age classes and then selectively harvest inferior animals. The reverse approach, selective protection of inferior-antlered young bucks and removal of superior-antlered young bucks can negatively impact standing crop antler development.

Nutritional factors which affect the initiation of pedicle growth during a buck's first winter and antler growth during subsequent spring and summer will affect the expression of a young buck's genetic potential for antler development. For example, the negative effect of a late birth date on antler development was documented at the MSU deer pens. Antler scores of bucks born in September-October were only about 30 percent as high as bucks born in June at 1 year of age and about 80 percent as high at 2 years of age. The disparity in antler size due to birth date disappeared as the bucks matured, but the pattern was present for 4 years. These results indicate that late born fawns may “catch up” to early born fawns if they survive to adulthood.

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SUMMARY

Age, nutrition, and genetics significantly influence antler development of white-tailed deer. Taken individually, each of these factors has clear impacts on antler growth. Antler development increases with age up to a maximum at 5-7 years of age. Nutritional deficits can negatively impact pedicle development in fawns and growth of antlers in all age classes. When possible, nutrition, age, and genetic considerations should be incorporated into management programs. However, management emphasis should be placed first on addressing the most significant limiting factors. The factors most likely to be limiting antler production in Southeastern states are nutrition and buck age distribution. Placing management emphasis on providing adequate nutrition and promoting survival of bucks to older age classes generally produces the most cost-effective results.

Effects of Age on Antler Production

Shed antlers of an MSU research buck through 4 years of age clearly demonstrate the effects of age on antler production. Some animals develop maximum antler size at 5 years of age; however, many do not reach full potential until 6 or 7 years.

1 year - based on averages from the MSU captive herd, bucks will grow about 10 percent of their maximum antler weight and about 26 percent of their maximum Boone and Crockett score at 1 year of age.

2 years - bucks will grow about 63 percent of their maximum antler weight and about 44 percent of their maximum Boone and Crockett score at 2 years of age.

3 years - bucks will grow about 71 percent of their maximum antler weight and about 77 percent of their maximum Boone and Crockett score at 3 years of age.

4 years - bucks will grow about 80 percent of their maximum antler weight and about 92 percent of their maximum Boone and Crockett score at 4 years of age.