A Protein Pellet Feed-delivery System For White-tailed Deer

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A PROTEIN PELLET FEED-DELIVERY SYSTEM FOR WHITE-TAILED DEER

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Abstract: **The most effective feed-delivery system I tested for supplemental feeding of protein pellets (3/16's of an inch in diameter) to white-tailed deer was an enclosed, controlled-time feeder with troughs. This delivery system is effective for the following reasons: (1) Protein pellets are retained in troughs, which allows for efficient feed consumption, reduces ground contamination of pellets, and decreases amount of feed on the ground that may attract nontarget species such as cattle, javelinas, and feral pigs. Deer will abandon a feeder to avoid feral pigs and javelinas. (2) Deer can be trained to come to a controlled-time feeder at a given hour in the morning or late afternoon, which permits feeding when certain nontarget animals are not normally active. (3) Protein pellets are subject to moisture absorption and lose their palatability to deer. Enclosed controlled-time feeders reduce the time protein pellets are exposed to the weather from 24 hours to 4 hours or less. (4) The high cost of feed necessitates a highly efficient feed-delivery system. Field observations indicated a controlled-time feeder to be in the range of 90-95% efficient in delivering feed to deer, whereas free-choice feeders appeared to be less efficient.**

An exclosure around the feeder is needed to deter nontarget animals. Exclosures constructed of 4-gauge stock-panel fence with 4-inch openings, 30-32 inches in height, and supported by tee posts at 10-foot intervals proved to be resistant to invasion by cattle, feral pigs, and javelinas while still permitting access by deer. An 80- by 80-foot exclosure is the minimum recommended size. The time required to convert deer from 100% shelled corn to a mixture containing protein pellets depends on the availability of natural food. I started with 100% shelled corn and increased the percentage of protein pellets by 25% per month until the ratio of 75% pellets to 25% shelled corn was reached.

The CKWRI readily acknowledges that other feed-delivery systems may be as effective.

INTRODUCTION

Rationale—why feed?

As Hellgren[4] points out, the expected biological effects of supplementation with protein pellets include increased numbers of deer due to improved reproduction and fawn survival, greater numbers of adult male deer due to better survival, and better antler development due to a higher nutritional plane. However, expectation may be greater than realization. The practice of supplemental feeding of deer has preceded the biological evaluation of the practice in south Texas.

This study does not endorse the concept; rather it was predicated with the thought of helping landowners and ranchers, who are currently feeding deer, find an efficient way to deliver protein pellets for their supplemental feeding program. This study was aimed at delivering protein pellets for deer to influence performance and not about delivering shelled corn to bait deer.

Prime Considerations

The prime considerations in the selection of a deer feeder, besides cost, are: (1) efficiency in delivering feed to deer, (2) minimal loss of feed to nontarget animals, (3) the amount of time required to inspect and service the feeder, and (4) the ability to protect protein pellets from the weather.[5]

Deer feeders can be classified as free-choice or controlled-time feeders. Both are widely used with shelled corn to attract deer for hunting purposes.

Deer using an enclosed, controlled-time feeder.

Table 1. My evaluation of protein-pellet deer feeders within an 80- by 80-foot stock-panel exclosure that excluded cattle, feral hogs, and javelinas.

	Free-choice Feeders			Controlled-time Feeders	
Evaluation Criteria	Crib/trough Feeders	Tube Feeders	Plate Feeders	Sling Feeders	Trough Feeders
Delivery Efficiency* of Protein Pellets	Inefficient	Inefficient	Inefficient	Inefficient	More than 90%**
Ground Contamination of Protein Pellets	Minor Problem	Major Problem	Major Problem	Major Problem	Minor Problem
Moisture Deterioration of Protein Pellets	Major Problem	Moderate Problem	Moderate Problem	Major Problem	Minor Problem
Contamination of Pellets by Nontarget Animals	Major Problem	Minor Problem	Minor Problem	Minor Problem	Minor Problem
Feed Consumption by Nontarget Animals	Major Problem	Major Problem	Major Problem	Minor Problem	Minor Problem

*Efficiency here means the amount of a given quantity of feed delivered to deer.
**My observations over 2 winters of study suggest that an enclosed, supervised, controlled-time feeder with troughs is at least 90% efficient in delivering a mixture of protein pellets and corn to deer.

Free-choice deer feeders can be classified as crib feeders, plate feeders, and tube feeders. With these feeders, food is available for deer on a 24-hour basis. Whereas, a controlled-time feeder has feed available only at pre-selected times within a 24-hour period. All free-choice feeders are subject to large amounts of feed being consumed by nontarget animals,[3] ground and/or fecal contamination of feed, and spoilage of protein pellets by atmospheric moisture. Once protein pellets absorb moisture they are less palatable to deer and have to be replaced, which is time consuming and costly. These problems reduce the desirability of free-choice feeders as an efficient delivery system for protein pellets (Table 1).

Controlled-time feeders with troughs have several advantages. They can be programed to predetermined feeding times, the protein pellets are in troughs preventing ground contamination, exposure to weather is minimized, and the feed quantity can be regulated to meet variable consumptive demands of the deer.

Controlled-time feeders are more expensive, but supplemental feeding is a long-term investment. Over a period of years, the cost of the feed, along with trips to inspect and resupply the feeder, becomes the major expense, not the feeder.

Type of Feed

The most commonly used deer feed is shelled corn. However, with year-round feeding designed to produce larger antlers and better fawn crops, protein pellets are being used to improve nutrition. Dr. Eric Hellgren, a nutritionist at Oklahoma State University (formerly at the CKWRI), suggested that a ration of 75% protein pellets (14-16% crude protein) and 25% shelled corn was appropriate for supplemental feeding of free-ranging deer (see Appendix). Both feed types have different delivery characteristics; a given feeder may efficiently deliver shelled corn but not protein pellets. A feeder that can use both feeds is the ideal choice.

A problem with using corn for feed is aflatoxin, which is produced by mold growing on corn. The aflatoxin level of shelled corn needs to be checked frequently to avoid negatively impacting your deer herd, as well as other wildlife species.

GETTING STARTED

Site Selection

Avoid selecting sites preferred by cattle[8] or intersected by cattle trails. Sites also should be selected to avoid sites preferred by feral pigs or javelinas. To facilitate servicing the feeder, sites should be located along all-weather roads. Flat terrain expedites construction of the exclosure. Deer are sensitive to disturbance, so it is important that a nonhunting area be selected for supplemental feeding and all disturbance be kept to a minimum.[9]

Explore potential sites by scattering shelled corn either with a controlled-time sling feeder or by hand until there is a response by animals. If the majority of the response is deer, you have a potential site for supplemental feeding. If the response is mainly raccoons, feral pigs, javelinas, and turkeys, then try another site. Avoid establishing a deer feeder in prime nontarget animal habitat. Raccoons are almost impossible to avoid, and various control procedures may be necessary. Successful sites in my study were relatively open areas with some woody vegetation (10-15% brush cover) within the enclosures and were close to good loafing or escape cover. Woody vegetation in the exclosure not only provided shade but security for deer and gave subdominant deer a chance to escape confrontations with more dominant ones.

Exclosures

An exclosure around the feeder is necessary to deter cattle, feral pigs, or javelinas from using the feeder. My best exclosure was an 80- by 80-foot stock-panel fence, 4-gauge wire with 4-inch openings, 30 inches high, and 20 feet in length. These panels were produced by cutting in half a 20- by 5-foot high stock panel. The stock-panel exclosure should be supported with a tee post every 10 feet. The tee post should be at least a foot higher than the stock-panel fence, just in case a strand or 2 of barbed wire has to be added to the top of the panel fence. The stock-panel fences I erected were on caliche soil on 1 site and on heavy clay soil on another and were tied securely to the tee posts with bailing wire and tee-post clips. The panels were not buried in the ground, but in sandy soil, burial of panels might be necessary. Hog panels, 3 feet in height by 16 feet in length, have also been used successfully to fence out livestock, feral pigs, and javelinas.[9]

Deer were baited to the area by spreading shelled corn on a daily basis. At 1 site, the stock-panel fence was erected in 1 day. Within 24 hours the deer were jumping the 30-inch high stock-panel exclosure. When a feral pig entered the exclosure, probably by climbing the fence, I added a strand of barbed wire about 2 inches above the stock-panel fence to help solve the problem. Also, deer did not seem to have any difficulty in clearing the 32-inch fence.

Example of the exclosure fence used in this study.

I recommend an 80- by 80-foot exclosure as the minimum size for several reasons: (1) there is considerable interaction among deer at a feeder; the dominant deer take over the feeder, and the subdominant deer need a chance to escape quickly or move away while awaiting an opportunity to feed, (2) the larger exclosure could permit the inclusion of more than 1 feeder, which would help to offset the presence of a dominant deer by allowing subdominants to move between feeders, and (3) the larger the exclosure, the less likely that nontarget animals such as cattle, feral pigs, and javelinas will enter.[1,7]

Getting Deer to Eat Protein Pellets

Protein pellets are less palatable to deer than shelled corn, and time is necessary to convert deer from 100% corn to a ration of 25% corn: 75% protein pellets. The amount of time undoubtedly depends on the availability of natural feed. I started with 100% shelled corn on November 1, 1995 and at monthly intervals increased the percentage of protein pellets by 25% until I reached 75% protein pellets and 25% corn on February 1, 1996. If the deer are not given enough time to accept the protein pellets, one may have to clear the feeder of protein pellets and start again with shelled corn.

Protein pellets are prone to deteriorate rapidly when exposed to moisture, making them unpalatable to deer. Even in limited amounts, moisture will coagulate protein pellets, and they will mildew. It is best to keep feed dry and fresh in feeders at all times.[10]

Warner[10] stated that deer tend to self-regulate feed intake. When there is a good supply of native vegetation, deer almost go completely off the supplemental feed. My observations confirmed this. With more than 2 inches of rain in March 1995, vegetation was lush and abundant, and deer use of supplemental feed dropped dramatically. DeYoung[2] stated that R. E. Zaiglin found deer would quit supplemental feed for about 3 weeks after a rain during the growing season to take advantage of new plant growth. Varner[9] reported that on a ranch near Freer, Texas, it took over 8 months to get deer to eat protein pellets because of the availability of lush forage. It took only 2 weeks during a dry spring.

MY EXPERIENCE IN EVALUATING FEEDERS

Location of the Study

My study was conducted within the Matanza Pasture of the King Ranch between November 1, 1994 and March 31, 1995 and within the same time frame in 1995-96. The vegetation on the pasture was originally Lower Coastal Prairie but is now rangeland with a heavy invasion of huisache and mesquite.

Evaluation Technique

I evaluated 5 types of feeders (Table 1). All 5 delivery systems were available to deer in each of 2 exclosures. This allowed me to observe how deer used each delivery system.

To determine deer and nontarget animal activity on a 24-hour basis at the feeder sites, I used an "active infrared" sensing unit (Trailmaster 1500). The system consisted of a transmitter, receiver, and a 35mm weather-proof camera. The transmitter and receiver were positioned at each feeder site so that when an animal attempted to feed at 1 of the feeders an invisible infrared beam was "broken," and the "event" was recorded. The monitoring unit consisted of a flash 35mm camera supplied with 400 speed film. The camera had a delay interval of 12 minutes, which prevented more than 1 photo from being taken within a 12-minute period. The date, hour, and time were recorded on each negative. Negatives and "events" were studied for animal visitations and 24-hour activity patterns.

I observed deer activity at each of the 2 controlled-time feeders at least twice a week during the morning or evening feeding periods, starting at least 30 minutes prior to the activation of the feeder and lasting for about 2 hours. This represents over 160 hours of direct observation during the 2-year study.

Findings

The main feeding period for deer at free-choice feeders, based on 24-hour camera surveillance, was late afternoon. Deer did feed throughout the night

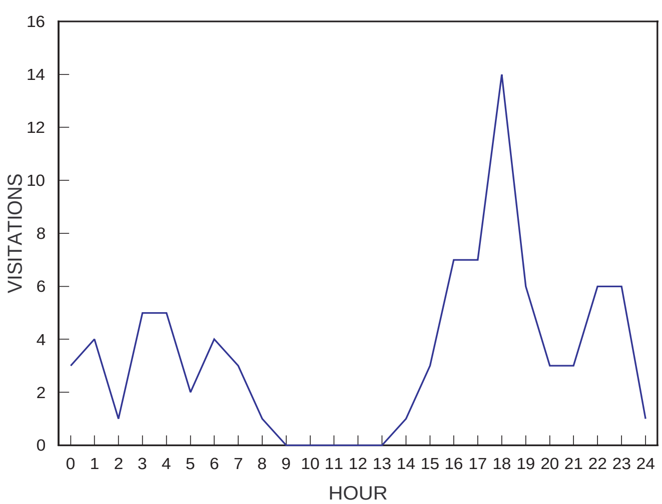

Figure 1. White-tailed deer visitations at free-choice feeders recorded by camera at the King Ranch, January-February 1995.

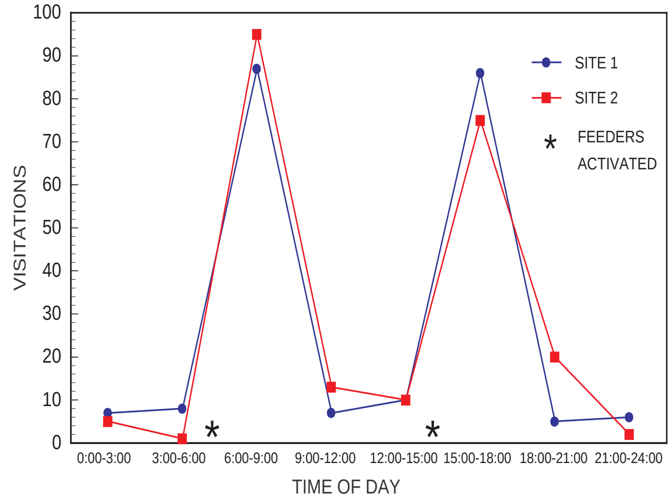

Figure 2. White-tailed deer visitations at controlled-time protein pellet feeders recorded by camera at the King Ranch, December 1995-March 1996.

with free-choice feeders but fewer events were recorded. At the free-choice feeders, the only period of inactivity during the January-February 1995 study period was between 900 and 1300 hours (Figure 1).

With the controlled-time feeder in the 1995-96 season, I used the average number of times (events) that the infrared beam was "broken" to measure deer activity. Deer activity started about 30 to 60 minutes before the feeders activated in the morning or afternoon and continued for about 2 hours thereafter (Figure 2).

If hungry, deer were easily trained to come to a feeder either in the early morning or late in the afternoon. By providing only enough feed to be consumed entirely by deer in a 2-hour period in the morning and again before sunset, I was able to achieve 90-95% efficiency in delivering protein-corn feed to deer. Also, I tended to avoid nontarget animals, such as raccoons and wild turkeys, that can not be excluded by a stock-panel fence.

The amount of feed released at each feeder in the morning and again in the afternoon was regulated by the demand for feed by the deer and varied from 8 to 25 pounds. The number of deer at a feeder fluctuated between 8 and 23 during 2-hour feeding periods in January and February 1996.

A disadvantage of only 2 feeding periods in a 24-hour period is that one may miss deer such as does, subdominant bucks, and large bucks that are alleged to feed only at night. The problem with night feeding is that it coincides with the height of activity for feral pigs, javelinas, and raccoons. Although the larger bucks at the feeders were more suspicious and tentative than smaller bucks upon approaching and using feeders, camera surveillance of feeders during night did not reveal any noticeable difference in the size of the bucks. However, in areas with high hunting pressure, their behavior may differ.

Because the feeders were within a stock-panel fence, I was able to exclude feral pigs, cattle, and javelinas. By timing the feeder to release feed about the first 2 hours in the morning and the last 2 hours of daylight in the evening, I largely avoided feeding raccoons and turkeys. The latter period was also the height of deer activity at free-choice feeders in my study area (Figure 1). But, with the absence of feed at night in controlled-time feeders, there was a peak of deer feeding activity between 0600 - 0800 hours after the feeder activated (Figure 2). As the days grew longer in February and March, I adjusted the feeding times according to deer activity.

The behavior of deer at a given feeding time indicated how hungry they were. If deer started to congregate in numbers of 5 or more as much as 30 minutes before the feeder was programed to activate, they seemed to be hungry. Also, feed (3 pounds or more) remaining in the troughs 2 hours after activation of the feeder suggested that deer had satiated their appetites, and I reduced the amount of feed.

Deer spent less time feeding from a trough than when the feed was scattered on the ground. From a trough, they fed between 5 and 20 minutes with the average time being close to 10 minutes. They were also more likely to consume both protein pellets and corn, whereas when the feed was on the ground, they selected the shelled corn. The metal troughs held the feed, thereby avoiding ground contamination.

Most controlled-time feeders are large in size, and time is required for the deer to adjust to the feeder. It appeared that the first choice of a feeding site by deer is at ground level. I experimented with the troughs by varying their height on a controlled-time feeder. For example, when the troughs were placed 32 inches above the ground, I did not observe deer feeding. When I lowered the troughs to 18 inches, deer immediately accepted the feeders.

The 4-sided controlled-time feeder used in this study had a trough on each side. This allowed restricted vision for individual deer feeding in any one of the troughs, which helped to reduce aggressive behavior while feeding. As many as 4 bucks fed at the same time from a 4-sided feeder.

CONCLUSION

When one enters into a supplemental deer feeding program using protein pellets, it is at least a 3 year commitment. Varner[8] states that this amount of time is necessary for the animals to become accustomed to using the feeder and to derive any real nutritional benefit from the program. Hence, the cost of the feeder is a small part of the investment as compared to the cost of the feed.

Based on my findings, I recommend an enclosed, controlled-time trough feeder using a mixture of 25% shelled corn and 75% protein pellets containing 14-16% crude protein. The feeder should be placed inside an exclosure consisting of a stock-panel fence between 30- and 32-inches in height and enclosing an area of at least 80 by 80 feet. The CKWRI recognizes that other protein feed-delivery systems may be as effective. Readers also are referred to a recent publication on supplemental feeding from the Texas Agricultural Extension Service.[6]

A raccoon visitation to a free-choice trough feeder.

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APPENDIX

Nutritional facts, fallacies, and problems with supplemental feeding. Dr. Eric Hellgren, Department of Zoology, Oklahoma State University, Stillwater.

What is truly known about the biological effects of supplementally feeding free-ranging deer populations? Scientific research on this topic has not kept pace with the use of the technique. Only 2 long-term, large-scale studies have been published. Ozoga and Verme[9] found that a supplementally fed deer herd in Michigan had increased body growth and maturation, antler growth, in utero productivity, condition characteristics, and postnatal fawn survival. Population size increased by 700% in 7 years. They recommended strict herd control through removal of antlerless deer for successful implementation of a supplemental feeding program, as reduction of the herd near the end of the study led to further increases in natality, survival, and antler growth.[9] However, deer in a high-density, supplementally-fed herd in Pennsylvania had small body size, poor antler development, and low reproductive and recruitment rates.[12] Possible causes for these diminished characteristics were suggested to be inadequate herd control (density effect) or an insufficient diet of natural and supplemented foods (nutrition effect). A key element in a supplemental feeding program appears to be proper herd management to maximize biological and economic returns.

Research in Texas has been limited to 2 small-scale studies. In Texas, Zaiglin and DeYoung[13] found that fawn:doe ratios were higher on supplemented areas than on control areas in south Texas. They suggested that supplementing food over a short period of time, such as the nutritionally stressful summer, may be economically feasible. Demarais and Lambert[3] found no effects on reproduction, body condition, or fawn recruitment from supplemental feeding on 3 ranches in the Texas Hill Country.

Natural mortality of adult male deer exceeds 20% annually,[4,5,8] of which nutritional stress associated with the rut is believed to be a major contributing factor.[5,8] Mortality of male deer in south Texas follows this post-rut, winter pattern.[4] By relieving nutritional stress, feed supplementation may reduce winter mortality of this economically important component of the deer herd. It has been shown that estimated annual natural mortality for a harvested, supplementally-fed population of deer was reduced from 17-28% to 5.9-7.2% following improvements in quantity and distribution of feed.[12] In Colorado, Baker and Hobbs[2] concluded that emergency feeding of a nutritionally adequate ration for mule deer can reduce winter mortality.

Expected biological effects of supplementation include increased numbers of deer due to improved reproduction and fawn survival, greater numbers of adult male deer due to better survival, and better antler development due to a higher nutritional plane. These biological impacts would translate into economic benefits based on a larger and higher-quality harvest. However, if harvest was not increased to counteract increased numbers of deer, the productive effects (growth, antler development) would dwindle over time as the herd reached a new plateau relative to carrying capacity in both a nutritional and social sense.

The nutritional content of supplemental feeds has been another subject of considerable discussion but little study. Commercially available feeds vary from 12 to 24% crude protein. Mineral supplements also vary considerably, with conventional wisdom saying that "more is better." Recent research at Texas A&M University-Kingsville[1] suggests that the crude protein requirement for adult male deer during antler development is about 10%, a value that provides adequate protein for weight gain and antler production. Higher levels of crude protein (14-16%) are probably necessary in supplemental feed at certain times of the year, such as during summer or dry winters, to provide an average diet (supplement + natural forages) of 10% crude protein. Does during late gestation and lactation have higher protein needs than antler-growing males; however, livestock requirements suggest that even these requirements do not exceed 13% except in peak-producing dairy cows. Feeds containing >20% crude protein are probably too high; that is, the manager paying to provide the extra protein is not receiving any additional benefit in performance.

Corn plays a role in supplemental feeding because it is highly palatable. Many managers use shelled corn to acclimate deer to feeders, then shift to nutritionally balanced, pelleted feed after deer become accustomed to using the site. This shift sometimes takes considerable time to be successful, because of the relative attraction of corn versus pellets. Though high in digestible energy, corn is relatively low in crude protein (8-9%) and it is lysine-deficient (an essential amino acid). Therefore, corn should not be used exclusively. Rather, a mixture of corn (20-40%) and protein pellets (16% crude protein) will provide an excellent mixture of palatability and nutritional value.

Mineral supplementation has similar pitfalls. Manufacturers make vigorous claims that mineral supplements produce greater body and antler development in deer, but these claims are not supported by research studies. First, Grasman and Hellgren[7] showed that requirements for phosphorus, a mineral in relatively short supply on many Texas ranges and important in antler composition, did not exceed 0.14% for bucks. Forbs and browses rarely drop below this figure, which is much less than previously believed. Second, Schultz and Johnson[11] found no effect of mineral supplements on deer performance in Louisiana on 3 ranches, and Schultz[10] also reported no effect on 2 groups of captive deer fed similar diets of 0.20% phosphorus, in which 1 group was supplemented with a commercial mineral mix.

Conventional wisdom suggests that once a maintenance or productive requirement is met for a given nutrient (protein, mineral, etc.), then more intake leads to more of that nutrient available for growth, reproduction, or other productive processes (such as antler development). Knowledge of nutrient turnover in animals indicates that this is not the case, except over a narrow range. Excess minerals and protein not used in production are excreted through urine. Considerable research is still needed on basic nutrient requirements of white-tailed deer to maximize production at minimum cost.

Supplemental feeding can be effective. The work of Franz Vogt in Europe in the 1930's[6] using captive red deer dramatized the role that nutrition can play in producing super-antlered deer in 3-4 generations. However, for supplementation to be effective biologically and economically, population management (i.e., harvest) must keep pace with the inevitable projected increase in deer numbers; and nutritional research is necessary to ensure that supplements produce maximal biological effects with a minimum of waste.

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