VELVET ANTLER PRODUCTION - IMPROVED NUTRITION AND MANAGEMENT

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Velvet antler is characterised as product harvested from actively growing antler at the correct stage of differentiation and calcification. It is a valuable food and nutriceutical. Processed velvet is marketed as traditional oriental medicine and used increasingly in western countries as a natural dietary supplement. It's financial value is assessed on the farm in terms of physical size and quality based on an understanding of growth, breed characteristics and age.

Market value of the dried product is based on weight, size, internal structure and colour of processed stick, processing quality and increasingly on biological activity and food safety standards.

The seasonality of production in farmed deer is dramatically expressed by the annual growth and harvest cycle of velvet antler. Growing antler at its full genetic potential requires dedicated management of nutrition for stags over the entire year not just in the late winter/spring antler growth period (Fennessy and Suttie, 1985). A summary of nutritional studies and the impact on velvet antler growth confirms that any restriction in feeding stags for maintenance or growth phases particularly from autumn until spring has a significant and negative impact on antler growth under New Zealand pastoral based feeding systems. Critically, pastoral feeding relies on winter supplementation of conserved forages as a cost effective ration in times of pasture shortage. This is a period of significant management and nutritional challenge that may compromise velvet antler growth and size if poor quality or inadequate feeding levels are followed.

Antler size, expressed through an objective grading and measurement system (NZ Game Industry Board) is assessed through the primary components of weight and beam circumference at specific measurement points and classical shape or style. Quality parameters are reflected as visual lack of calcification in base and tyne tips, days of growth and to a lesser extent age, breed type, handling and storage. Nutritional factors can play a role in affecting all these components. In both the North American Elk industry and the New Zealand industry huge gains have been made in lifting antler weight for age production through the identification of superior strains and individual sires within strains. Application of AI and ET technologies facilitate the rapid spread of these genetics through specialist velvet antler and breeding herds. There is good evidence that the heritability of antler weight is high. Values of between 0.36 and 0.45 are quoted on limited objective analysis in NZ work (Fennessy, 1997; Garrick, 1996). Evaluation of production data gives confidence that antler weight ranking at 2 years of age is the most definitive indicator of future production as animals grow to reach peak performance at 6-8 years of age in red deer and 6-10 years in elk .

Expression of the genetic potential is critically linked to feeding requirements and strategic supplementation at crucial stages of the seasonal cycle.

Velvet production systems in NZ and to a lesser extent the North American elk and red deer industries are based on the intensive use of pasture to maximise production, while minimising costs (Suttie *et al*, 1996). Feed shortfalls at any time of the year are balanced by feeding conserved forages as hay, baleage or silage and grain based supplementary feeds. Overwintering feed deficits may also be met by controlled direct grazing of brassica crops mixed with quality hay or ensiled grasses or legumes. There is however only sparse experimental work on the specific feed requirements and appropriate ration balance for velvet stags as this management is an adaptation of traditional stock management. The general approach has been to provide a basal quality ration to appetite and then replace components of that with grain or protein based supplements that enhance energy or protein intake. The most cost effective combination of conserved forage and supplemental grain generally determines the ration formulation. For older red stags, this might be silage or hay to appetite (3-3.3kg DM/head/day) plus 1.0-1.2 kg whole grain barley, a total daily intake of 46 MJME.

Detailed nutritional investigations on the influence of feed level and nutritional components of feed for enhanced velvet growth have been on-going and well reported (Suttie *et al*, 1996.) Once stags are fed to appetite, little additional gain is possible by feeding extra protein or energy. The effect of levels of nutrition at different stages of the annual seasonal cycle confirms that underfeeding of stags during any period reduces antler production in the subsequent spring. This is most severe when restriction applies to the late autumn post-rut bodyweight recovery period. Pre casting and the velvet growth period itself are also critical in terms of any restriction but consistently difficult to enhance by luxury nutrition levels. Studies indicate that this effect is more evident in lower producing stags.

There are similar recommendations for elk (Friedal *et al*, 1995) using an ad lib 13.5% protein alfalfa based diet plus 22 MJ daily in the form of whole oats with 0.5kg daily of a pelleted vitamin and mineral supplement to gain body weight and condition prior to winter. Late winter feeding ideally should boost protein rations to 16-18% while maintaining energy and supplemental rations. ME requirements are estimated at 57-64 MJ/d with an increase in the precasting and antler growth periods.

The concept of strategic feeding at specific stages of the antler cycle to improve both weight and beam dimension or grading has been advanced adapting the pastoral situation along similar patterns to the Chinese pen feeding systems (Suttie *et al.*, 1996). Specifically formulated diets combining protected protein(18%), protected fat (8%) and organically bound trace minerals amplifying copper and selenium (Bioplex TM 500, Cundy Technical Services) showed a variable but

significant mean weight increase of 7% in commercial herds and strong improvement in antler grade.

Encouraged by the Chinese system that changes the balance of protein and energy through out the year, further developments in strategic feeding are indicated. During the antler growth period protein levels of 25% are targeted. Table 1 shows a concentrate diet formulation for a production Wapiti stag in china (Liang *et al.*, 1993). Roughages including ensiled corn, tree leaves, podded plants, forage grasses and roots and melons fed first and complemented by fermented, steamed or expanded concentrates to improve feed conversion efficiency and balance the cost of grains and roughage sources. (Gao *et al.*,. 1996).

In preparatory work this year the basic winter forage diet for the Agresearch Invermay herd of mixed age stags on grass pasture baleage (or silage) was changed to a specific crop baleage fed ad lib for the winter and pre casting period in combination with 1.2kg of whole grain barley

With both red clover and lucerne sources, wastage was almost nil in comparison with pasture forage. Velvet weights average 4.07kg compared with 3.78kg the previous year.

Management factors also play an important role in optimising production. The key to advancing velvet growth is in the 3 to 4 week post rut recovery period and in the pre casting period. Beneficial nutrition effects are enhanced by forming stable cohorts of similarly aged stags from as early as yearling age and to avoid adding in new animals or mixing groups. During the rut, non breeding stag groups should be located with as much space as sensible feed conservation allows and as far from active breeding groups as is practical to reduce fence pacing, aggressive behaviour and extreme rut-related weight loss. Rapid post rut recovery with targeted feeding is readily achieved. Concentrates should be offered on an individual animal basis rather than by group feeding in troughs or lines. Bulky forages must be of the highest quality possible to counteract the rumen fill limitations to intake.

This valuable and unique antler food product requires a total commitment to quality of feeding, breeding and selection and sound animal handling management to return the investment in years of production and adaptation of deer to a modern pasture based farming and strategic nutrition regime (Table 2).

Table 1. Concentrate diet formulation for Wapiti stags in China.

Growth phase	Soybean cake (kg)	Maize (kg)	Bran (kg)	Distillers grain (kg)	ME intake (MJ/day)
Pre antler	1.0	0.5	0.7	1.5	45
Antler	1.45	0.7	1.1	1.5	58
Rutting	0.8	0.45	0.65	-	23
Recovery	0.95	0.45	0.65	1.25	40

Table 2. Feed composition analysis of Invermay velvet stags base forage ration.

Baleage	DM%	Crude protein %	In vitro digestibilty	Crude lipid %	Estimated ME (MJ/kg DM)	pH
Pasture	33.3	12.5	68.3	4.1	10.9	4.1
Red clover	16.5	21.5	64	5.0	10.2	4.7
Lucerne (3rd cut)	43.4	24.8	71.8	5.5	11.5	5.2

REFERENCES

Adam, J.L.; Asher, G.W. 1986. Deer growth and production. Proceedings of a Deer Course for Veterinarians 3: 8-16. Deer Branch NZ Veterinary Association.

Adu, E. K.; Barry, T. N.; Wilson, P. R.; Kemp, P. D. 1998. Evaluation of *Lotus corniculatus* for increasing pre-weaning growth in red and hybrid deer. Journal of Agricultural Science, Cambridge. 131: 197-204.

Ataja, A. M.; Wilson, P. R.; Barry, T. N.; Hodgson, J.; Hoskinson, R. M.; Parker, W. J.; Purchas, R. W. 1992. Early venison production from red deer *(Cervus elaphus)* as affected by grazing perennial or annual ryegrass pastures, pasture surface height and immunization against melatonin. Journal of Agricultural Science, Cambridge, 118: 353-369.

Barry, T.N.; Wilson, P.R. 1994. Venison production from farmed deer. Journal of Agricultural Science (Camb) 123: 159-165.

Dryden, G. M^{c}L.; Stafford, K. J.; Waghorn, G. C.; Barry, T. N. 1995. Comminution of roughages by red deer during the prehension of feed. Journal of Agricultural Science, Cambridge 125: 407-414.

Fennessy, P.F.; Milligan, K.E. 1987. Grazing management of red deer in 'Livestock Feeding on Pasture' (Ed AM Nicol) Occasional Publication No 10, NZ Society of Animal Production, pp 111-118.

Fennessy, P.F. 1997. Issues in genetic improvement in deer. Deer Branch, New Zealand Veterinary Association. Proceedings of a deer course for veterinarians 14: 15-22.

Fennessy, P.F.; Suttie, J.M. 1985. Antler growth: Nutritional and Endocrine factors, in the Biology of Deer Production. Royal Soc. NZ Bull. 22: 239-250.

Freudenberger, D. D.; Burns, C. J.; Toyakawa, K., Barry, T. N. 1994. Digestion and rumen metabolism of red clover and perennial ryegrass/white clover forages by red deer. Journal of Agricultural Science, Cambridge. 122: 115 - 120.

Friedel, B.L.; Goonewardine; Hudson, R.J. 1995. Effect of Nutrition on velvet antler production in farmed elk. Alberta Agriculture Research Update 6: 56.

Gao Xiuhua et al 1996. Recent Development in feed utilization and nutrition of antler producing deer in China. '96 International symposium on deer science and deer products, 71-77.

Garrick, D.J.; Van Den Berg, G.H.J. 1996. Relationships between adult liveweights in farmed red deer. Proceedings of the New Zealand Society of Animal Production 56: 334-337.

Hamilton, W.J.; Sibbald, M.A.; Feist, D. 1995. The effect of sward height on the liveweight gain of farmed yearling red deer (*Cervus elaphus*) stags. Grass and Forage Science 50: 399-404.

Hodgson, J. 1982. Influence of sward characteristics on diet selection and herbage intake. *In* Hacker J.M. (Ed). "Nutritional limitations to animal production from pasture. Commonwealth Agricultural Bureau, Farnham Royal UK. pp 153-165.

Hoskin, S. O.; Barry, T.N.; Wilson, P.R.; Charleston, W.A.G.; Hodgson, J. 1999. Effects of reducing anthelmintic input upon growth and faecal egg and larval counts in young farmed deer grazing chicory and perennial ryegrass/white clover pasture. Journal of Agricultural Science, Cambridge. 132: 335-345.

Hunt, W. F.; Hay, R. J. M. 1990. A photographic technique for assessing the pasture species performance of grazing animals. Proceedings of the New Zealand Grassland Association 51: 191-196.

Judson; H.G.; Nicol, A.M. 1997. Effect of feeding level on the seasonal liveweight gain of young red deer and red/elk hybrid stags. Proceedings of the NZ Society of Animal Production 57: 139-143.

Kusmartono; Barry, T. N.; Wilson, P. R.; Kemp, P. D.; Stafford, K. J. 1996a. Effects of grazing chicory (*Chicorium intybus*) and perennial ryegrass (*Lolium perenne*)/white clover (*Trifolium repens*) pasture upon the growth and voluntary feed intake of red and hybrid deer during lactation and post-weaning growth. Journal of Agricultural Science, Cambridge 127: 387-401.

Kusmartono; Shimada, A.; Barry, T. N. 1997. Rumen digestion and rumen outflow rate in deer fed fresh chicory and perennial ryegrass. Journal of Agricultural Science, Cambridge, 128: 87-94.

Kusmartono; Shimada, A.; Stafford, K. J.; Barry, T. N. 1996b. Intra-ruminal particle size reduction in deer fed fresh perennial ryegrass and chicory. Journal of Agricultural Science, Cambridge, 127: 525-531.

Liang Fengxi; Wang Quankai; Weng Tiefeg. 1993. Deer Farming for Velvet production. The 4th ARRC International Symposium: 115-122.

Min, B. R.; Barry, T. N.; Wilson, P. R.; Kemp, P. D. 1997. The effects of grazing chicory (*Chicorium intybus*) and birdsfoot trefoil (*Lotus corniculatus*) on venison and velvet production by weaner red and hybrid deer. New Zealand Journal of Agricultural Research, 40: 335-347.

Molan, A.L.; Hoskin, S.O.; Barry, T.N.; McNabb, W.C. 1999. The effect of condensed tannins extracted from four forages on deer lungworm and gastrointestinal nematode larval viability. Veterinary Record (In press).

Nicol, AM 1996. Seasonal pasture supply and manipulations to match demand. Proceeding of a Deer Course for Veterinarians 13:115-126 Deer Branch NZ Veterinary Association.

Niezen, J. H.; Barry, T. N.; Hodgson, J.; Wilson, P. R.; Ataja, A. M.; Parker, W. J.; Holmes, C. W. 1993. Growth responses in red deer calves and hinds grazing red clover, chicory and perennial ryegrass/white clover swards during lactation. Journal of Agricultural Science, Cambridge, 121: 255-263.

Pearse; A.J. 1992. Farming Wapiti and Wapiti hybrids in New Zealand. In Brown RD (ed) The Biology of Deer Springer-Vertag, New York, pp 173-179.

Rattray; P.V.; Clark, D.A. 1984. Factors affecting the intake of pasture. NZ Agricultural Science 18: 141-152.

Stevens; D.R. 1999. Late-lactation and post-weaning growth studies 1999. Report to Deermaster Programme South Canterbury and North Otago Deer Farmers Association.

Suttie, J.M.; Webster, J.R.; Littlejohn, R.P.; Fennessy, P.F.; Corson, I.D. 1996. Increasing Velvet production by improved nutrition. Deer Branch of the New Zealand Veterinary Association. Proceedings of a deer course for veterinarians 13: 149-153.

Webster, JR; Corson, ID; Masters, B; Littlejohn, RP; Suttie, JM 1998. Winter feeding of young male deer. Proceeding of a Deer Course for Veterinarians 15: 213-217 Deer Branch NZ Veterinary Association.

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