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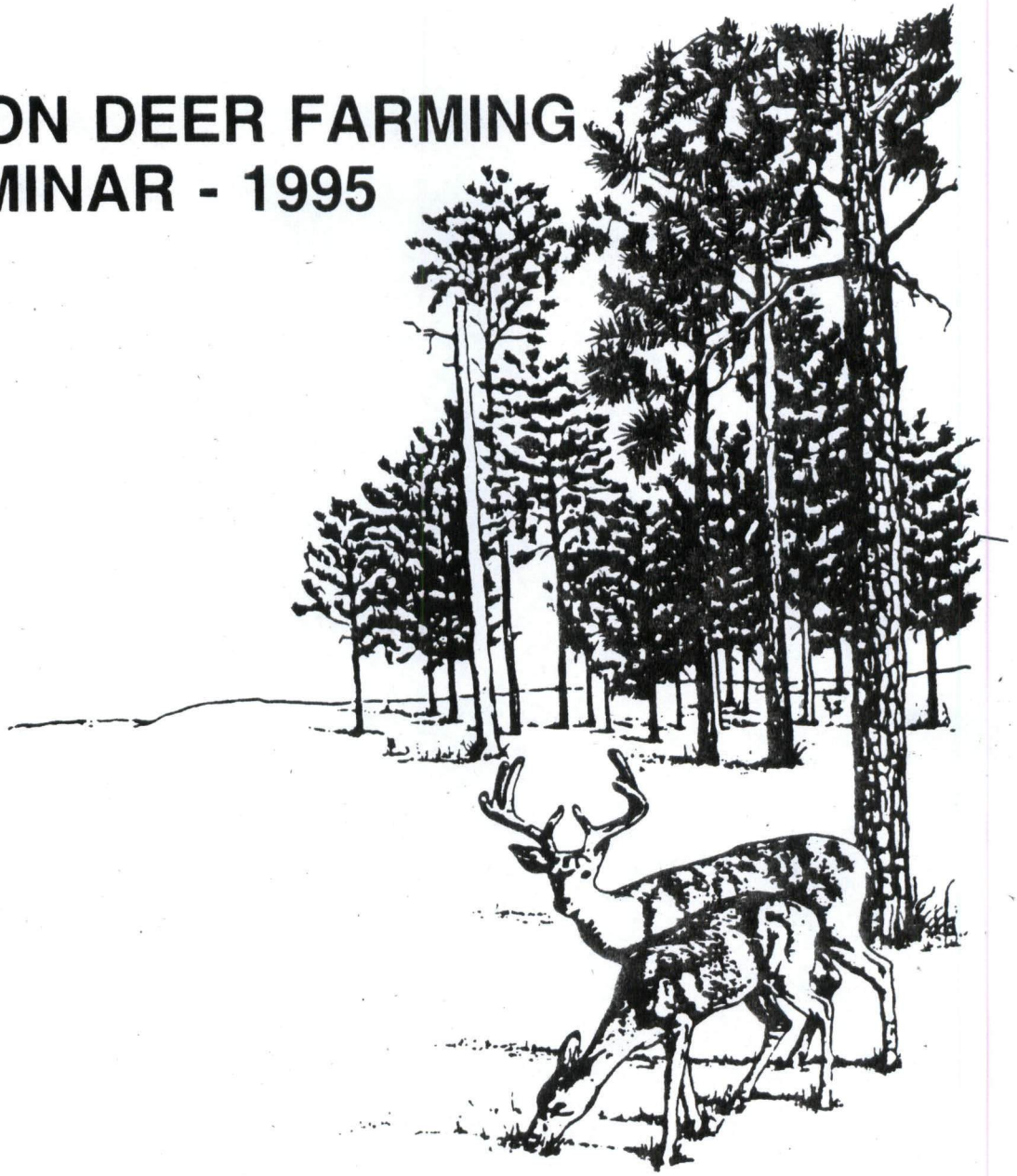

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REPRODUCTIVE MANAGEMENT OF MALE CERVIDAE AND GROWTH CHARACTERISTICS OF AXIS DEER

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Introduction. The effective management of bucks and stags is an important aspect of any deer farming operation. Regardless of whether the producer is interested in meeting the needs of the breeder, venison or hunter markets, buck management becomes a key to success. At the present time, few studies have addressed the cyclical changes in growth and reproductive function under the environmental and management conditions we may experience in Texas. Understanding the seasonal cycles of reproduction allows for more efficient management of breeding and fawning seasons, as well as the ability to optimize the collection of semen for artificial insemination and the use of other reproductive technologies.

Growth and development of bucks post-weaning and seasonal maintenance of body weight are important considerations for maximizing weight gains and ultimately carcass weights in venison production systems. Feed intake, feed efficiency and rate of gain in axis and fallow deer are factors which require further investigation in order to provide accurate assessments of input costs and returns from increases in liveweight. At the Texas A&M University Agricultural Research and Extension Center at Overton we have begun to investigate these seasonal and production-based questions as they relate to a non-seasonal species, the axis deer, and a seasonal species, the fallow deer. While information currently available from deer production systems and research centers in other areas of the world provide a basis of these investigations, understanding the reproductive biology and developmental aspects of these deer species under the management and forage conditions in Texas will provide more accurate assessments of the feasibility of deer farming and growth of the deer industry in Texas.

I. *Reproductive Cycles and Testicular Function in Axis Deer.* In order to maximize the reproductive potential of each deer species, it is necessary to define the reproductive cycles of deer within the environments to which they will be exposed. With the aid of the Texas Wild Game Cooperative (Ingram, TX), testis from axis (*Axis axis*) males were collected and information recorded for each individual harvested, such as antlerogenic state, age and season of harvest. Utilizing testicular homogenization methods, in which the testis and epididymis are minced and then diluted, sperm content at the time of harvest can be discovered and correlated to information collected at harvest. Preliminary data indicate that yearling (1-1.5 years old) axis bucks, with hard spikes, appear to be producing testicular and epididymal sperm concentrations capable of

producing a pregnancy (Table 1). However, factors such as behavioral immaturity, herd dominance hierarchies and actual ejaculate sperm concentrations may contribute to the potential breeding ability of axis yearlings.

Table 1. Testicular parameters from hard antlered axis bucks harvested in the fall.

Age	Left Testis Weight (g)	Testis Sperm Content ($x10^6$)	Epididymal Weight (g)	Epididymal Sperm Content ($x10^6$)
Yearling	12.01±2.5	923.26±330.3	2.91±.35	586.30±222.0
1.5 - 2 yrs.	15.88±1.0	1410.62±157.8	3.86±.16	1712.10±124.3
>2 yrs.	20.36±3.7	1538.32±310.3	5.12±.90	3072.45±1015.1

In addition, axis deer appear to be aseasonal in their reproductive cycles, providing an economic advantage to the deer producers. Analysis of testicular and epididymal sperm content of mature hard and velvet antlered axis males, during different seasons, illustrated that while testis sperm content fluctuated during the year, readily available stores for sperm output, as indicated by epididymal stores (Figure 1), do not appear to be affected by season or antler status. Additional studies are being developed to further enhance our knowledge of male reproductive biology through studies on puberty, spermatogenic cycles and determining the breeding potential of individuals.

II. *Seasonal Changes in the Reproductive Characteristics of Fallow Bucks in East Texas.* Much research has been done concerning the seasonal reproductive cycles of fallow deer. To date, most breeding systems in the United States and Texas have utilized this information and adopted these systems making necessary adjustments in breeding seasons based on environmental factors and other obvious conditions such as changes in antler development. However, in order to fully utilize the breeding potential of fallow deer, it is imperative that we define their reproductive cycles based on the environmental and nutritional conditions under which they will be raised.

In our initial investigations, four yearling fallow bucks were weighed weekly, and changes in neck girth and scrotal size monitored every two weeks. In addition, semen was collected by electroejaculation every two weeks to assess semen quality and quantity.

Body weights fluctuated prior to and during the breeding season increasing to 100 lbs as the breeding season ended (Figure 2). Neck girth increased steadily from July to October and then decreased until the end of the sampling period in December (Figure 2). We also noted that peak

Figure 1. Total epididymal sperm content in Axis bucks (>1.5 yrs.)

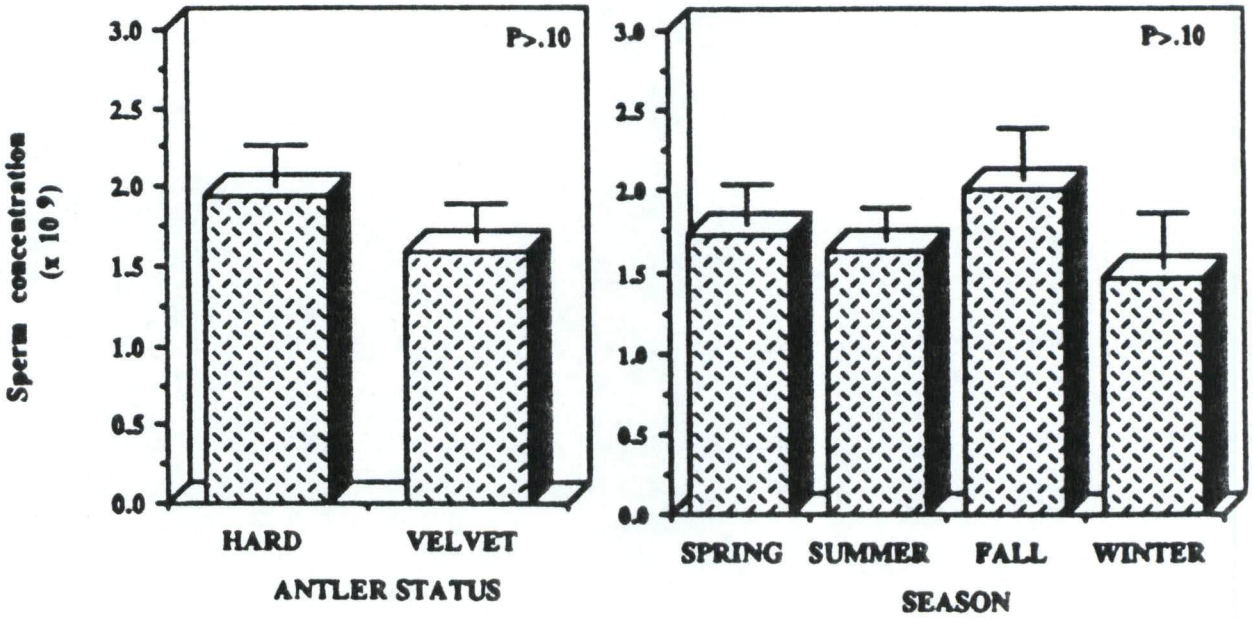
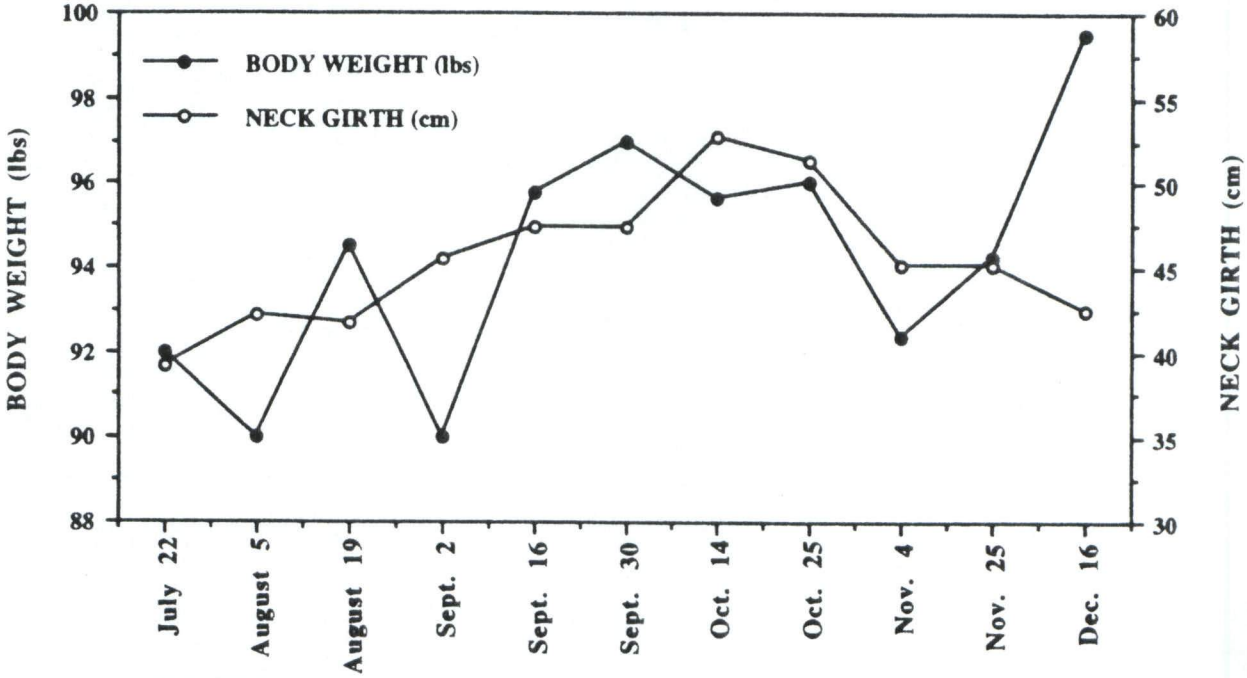


Figure 2. Neck girth and body weight changes in yearling fallow bucks



increases in scrotal circumference preceded maximum sperm concentrations by 30 days (Figure 3). These results suggest that changes in neck girth and scrotal circumference may be used to estimate the timing of peak sperm production to facilitate collection of semen for storage or artificial insemination. In addition, the data further define the reproductive cycles of fallow bucks in East Texas and provide valuable preliminary information for more intensive investigations into the seasonal cycles of this and other species of farmed deer. Another important finding of this study involves the method of semen collection used on the fallow bucks. The semen was obtained from bucks eletroejaculated in a drop-floor chute without tranquilizers or other drugs. In fallow deer, the collection of semen in this manner does not appear to result in any adverse or harmful effects provided care is taken with regard to restraint and the presence of experienced personnel. The Texas A&M University Agricultural Research and Extension Center at Overton is committed to continuing our efforts to further defining the reproductive and growth cycles of various agriculturally important species of deer, as well as interfacing practical methods for the effective management of deer with concerns for the welfare of deer under intensive farming conditions.

III. *Growth and Developmental Characteristics of Axis Deer.* Information concerning the early growth and development of axis deer is currently lacking. To improve the rates of growth, increase feed efficiency and ultimately enhance carcass weights, information is required which indicates potential feed requirements for calculating rations, estimating the rate and quantity of feed consumed and subsequently the feed costs per lb of gain. These factors may be further influenced by environmental factors, such as temperature and humidity, as well as physical and behavioral changes which includes the initiation of antler development and the attainment of puberty. Reproductive maturity may be greatly advanced or delayed depending on the availability of adequate nutrients and the conversion of those nutrients into actual increases in body weight. To investigate these relationships, 9 axis fawns (4 male and 5 female) were separated from their mothers at birth and bottle-reared until 3.5 months of age. At this time, fawns were placed on a complete feed (Table 2) which supplied adequate nutrients for maintenance and growth. The feed intake of the fawns was monitored daily and fawns were weighed at weekly intervals.

Table 2. Dietary composition of the complete feed for growth and development of Axis deer trials at the Overton Texas A&M University Agricultural Research and Extension Center.

Ingredient*	Proportion (Dry Matter Basis)
Corn, cracked	30%
Alfalfa, 17% protein	27%
Oats, grain	15%
Cottonseed hulls	13%
Soybean meal, 48% protein	10%
Molasses	2.50%
Dical. phosphate**	1.00%
Vitamin ADE premix**	0.50%
Trace mineral mix w/cobalt**	1.00%
Mix should contain:	16-18% protein 16% fiber DE = 3.0 Mcal/kg ME = 2500 - 3000 kcal/kg 10-11 MJ ME/kg DM

Mix should be pelleted into 3/16" pellets, or smaller, and be packaged into 50 lb bags.

*Above ingredient list is given in dry matter percentages and therefore actual mix must be recalculated by feed manufacturer.
**Replace with dairy ration (2.5%) min-vit premix.
Complete deer ration calculated by Dr. Donald E. Spalinger of the Texas A&M University Agricultural Research and Extension Center at Uvalde. Diets were formulated at Big Tex Grain, San Antonio, TX. Feed costs are currently $5.55 per 50 lbs.

Results from this trial indicate that during the first 100 days following weaning, daily feed intake increases from 1.7 to 2.3 lbs in females and from 1.6 to 2.5 lbs in males (Figure 4). While the average feed intake of axis fawns, expressed as a percentage of body weight, decreases from 4.0 to 3.7% for male fawns, and 4.2% to 3.5% for female fawns during the first 100 days (Figure 4). The average daily gain during the 100 day test period was .28 lbs for female fawns and .32 lbs for male fawns (Table 3). These findings provide valuable information with regard to rates of intake and feed requirements which are important to producers when calculating the quantities of feed to be provided for maintenance and growth.

The prepared ration (Table 2) utilized in this study required 5.7 to 6.0 lbs of feed during the first 50 days, and 7.3 to 8.9 lbs of feed during the last 50 days to achieve one pound of gain. The cost per lb of gain ranged from $.63 to $.98 per pound of gain depending on the sex and age

Figure 3. Sperm concentration and scrotal circumference in yearling fallow bucks

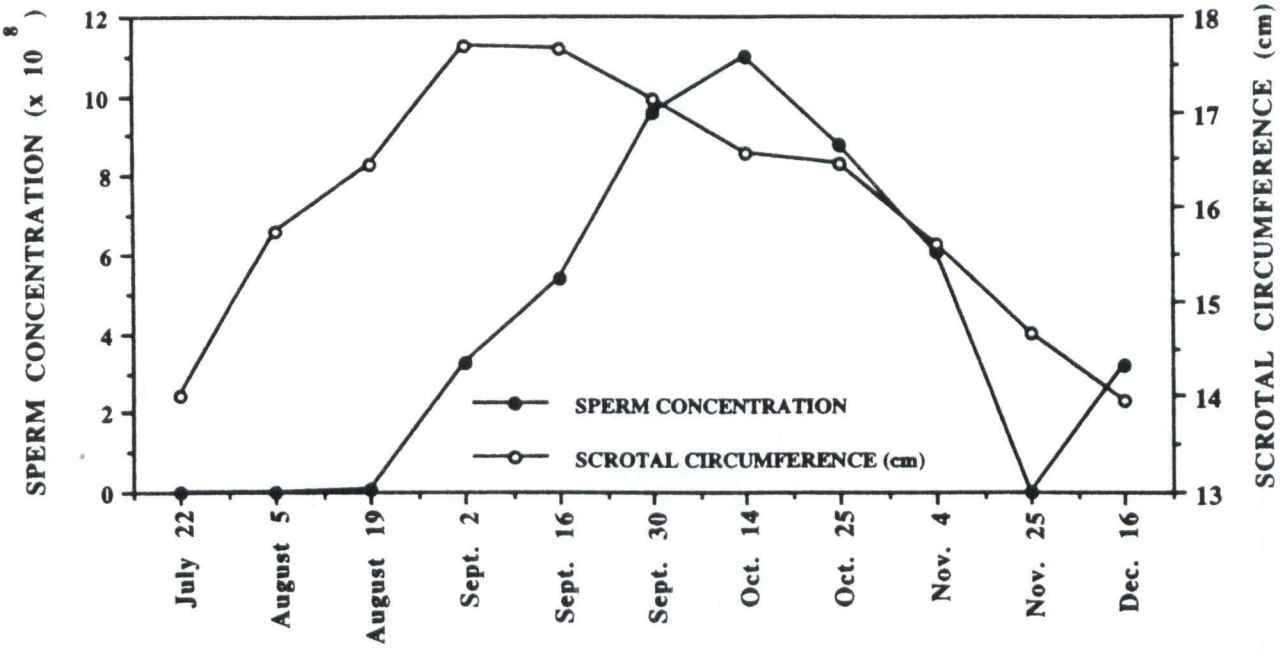
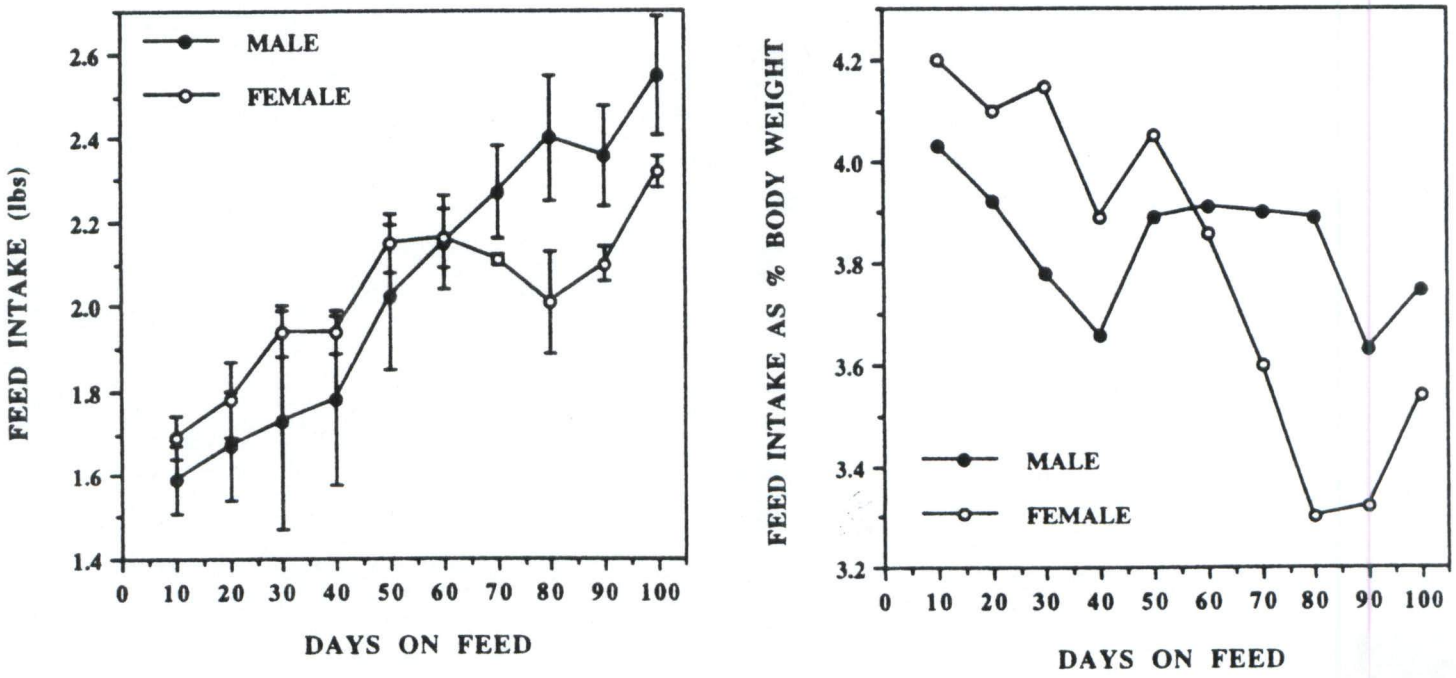


Figure 4. Feed intake and body weight percentages of Axis fawns consuming a complete ration (Table 2)



of the fawn (Table 3). It must be emphasized that the ration utilized in this study is a complete feed not requiring the use of pastures or hay as part of the diet. The use of well managed pastures or hay supplementation as needed to balance growth and maintenance requirements will further maximize gains and decrease feed costs. In the event that pasture systems are unavailable, as is the case in some areas, the results presented here may be representative of the performance characteristics of axis fawns maintained in drylot or penned environments. The data we have collected at the present time are similar to that which are obtained for most other species of ruminants in that rapidly growing young animals are the most efficient at producing gains in liveweight. We are continuing to monitor the growth and development of both male and female axis fawns and will continue our investigations until the fawns reach 15 to 18 months of age. We hope to further clarify the nutritional requirements of axis deer as well as to investigate the interaction between body weight and the attainment of puberty in this species.

Table 3. Growth and feed efficiency of Axis deer consuming a complete ration (Table 2) from 3.5 months of age to 6.8 months of age (i.e., 100 Days).

Item	Male (n=4)	Female (n=5)
Body Weight (lbs)		
Birth weight	8.8	9.8
Weaning weight (3.5 mo)	38.0	38.6
Day 0*	38.0	38.6
Day 50	53.5	54.8
Day 100	69.8	67.0
Average Daily Gain		
Days 0-50	.31	.32
Days 51-100	.32	.24
Days 0-100	.32	.28
Total Feed Consumption (lbs)		
Days 0-50	88.1	95.3
Days 51-100	117.5	107.2
Days 0-100	205.6	202.5
Feed Efficiency (lbs feed/lb gain)		
Days 0-50	5.7	6.0
Days 51-100	7.3	8.9
Feed Cost per lb of Gain ($)		
Days 0-50	.63	.66
Days 51-100	.80	.98

*Day 0 represents weaning (3.5 months of age), or day on test, in which the test ration became the sole source of feed. Day 50 represents 5.2 months of age and Day 100 represents 6.8 months of age.