

DEER FARMING IN KOREA : ON-FARM SURVEY IN KYUNG-KEE AND CHUNG-BUK PROVINCES

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Summary

Thirty farmers, representing three major deer counties in Kyung-Kee province and 50 farmers scattered in Chung-Buk province were interviewed to determine the current status of the Korean deer industry. Items surveyed were general information, farmed deer breeds, farm facilities, feeding and nutrition, hygiene and disorder incidence, velvetting, income sources, products and their sale, management problems, and herd size control. The 888 deer farmed in Kyung-Kee province included spotted deer (*Cervus nippon*, 69.4%), red deer (*Cervus elaphus*, 6.1%), wapiti (*Cervus elaphus canadensis*, 12.2%), spotted × red deer hybrids (6.2%), red deer × wapiti hybrids (4.6%), and fallow deer (*Dama dama*, 1.5%). Poor information on feeding was evidenced by wide variation among farms of daily feed supply and ratios of forage to concentrate, and poor nutritional considerations according to physiological status of deer. Hygiene needed more attention. The incidence of diseases and disorders was high; enteritis (73.3% in Kyung-Kee province), fractures (60.0%), and dystocia (56.7%). The major source of farm income was velvet antler and its blood. To improve productive efficiency, attention should be given to improving farm facilities, simplified product marketing, developing standard feeding system and economic grazing system.

(Key Words : Game Farming, Deer, Feed, Velvet Antler)

Introduction

Korea has the largest velvet antler market in the world. Since January 1, 1992, the Korean government has permitted importing live deer from foreign countries. Accordingly, the population of deer farmed in Korea is expected to increase rapidly in the near future. Also, the forthcoming complete opening of importation of all animal products under pressure of the Uruguay Round of GATT will stimulate structural reorganization and diversification of Korean traditional livestock industry. The role of the deer industry is becoming ever more important.

In many countries, considerable research has been conducted on fallow deer (Reinken et al., 1990), red deer (Blaxter et al., 1976; Yerex and Spiers, 1990), and wapiti (Renecker et al., 1988; Yerex, 1990). Although Korea is a world-top velvet antler importing country as well as possesses over 160,000 farmed deer, organized surveys of Korean deer industry are few.

This study evaluates the current status of the Korean deer industry through a survey of farms in Kyung-Kee province, where deer are raised intensively relative to other sides of the country and farms in Chung-Buk province, where deer are less intensively raised than in Kyung-Kee province.

Materials and Methods

Survey of farms

Thirty deer farms located in three major deer counties (Yong-In, Yang-Paeng, and Nam-Yang-Ju) in Kyung-Kee province and 50 deer farms scattered in Chung-Buk province were randomly selected from a list of farms provided by the Korean Deer Farmers Association. Each farm has been visited and a questionnaire completed with the manager from October 9, 1991 until March 31, 1992. This survey covered a total of 888 deer on the farms visited in Kyung-Kee province and a total of 833 deer on the farms visited in Chung-Buk province. Breeds on these farms included spotted deer, red deer, wapiti, fallow deer, hybrids of spotted and red deer, and hybrids of red deer and wapiti. Questions were grouped into 10 categories: 1) general information, 2) farmed deer breeds, 3) farm facilities and machinery, 4) feed, feeding and nutrition, 5) hygiene and disorders, 6) velvetting,

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7) farm income, 8) production and sale of velvet and velvet blood, 9) management problems, and 10) herd size control.

Sampling, assay and calculation

Samples of roughage, commercial deer feeds and farm supplements were collected from the farms surveyed, placed in an ice chest, transported to the laboratory and stored at -20°C ready for the analyses of chemical composition. Fresh clean samples of feces on the floor were collected from the 30 farms surveyed in Kyung-Kee province. The samples were sealed in plastic bags, placed in an ice chest, and analyzed within 24 h for worm eggs.

Dry matter (DM) of feed samples was determined by drying to a constant weight at 105°C for 24 h and DM of silages at 60°C for 48 h. Ash was determined by ashing in a muffle furnace at 600°C for 3 h. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined according to Goering and Van Soest (1970). Nitrogen (N) and ether extract (EE) were determined according to standard methods of AOAC (1985). A portion of samples were wet-ashed according to Sandell (1950) and analyzed for calcium by atomic absorption spectrophotometry and for phosphorus by the colorimetric method of Fiske and Subbarow (1925). Parasitic eggs in sampled feces were identified using the flotation technique of Soulsby (1965).

Daily individual feed DM supplied and ratios of roughage to concentrate in diets on DM basis were calculated using data collected from 18 spotted deer farms surveyed in Kyung-Kee province. The following items were calculated as percentage of related farms out of the total number of the farms surveyed in each province: general information, farms raising deer breeds, farm facilities and machinery, cultivation of forage crops, farms using different feed formulas, nutritional considerations, hygiene and disorders, use of immobilizing drugs, farm income, and herd size control.

Results and Discussion

General information

Careers of the 30 farm owners in Kyung-Kee province averaged 10 years, and those of the 50 farm owners in Chung-Buk province averaged approximately 6 years. In Kyung-Kee province, 53.3% of these farms were managed by owners

considering deer farming as a specialty, with remainder by salaried employees, whose employers were farming deer as a sideline. In Chung-Buk province, 72.9% of the farms surveyed were managed by owners, with the remainder by salaried employees. Approximately three quarters farmed deer as a sideline to other major activities. The relative high rate of employment in Kyung-Kee province may be attributed to the larger scale of deer farming than in Chung-Buk province. The daily labor requirement during the winter and spring months averaged 2.4 h in Kyung-Kee province, indicating that deer farming was less labor-requiring than traditional livestock farming. Labor was proportional to deer herd size and was spent mainly feeding and cleaning.

Farmed deer breeds

Breed distributions of farmed deer were presented in figure 1. In Kyung-Kee province, the most popular breed was spotted deer (69.4% of 888 deer) and the next was wapiti (12.2%). Among minor breeds, percentage of fallow deer, red deer, hybrids between spotted and red deer, or hybrids between wapiti and red deer fell within the range of 1.5 and 6.2. In Chung-Buk province, spotted deer made up 80.9%, wapiti 14.8%, and red deer 4.3%. In this survey, spotted deer type included spotted deer and hybrids between spotted and red deer, and wapiti type included wapiti and hybrids between wapiti and red deer because hybrids of spotted and red deer were more close to spotted deer and also those of wapiti and red deer to wapiti in their appearance and body shape. The figure reflected that many of the red deer were used for crossbreeding with spotted deer or wapiti. In addition, most of the spotted deer farmed in both provinces were historically multiple hybrids among Taiwanese, Manchurian, and Japanese spotted deer.

Farming spotted deer alone showed highest percentage in both provinces (table 1). Raising red deer alone (0 to 4.1%) was very rare, compared to raising wapiti alone (10.0 to 16.7%). Raising multiple breeds of deer was more popular in Kyung-Kee province (53.3%) than in Chung-Buk province (29.2%). Some farmers (4.1 to 6.7%) were raising all three breeds together. Herd size averaged 29.6 and ranged from 4 to 100 in Kyung-Kee province and it averaged 16.7 and ranged from 4 to 119 in Chung-Buk province.

KOREAN DEER INDUSTRY

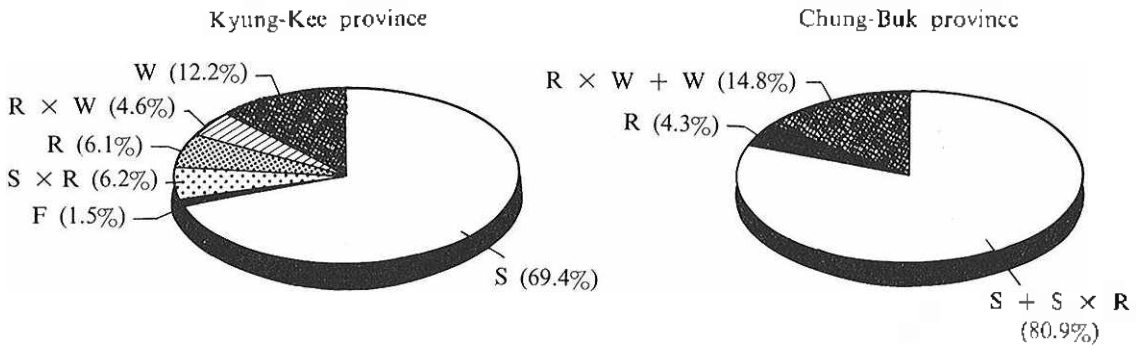


Figure 1. Breed cistribution of the 888 deer surveyed in Kyung-Kee province and the 833 deer surveyed in Chung-Buk province (S: spotted deer, F: fallow deer, R: red deer, W: wapiti, S × R: hybrids of spotted and red deer, R × W: hybrids of red deer and wapiti. For Chung-Buk province, hybrids of spotted and red deer were included in spotted deer and hybrids of red deer and wapiti, in wapiti.)

TARIF 1. PROPORTIONS OF FARMS RAISING SPOTTED DEER, FED DEER AND (OR) WAPITI^a

Breed raised	Province	
	Kyung- Kee	Chung- Buk
 (%)	
Spotted deer alone	36.7	50.0
Red deer alone	0.0	4.1
Wapiti alone	10.0	16.7
Both of spotted and red deer	20.0	6.3
Both of spotted deer and wapiti	23.3	16.7
Both of red deer and wapiti	3.3	2.1
All of spotted deer, red deer and wapiti	6.7	4.1

^a Hybrids with red deer were included in either of spotted deer or wapiti.

Farm facilities and machinery

Fenced area (mean ± standard deviation) of deer farms surveyed was 2,216 m² ± 1,985 in Kyung-Kee and 965 m² ± 1,145 in Chung-Buk province. The larger fenced area and the bigger herd size in Kyung-Kee province demonstrate its larger scale of deer farming than in Chung-Buk province. Kyung-Kee province has a benefit in that geographically it's located near the Metropolis, Seoul, where demand of deer products is high, resulting in relative ease sale of the products. The number of small paddocks was 5.6 ± 2.8 for farms surveyed in Kyung-Kee province. In both provinces, all farms had shelters for the deer. The major

source of water was ground water. Few farmers used mountain stream or tap water. The same 20% of the farmers in both provinces used various types of silo. The majority were brick bunker type in Kyung-Kee and trench type in Chung-Buk province. Only 38.0 to 56.7% of farms had race structure. Velvetting facilities, mostly pitfall type, were built in few farms (14.0 to 23.3%) because many farmers used immobilizers for velvetting.

For farm machinery used, the proportion of farmers using forage cutter was close to half in both provinces. Scales for weighing deer were used at only one of the total 80 farms surveyed. Accordingly, no herd body weight records were available in any farms. It should be stressed that recording live weights of animals periodically is essential for reasonable and scientific management of deer. Amounts of feed supply also have never been weighed on scale. Two farms were equipped with velvet-drying ovens.

Feeds, feeding and nutrition

Approximately 46% of farmers surveyed in Kyung-Kee province cultivated forage crops for deer on their farms. Forage crops cultivated were maize (53.8%), sudangrass (30.8%), soybean (15.4%) and other minor species, such as barley, alfalfa, kale, pumpkin and mulberry. Only a very small proportion of the annual feed supply came from forage crops cultivated on the farm. The feeding periods of the forage crops depended upon their harvested seasons.

Among roughage sources fed to deer (table 2), first priority was put on browse by most far-

TABLE 2. SEASONAL ROUGHAGE SOURCES FED TO DEER IN KYUNG-KEE AND CHUNG-BUK PROVINCES

Roughage type	Seasons			
	Spring	Summer	Fall	Winter
Browns ^a	<i>Quercus dentata</i> , <i>Pueraria thunbergiana</i> , <i>Lespedeza</i> spp., <i>Robinia pseudoacacia</i> , <i>Castanea crenata</i> , <i>Quercus serrata</i> , <i>Capsella bursa-pastoris</i> , <i>Camellia japonica</i> , <i>Hemistepta lyrata</i> , <i>Fumex crispus</i> , <i>Rosa multiflora</i> , <i>Pinus densiflora</i> .	<i>Quercus dentata</i> , <i>Pueraria thunbergiana</i> , <i>Lespedeza</i> spp., <i>Robinia pseudoacacia</i> , <i>Castanea crenata</i> , <i>Quercus acutissima</i> , <i>Erigeron canadensis</i> , <i>Miscanthus purpurascens</i> , <i>Morus alba</i> , <i>Digitaria sanguinalis</i> , <i>Salix flora</i> , <i>Koreensis</i> , <i>Prunus serrulata</i> , <i>Rubus crataegifolius</i> .	<i>Quercus dentata</i> , <i>Pueraria thunbergiana</i> , <i>Robinia pseudoacacia</i> , <i>Quercus aliena</i> , <i>Quercus serrata</i> , <i>Quercus acutissima</i> , <i>Stelobaria aquatica</i> , <i>Equisetum arvense</i> , <i>Rumex japonicus</i> , <i>Pinus densiflora</i> .	<i>Quercus dentata</i> , <i>Quercus aliena</i> , <i>Robinia pseudoacacia</i> , <i>Camellia japonica</i> , <i>Morus alba</i> , <i>Pueraria thunbergiana</i> , <i>Pinus densiflora</i> .
Others ^a	Maize silage, orchardgrass, ryegrass, alfalfa hay, pellet and cube, pumpkin, carrot, mugwort, peanut pod and stem, barley huff, sweet potato vine.	Sudangrass, sorghum forage, alfalfa hay, kale, pellet and cube, pumpkin, radish, peanut pod, pea vine, sawdust.	Sudangrass, kale, alfalfa hay, pellet and cube, pumpkin, carrot, sweet potato vine, sawdust.	Maize silage, alfalfa hay, pellet and cube, carrot, pumpkin, rice straw, rice hull, rice bran, barley huff, sorghum bran, peanut stem and leaves, acorn starch jelly waste, sawdust.

^a Common feed names were used.

KOREAN DEER INDUSTRY

mers regardless of the breeds of deer. All the wild browse species listed could be manually obtained from mountains near the farms throughout the late spring, summer and fall. Throughout the seasons, most farmers used *Quercus dentata* as a major roughage source. In summer and fall, the next species used in quantity included *Pueraria thunbergiana*, *Lespedeza spp.*, and *Robinia pseudo-acacia*. The preference of these browse species by spotted deer was proved by the palatability study of Lee et al. (1990). During the winter and spring seasons, however, most farmers (78.4%) used browse hays such as *Quercus dentata*, *Q. acutissima* and *Robinia pseudo-acacia* imported from China or North Korea. The limited supply of browses in winter was attributed to high labor cost in harvesting browses before winter. Feeding *Pinus densiflora* was favored by most farmers due to its efficacy for reducing diarrhea.

As a substitute for part of the browse and concentrate, some farmers fed sudangrass, orchardgrass, ryegrass or kale cultivated on farms during the spring, summer and fall seasons. Maize silage was made on 4 of the 30 farms in Kyung-Keo province where it was fed as an energy source during winter and spring. Alfalfa hay, pellets and cubes, mostly imported, were fed on 6 farms. Also, a variety of cheap agricultural byproducts were widely used during the winter and spring, such as rice bran, barley bran, sorghum bran, rice straw,

rice hull, barley hull, peanut pod, leaves and stem, pea vine and sweet potato vine. When available, acorn and acorn-starch jelly waste were favored by farmers. Even if rare, some medical herbage wastes cheaply available were fed to deer stags and thought by the farmers to enhance the medical efficacy of velvet antler. Even, sawdust was blended in diet and fed as a fiber or water-absorbant source on two farms. All these individual byproducts were supplied at small to medium levels of the ration depending upon their availability, nutritional usage and economy.

Chemical compositions of roughage sources collected from the farms surveyed are presented in table 3. Crude protein of browse species ranged from 9.5 to 15.5%, NDF from 43.3 to 59.2%, ADF from 23.7 to 50.8%, and ash from 4.6 to 15.1%. Among them, *Quercus* species showed similar CP (11.6 to 11.8%) and NDF (54.3 to 56.4) contents. Compared to *Quercus* species, *Robinia pseudo-acacia* and *Morus alba* leaf hays had high CP (14.3 and 15.5%, respectively) and high ash (11.8 and 15.1%) contents. Alfalfa products were highest in CP content among roughage sources listed. Among peanut byproducts, peanut leaf showed desirable nutritive values (15.8% CP and 49.8% NDF), compared with peanut pod or peanut stem. Sawdust was lowest in CP and ash contents and highest in NDF and ADF contents among roughage sources listed.

TABLE 3. CHEMICAL COMPOSITIONS OF ROUGHAGE SOURCES

Roughage	DM	OM	CP	NDF	ADF	Ash
	(%)					
<i>Quercus dentata</i> leaf hay	89.7	94.3	11.6	54.3	33.7	5.7
Chinese <i>Quercus dentata</i> leaf hay	88.2	92.2	11.6	54.9	39.3	7.8
Chinese <i>Camellia japonica</i> leaf hay	90.3	94.5	9.5	59.2	45.7	5.5
<i>Morus alba</i> leaf hay	86.9	84.9	15.5	43.3	23.7	15.1
<i>Quercus acutissima</i> leaf hay	89.3	95.4	11.8	56.4	50.8	4.6
<i>Robinia pseudoacacia</i> leaf hay	90.0	88.2	14.3	56.8	38.8	11.8
Alfalfa hay ^a	90.4	90.1	17.7	55.9	52.1	9.9
Alfalfa pellet and cube ^a	88.7	89.6	18.8	50.7	31.5	10.4
Peanut pod ^a	87.8	95.6	3.9	67.4	40.3	6.0
Peanut leaf ^a	87.2	90.0	15.8	49.8	31.0	9.1
Peanut stem ^a	84.3	90.2	7.5	65.7	57.2	9.8
Acorn starch jelly waste ^a	50.1	95.0	5.2	61.0	39.5	5.0
Sawdust ^a	71.7	99.6	0.6	92.1	80.7	0.4

^a Common feed names were used.

^b Alfalfa pellet and cube were ground and blended in equal portions.

All the farmers supplied concentrate sources with commercial feed formula throughout the year. Feeding commercial deer feed formula was higher (58.6%) in Kyung-Kee province and was very low (only 4.1%) in Chung-Buk province, where the remaining 95.9% were still feeding commercial beef cattle feed formula. Also, 10.3% of the herds in Kyung-Kee province were fed both commercial deer and beef cattle feed formulas. The high pro-

portion of feeding commercial deer feed formula in Kyung-Kee province may be attributed partly to that the deer feed mills put their first marketing priority on Kyung-Kee province, where deer farms are highly concentrated. The commercial deer feed formulas were composed of maize- and soybean meal-based ingredients, including small grain hulls, soybean hull and (or) alfalfa products as roughage sources, and mineral and vitamin additives.

TABLE 4. CHEMICAL COMPOSITION OF COMMERCIAL DEER FEED FORMULAS

Feed formula	DM	OM	CP	EE	CF	Ash	Ca	P
	(%)							
A	87.8	94.8	16.2	3.1	6.3	5.2	0.78	0.61
B	89.0	94.7	16.3	2.3	5.5	5.3	0.67	0.50
C	88.2	94.1	14.0	3.4	5.0	5.9	0.97	0.72
D	87.4	94.1	16.1	2.5	17.9	5.9	0.70	0.59
E	90.2	96.0	13.1	5.0	8.7	4.0	0.15	0.55
F	87.0	93.0	14.0	2.0	15.0	7.0	0.99	1.50

The chemical compositions of six commercial deer feed formulas sampled on these farms are shown in table 4. Crude protein of all the formulas was in the range of 13.1 and 16.3%. Crude fiber was low (5.0 to 8.7%) in four formulas and high (15.0 and 17.9%) in two formulas. Calcium ranged from 0.15 to 0.99% and P from 0.50 to 1.50%. Ratios of Ca to P were in the range of 1.19 and 1.34 in four products and lower (0.27 and 0.66) in other two products. These wide ranges of chemical compositions seem to be because the nutritional requirement of deer has not yet been established for velvet antler growth.

In addition to feeding roughage and commercial feed formula, percentage of farmers feeding supplements were 60 and 65.2 in Kyung-Kee and Chung-Buk provinces, respectively. Among farm supplements, a small portion of whole soybeans with high protein were most widely fed in either ground or water-swollen form to stags during the velvet-producing period and to hinds during the pregnant or lactating period. Ground maize grain, broken rice, small grain brans and (or) maize germ meal were blended in diets and used mainly as a source of energy on a few farms.

Concerns about nutritional needs according to physiological status of deer were high in the order of velvet-producing, pregnant, fawning and lactating

periods in both provinces (table 5). During the velvet-producing period, stags were supplemented with whole soybeans or extra allowances of concentrate formula. As pregnancy advanced, feed supply was lowered on some farms, but was enhanced on other farms, indicating no standard feeding program in this period. During the fawning and lactating periods, fawns and mothering hinds should be fed well enough to meet each of their requirements. However, percentage of farmers who take into nutritional consideration fully in these periods were low in both provinces, because many farmers had practical difficulties in weaning fawns away from mothers due to the insufficient numbers of small paddocks. Farms with creep feeders were few. In general, less nutritional care of animals on farms surveyed in Kyung-Kee province may be related to the high rate of employment compared with in Chung-Buk province.

Daily feed DM supplied to spotted deer on the 18 spotted deer farms during the winter and spring months varied from 1.0 to 3.2 kg per head, with an average of 2.2 kg. Also, proportions of forage to concentrate in these diets varied from 89:11 to 29:71. Like this, all the farmers relied solely on their own experience without any standard feeding program established.

KOREAN DEER INDUSTRY

TABLE 5. PROPORTIONS OF FARMS CONTROLLING NUTRITIONAL LEVELS ACCORDING TO PHYSIOLOGICAL STATUS OF DEER

Physiological status	Province	
	Kyung- Kee	Chung- Buk
 (%)	
Velvet-producing period	56.7	65.2
Pregnant period	34.5	60.9
Fawning period	23.3	34.8
Lactating period	13.3	30.4

Deer hygiene and disorder incidence

Farmers dosed with anthelmintics was 76.6%, with 20% once each year and the remainder twice in spring and fall. On these farms, tests for fecal worm eggs were negative. However, the tests were positive on three of seven farms where no anthelmintic dosing was practiced. Worm eggs identified were *Moniezia expansa*, *Fasciola hepatica*, *Strongyloides papillosus*, *Dictyocaulus filaria*, and *Eimeria parva*. Farmers disinfecting their farms was only 30%, with only 13.3% disinfecting less than twice and the remainder disinfecting more than three times each year. Furthermore, preventive measurement against contagious disease has not been made in any of the 30 farms.

Among deer disorders encountered in Kyung-Kee province, over half of the 30 farmers have experienced enteritis (73.3%), bone fracture (60.0%) and dystocia (56.7%). Bloat, dermatitis, osteomyelitis and anemia have broken out on 33.2, 33.2, 30.0 and 30.0% of the farms surveyed, respectively. Other minor disorders encountered were choke (23.2%), indigestion (16.6%), endometritis (6.7%), and prolapse of uterus (6.7%), vagina (3.3%) or anus (3.3%). In general, the incidence rate of digestive and metabolic diseases was high. The overall death rate of deer was 7.1% per year. The death rate was high in stags rather than in hinds due apparently to their struggles in a small fenced area and incidents associated with velvetting.

Immobilizers used

At time of velvet cutting, all of the 30 farmers surveyed in Kyung-Kee province used immobilizers such as succinylcholine Cl, xylazine HCl or mixture of the two. Proportions of immobilizers used was 78.5% for succinylcholine Cl, 17.9% for

xylazine HCl, and 3.6% for the mixture of the two. Preference of drug type depended upon deer breeds. For spotted deer, using succinylcholine Cl was more popular, mainly due to its quick immobilization and waking-up. For wapiti, using xylazine HCl was more favored due to its safe property. Not as in New Zealand (Yerex, 1990), the cutting procedure may be done without veterinary supervision.

Income sources and deer products

Velvet antler is a very valuable product in traditional oriental medicine. Also, velvet antler blood is considered to improve human health. All the farmers surveyed in both provinces produced velvet antler and its blood as a major annual source of income. Trade of fawns and breeders provided additional income. Deer killed by old age or by accident may be moved to a processing plant to manufacture a condensed deer soup under high pressure and heat. This product sealed in plastic bags has been told to improve the health of old or weak humans. Percentage of farmers who had obtained any income through this way was 26.7 in Kyung-Kee province and 0 in Chung-Buk province. Venison was not produced on any of the 80 farms.

Adult red deer stags produced about 3 times more velvet antler than spotted deer stags, and wapiti stags over 4 times more than red deer stags (table 6). The velvet production increased proportionally to the body size of deer breeds. Relatively poor antler growth of spotted deer was pointed out also in Kim and Han's report (1985). After removal, the velvet was sold immediately to the consumers visiting to the farms. Prices of fresh velvet antlers sold directly to the consumers on farms were in the range of 573 and 1,053 US dollars per kg. Relatively low price of wapiti velvet on some farms was attributed to the uneasy sale of large volume produced at a time. Surplus of wapiti velvet was frozen, until sold or dried for further processing. Within the same breed, prices varied from farm to farm. Farmed spotted deer and red deer stags produced small volumes of velvet antlers and velvet blood relative to wapiti stags. These fresh products were usually sold together to a group of customers visiting to the farm, while those of wapiti were sold separately due to their large volumes.

At time of velvetting, velvet blood is released.

Volumes of velvet blood produced for sale in each farm had much variation. However, the general ratio in blood production of spotted deer, red deer and wapiti was 1:2:4. The more velvet blood production was related to the bigger body size.

Normally, the released blood was mixed immediately with various alcoholic beverage or liquids of digestion aids to prevent clotting. The price of the blood mixture per 100 ml averaged 66 US dollars for red deer and wapiti.

TABLE 6. PRODUCTION AND PRICES OF FRESH VELVET AND (OR) VELVET BLOOD

Item	Spotted deer		Red deer		Wapiti	
Velvet						
Production ^a (kg)	1.0	0.33	2.9	0.44	12.8	2.95
Price ^a (US \$/kg)	889	149.3	1,053	133.3	573	160.0
Velvet blood						
Production ^b (ml)	567	259.7	913	317.2	1,900	1,250.0
Price of blood mixture ^c (US \$/dl)	—	—	66	23.4	66	23.4

^a Mean and SD of 5 observations, respectively, for sika deer and wapiti and 3 observations for red deer (adult deer).

^b Blood alone (mean and SD of 8 observations for sika deer, 3 observations for red deer, and 6 observations for wapiti). (deer of all ages)

^c Mixture of blood and various alcoholic beverage or liquid of digestion aids (mean of 5 observations, respectively).

Prices of live deer

Male deer were more costly than female ones due to the important role as velvet producers. Regardless of sex, prices in US dollars of live adult deer older than 2 years were in the range of 750 and 1,280 for spotted deer, 1,750 and 2,790 for red deer, 3,140 and 4,650 for hybrid of red deer and wapiti, and 6,980 and 10,470 for wapiti (Bang, S. K., personal communication). Nowadays, live deer prices tended to slightly go upward from the bottom points formed in the past two years which were caused by complete opening of live deer importation.

Current industry problems and herd controls

A variety of current problems in the Korean deer industry exposed from this survey were as follows. All the farmers surveyed complained of completely opened deer imports, disadvantageous legal aspects, excess taxation on stags and products, and lack of roughage source during the winter. Many farmers pointed out damage by imported velvet, the lack of marketing system for deer and their products, freezing of winter drinking water for deer, consanguineous mating on small-scale farms, inefficient and expensive commercial deer feed formulas, and administrative restrictions on the use of mountain grazing aimed at forest con-

servation.

Herd size control was surveyed in Kyung-Keo province. Approximately 34.5% of the farmers were planning to increase herd size, 27.6% to decrease, and 34.5% to maintain. Only 3.4% wanted to quit farming deer if the present situation continued. General pattern was that farmers with large-scale farms wanted to reduce, farmers with small-scale farms to increase herd size, and farmers with medium-scale farms to maintain the present herd size. Many farmers appeared to watch the development of the current situation before taking further action. With the completely opened deer imports, anyhow, the total population of farmed deer in Korea is expected to increase to a great extent in the future due to the high demand and low domestic supply of velvet antler.

In general, the deer farming system in Korea aims mostly at velvet antler production compared with venison production in Canada (Haigh and Hudson, 1993), New Zealand (Yerex and Spiers, 1990) and some European countries (Blaxter et al., 1976; Reinken et al., 1990). In Korea, the penned deer, mainly spotted deer, were raised intensively on a relatively small size of farms, on which browse was fed as a main roughage source. Poor systems of animal feeding and care should be improved for more profitable deer farming. In

the future, more systematic studies, especially for the enhancement of velvet antler production should be conducted using the basic information obtained from this on-farm survey.

Conclusions

The data in this study represent the current status of Korean deer industry and are reasonably compared with large farm scale and venison production system of the deer industries in Europe, Canada, and New Zealand. In order to compete with imported velvet antlers in quantity and quality aspects, it requires the intensive and efficient production system on the farm levels. As a whole, multilateral efforts should be made for convenient and ideal facility construction, development of standard feeding system, genetic improvement of breeders for velvet antler production, hygienic care of deer, and simplified transactions and diversification of products.

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