
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

The effect of hybridisation on venison production

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ABSTRACT

Elk x red deer 'hybrids' or technically, crossbreds make a major contribution to New Zealand venison production. Probably over half of the venison produced from young animals (< 2 yrs of age) contains some proportion of elk genes. Elk, and the numerically more significant 'hybrid' (50-88% elk), stags are used as terminal sires over red deer hinds to produce faster growing progeny. The main benefit of the faster liveweight gain is that a high proportion of hybrids reach slaughter live weight (100 kg+) at around 1 year of age to capture current market premiums. Due to the lesser sexual dimorphism of elk than red deer, hybrid females show a greater increase in liveweight gain and weight-for-age over their red deer counterparts than do males. Most of the advantage in yearling weight of hybrids has accrued by weaning and is, thus, captured by the breeder. The absolute and proportional increase in liveweight of hybrids is greater when live weight gain is high (in autumn and spring and under generous feeding levels) and production systems utilising hybrids must recognise this. The metabolisable energy (ME) requirement for maintenance per unit metabolic weight seems to be higher (20%) for young hybrids than for red deer, although in contrast, the ME cost of liveweight gain may be slightly lower. Small differences in body composition also exist. However, neither of these necessitates major modification to venison production systems.

The widespread use of 'hybrid' stags in the New Zealand deer industry has increased the biological efficiency and economic returns to venison production, although increased liveweight gain and weight-for-age must be offset against a somewhat lower reproductive rate in red deer hinds joined with elk or hybrid stags. Hybridisation has also increased the demand for red deer replacement hinds and raised doubts about the wisdom of retaining hybrid hinds as breeding females.

Keywords: wapiti; red deer; hybridisation; venison; growth; production.

INTRODUCTION

True hybridisation has an insignificant impact on venison production in New Zealand. Examples of true hybrid deer in New Zealand are Père David's deer (*Elaphurus davidianus*) x red deer (*Cervus elaphus*) (Asher *et al*., 1988) and sambar (*Cervus unicolor*) x red deer (Muir *et al.*, 1997), neither of which contribute significantly to venison production. However, the common elk x red deer, which do make a significant contribution to New Zealand venison production, are currently accepted as subspecies of *Cervus elaphus (Tate et al., 1992)*, so elk x red deer are technically crossbreds. The generally accepted subspecies are *C. e. scoticus* (UK, red deer); *C. e. hippelaphu*s (eastern European red deer) and, *C.e. roosevelti*, *manitobensis*, *nelsoni* (elk). On morphological, ecological and behavioural grounds elk and red deer may be sufficiently different to justify differentiation at the species level (Geist, 1998) but DNA profiles of elk and red deer show enough conformity to justify same-species status (Tate *et al.*, 1992).

A further confusion exists between the definitions of elk and wapiti. In North America the native Indian word 'wapiti' is used instead of elk for *Cervus elaphus spp*. In New Zealand, 'wapiti' is reserved for the stabilised Fiordland-based elk x red and 'elk' is reserved for pure animals of recent North American ancestry. In this paper elk includes wapiti.

The term 'hybrid' is so generally accepted in the New Zealand deer industry when referring to the various crosses between elk and red deer that it will be used in this paper rather than the more correct 'crossbred'.

This paper is divided into a number of sections that review published comparisons of hybrid and red deer and discusses the implications of these differences to practical venison production systems in New Zealand.

Importance of hybrids

It is difficult to quantify the overall effect of hybridisation on venison production in New Zealand because of the lack of appropriate statistics on the

i. relative numbers of hybrid and red deer slaughtered for venison
ii. proportion of elk/red genes in many hybrids
iii. level of introgression of elk and European subspecies of red deer into the breeding female population
iv. paucity of published comparative data on hybrids and red deer.

Although the formal estimate of the relative proportions of red deer and elk in the New Zealand deer herd is 75:25 (DINZ, 2003), the contribution of elk to New Zealand venison production is probably greater than this. Various estimates are given for the proportion (40-60%) of young deer slaughtered for venison production that are hybrid. Given that the carcass weight of hybrids is around 10% heavier than similar aged red deer (Table 1), the quantitative contribution of hybrids to venison production could be in the order of 60-65%.

Despite the widespread use of hybrids, and on-farm experience with both hybrids and red deer, there are not many formal comparative data. Furthermore, the proportion of elk in hybrids is often not substantiated and with all 'breed' comparisons there is the risk that the animals chosen may not fairly represent the population as a whole. Few New Zealand sources contain data on

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TABLE 1: The liveweight gain, weight for age and proportion of elk (E), hybrid and red deer (R) reaching target slaughter live weight around 1 year of age

	100 R	25 E	>25<50E:	50 E	100 E	100(E-R)/R	Comment	Source
Liveweight gain -pre-weaning (g/day)								
males	398		420			5.5	bad year	Simpson, 1993
	408		544			33.3	good year	
				558				Moore & Littlejohn,
					753			Friedel & Hudson, 1994
females	348		382			9.8	bad year	Simpson, 1993
	375		523			39.5	good year	
				536				
					686			Friedel & Hudson, 1994
Liveweight gain -post-weaning (g/day)								
males	152		162			6.6	bad year	Simpson, 1993
	187		224			19.8	good year	
	170	195				14.7	pasture	Kusmartono *et al.*, 1995
	209	273				30.6	chicory	
	170	195				14.7		Min *et al.*,1997
females	104		116			11.5	bad year	Simpson, 1993
	129		178			38.0	good year	
	143	200				39.9	pasture	Kusmartono *et al.*, 1995
	146	182				24.7	chicory	
	120	160				33.3		Min *et al.*,1997
Weight for age- weaning (kg)								
males	47.2		52.0			10.2	bad year	Simpson, 1993
	48.8		64.4			32.0	good year	
	47		57.3			21.9	survey	Deermaster
	42			56.7		35.0		
	57.3	56.7				-1.0		Walker *et al.*
					94		in Canada	Friedel & Hudson, 1994
	48			74	73	54.2		Fennessy & Pearse
Average						25.4		
					110			Renecker *et al.*, 1995
females	42.3		47.2			11.6	bad year	Simpson, 1993
	45.0		61.3			36.2	good year	
	49.7	54.7				10.1		Walker *et al.*
	37			53.9		45.7		
					85		in Canada	Friedel & Hudson, 1994
	43			71	70	65.1		Fennessy & Pearse
Average						33.7		
Weight for age - yearling (kg)								
stags	84.8		91.3			7.7	bad year	Simpson, 1993
	90.7		114.5			26.2	good year	
	106	107				0.9		Walker *et al.*, 2002
	108	105				-2.8	pasture	Kusmartono *et al.*, 1995
	111	125				12.6	chicory	
	84.4		98.9			17.2	range of allowances	Judson & Nicol, 1997
Average						10.3		
females	67.5		75.4			11.7	bad year	Simpson, 1993
	74.0		101.0			36.5	good year	
	86	96				11.6	pasture	Kusmartono *et al.*, 1995
	86	100				16.3	chicory	
	79	91				15.2		Walker *et al.*, 2002
Average						18.3		
Carcass weight (kg) at similar age								
males	56.6	57.0				0.7	pasture	Kusmartono *et al.*, 1995
	63.2	73.0				15.5	chicory	
	54.9			67.6		23.1		Drew & Hogg,
					92		in Canada	Renecker *et al.*, 1995
Proportion (%) reaching slaughter weight around 1 year of age								
stags	14		25				bad year	Simpson, 1993
	24		100				good year	
hinds	4		10				bad year	Simpson, 1993
	4		74				good year	

pure elk. Some data for elk from North America are included for comparison.

Liveweight gain, weight-for-age, carcass weight and slaughter date

Elk have a larger mature live weight than red deer and their sexual dimorphism is much less. Mature male elk (around 400-450 kg live weight) are only about 1.4 times the live weight of mature female elk compared with nearer to 2 times for red deer (males 200-220 kg, females, 90-110 kg). The greater mature size of elk is associated with greater daily liveweight gain and this is reflected in higher weight-for-age and carcass weight of hybrid progeny (Table 1). The proportional increase in these characteristics is greater for female (20-30%) than male (10-20%) hybrids and when liveweight gain is high (>30%) in autumn/spring and under better feeding conditions than when liveweight gain is lower (<10%). As a result of their greater weight-for-age, a much higher proportion (2 to 3 times) of hybrids reach target slaughter live weight (96-105 kg live weight) by 11-12 months of age (Table 1) and this difference is more pronounced for females than males.

There are insufficient data, particularly on pure elk in New Zealand to make a definitive statement about the effect of elk genes on productive characteristics. However, a crude estimate, based on data in Table 1 and field experience, is that yearling live weight increases by 5-6 kg per 10% introduction of elk genes. The most important attribute of hybrids that has increased their use in venison production is the increased proportion that meet target slaughter weight at the time of year the export schedule is high (Sept-Nov for stags and before summer, hinds). This is also of practical benefit for finishing systems in summer-dry areas. A further advantage of early slaughter to breeding plus finishing venison enterprises is the synchronised reduction in feed demand with the progressive slaughter of yearlings deer with the increase in feed demand of late-pregnant, lactating hinds. The greater effect of hybridisation on female (than male) liveweight gain, renders hybrid hinds an acceptable finishing proposition (on a par with red stags), whereas red hinds rarely reach carcass weighs of over 50 kg at 15 months.

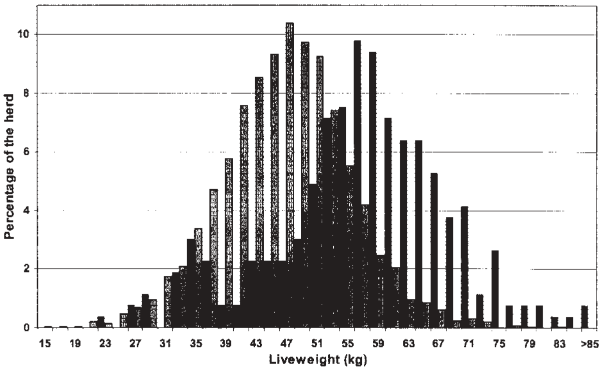
It appears now, presumably through hybridisation, that sufficient animals are available in Oct to meet processors requirements, so the peak value ($/kg carcass weight) has advanced to Sept. Only animals with at least 50% elk genes or those carried through from the previous autumn to 'farm' the schedule now meet this deadline. This is even more so now that the optimum carcass weight has risen from 50-60 kg to 55-65 kg.

Phenotypic variation

The phenotypic variation in at least some production traits appears to be greater for hybrids than reds. Figure 1 (Deer Master, 2000) illustrates the higher mean weaning weight of hybrids (57 kg) than red deer (52 kg) in a large survey (n >2000) on commercial deer farms but also shows a wider variation in hybrids, for which there are a number of possible explanations. There is a range from 50-100% in the proportion of elk genes in the stags used commercially to produce hybrids but most are in the 50-88% range. Gene segregation in offspring of hybrid stags will inevitably lead to greater variation in the 'F2' generation. Red deer stags are often used to 'back-up' hybrid stags later in the breeding season and later born fawns sired by red stags are likely to contribute to the small bimodal distribution of the 'hybrid' weaning weight (Figure 1).

This greater variability of hybrids has implications for production systems. There is no correlation between weaning weight and winter liveweight gain in mobs of weaner deer from a similar source (Nicol, 2001). This makes decisions, on which individual deer to reject/select from a mob purchased at weaning, somewhat of a lottery. Also, sorting into weight ranges is likely to give only a temporary reduction in the within-mob variation in live weight.

FIGURE 1: The distribution of weaning weight of hybrids and red deer (Source: Deermaster 2000).



Velvet production

Another feature of the later maturity of elk compared with red deer is the greater live weight and/or later chronological age at pedicle initiation and antler growth (Kusmatono *et al.*, 1995). Thus, generally, a smaller proportion of yearling hybrid stags are velveted prior to slaughter than red deer stags, but those that are, produce a greater weight of velvet (30%) than their red deer cohorts.

This later onset of 'spiker' velvet in hybrids is either seen as an advantage or disadvantage of hybrids. To finishers who view velvet production in yearling stags as a 'nuisance', the dearth of spiker velvet on hybrids is a boon. To those who view velvet as a valuable by-product of a finishing enterprise, the slaughter of a higher proportion of hybrid stags before a harvest of velvet is a disadvantage against their red deer cohorts. The lighter carcass weight of red deer can be partially offset if a higher proportion are velveted before slaughter. For example, 300 g of good spiker velvet can be equivalent to 3 kg carcass weight.

Feed intake and seasonal pattern of intake and liveweight gain

Larger animals eat more than smaller ones, so hybrids eat more than red deer (Table 2). There is a strong seasonal pattern to feed intake and liveweight gain of deer (Suttie *et al.*, 1983, Webster *et al.*, 2000). The seasonality of the liveweight gain of young hybrid stags appears greater than that of red deer (spring liveweight gain was more than twice that in winter for hybrids compared with only a 75% increase for red deer (Table 2). The greater amplitude in liveweight gain of hybrids can be mainly explained by their greater liveweight as feed intake and liveweight gain of both types are similar when expressed per unit metabolic weight ($W^{0.75}$) (Judson, 2003).

Because the liveweight gain advantage of hybrids over red deer is absolutely and proportionately greater when liveweight gain is high, in situations where both

TABLE 2: Seasonality of liveweight gain and feed intake of young hybrid and red deer stags (Source, Judson, 2003)

Season	Per head Hybrid	Per head Red		Per $W^{0.75}$ Hybrid	Per $W^{0.75}$ Red	
Winter						
liveweight gain (g/day)	168	162	NS	8.0	7.0	NS
feed intake (g DM/day)	1740	1630	NS	92	95	NS
Spring						
liveweight gain (g/day)	345	285	**	12.3	10.7	*
feed intake (g DM/day)	2690	2430	**	111	109	NS

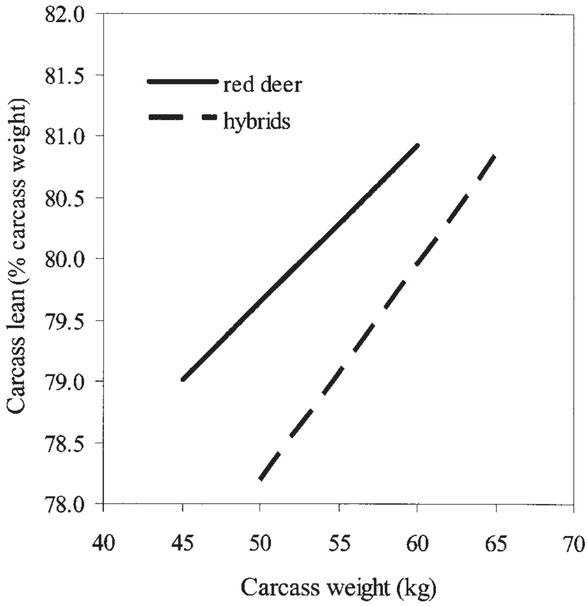
hybrid and red deer are run, a case can be made for separate grazing of the genotypes at such times (in autumn and spring). A leader (hybrid): follower (red deer) grazing system may be appropriate.

There has been some research effort to increase winter liveweight gain of young deer (Ataja *et al.*, 1992), but there is now more recognition of the importance of capturing the greater potential for growth of young deer in the 'shoulder' seasons (late autumn and early spring) and that measures taken to increase winter liveweight gain should not be at the expense of autumn or spring liveweight gain.

Body (carcass) composition

Differences in maturity also affect body composition at any given weight or chronological age. There are relatively few comparative carcass data for hybrid and red deer. Early work (Drew & Hogg, 1985) on a small number of animals showed little difference in dressing out percentage, proportion of various parts of the carcass or in saleable meat yield between the two types. In contrast, a more recent study using computer aided tomography (Judson, 2003) shows that, at a similar estimated carcass weight (over the range of 45 to 65 kg),

FIGURE 2: Relationship between % lean tissue in the carcass and carcass weight for hybrid (25 E:75 R) and red deer (100R) stags (Source: Judson, 2003).



carcasses of red deer stags have a slightly higher lean content (about 1%) due mainly to a lower bone content and thus have a significantly ($P<0.05$) higher lean:bone ratio (Figure 2) than hybrids.

At the same age, the average carcass weight of hybrids is around 5 kg greater than that of red deer (Table 2) and at this carcass weight difference there would appear to be no important differences in saleable meat yield. On this basis there is no need for a different value ($/kg) to be offered for the carcasses of hybrid and red deer.

Nutritional requirements

There have been a number of estimates of the nutrient requirements (mainly energy) of red deer and elk but seldom in the same study and most of them indoors (Table

TABLE 3: Estimates of the metabolisable energy (ME) requirements for maintenance (ME_m) and for liveweight gain (MJ ME/kg) for elk (E), hybrid and red deer (R).

100E MEm ($kJ/W^{0.75}$/day)	100E LWG (MJ ME/kg)	25 E: 75 R MEm ($kJ/W^{0.75}$/day)	25 E: 75 R LWG LWGMJ ME/kg LWG	100R MEm ($kJ/W^{0.75}$/day)	100R LWG MJ ME/kg LWG	Sex	Age (months)	Environment	Season	Source
				520	55	hinds	5-17	housed	year	Suttie *et al.*, 1987
				570	37	stags	6-20	housed	winter	Fennessey *et al.*, 1881
				850	65	stags	6-21	outdoors	winter	
				630	38	stags	5-22	housed	year	Semiadi *et al.*, 1998
				620	46	hinds	5-22	housed	year	
		590	55	390	67	stags	7-12	housed	win/spr	Judson, 2003
		390	55	370	45	stags	6-8	housed	winter	
		470	35	350	64	stags	10-12	housed	spring	
560							5	outdoors	winter	Cool & Hudson, 1996
470							6-14	housed	winter	Jiang & Hudson, 1994
570							24	housed	winter	
900							6-14	outdoors	spring	
730							6-14	housed	summer	
940	38.5						24	outdoors	summer	
695	38.5	483 [1]	48	370 [1]	59					

[1] average of values measured concomitantly

3). Taken overall, these suggest that elk have a higher maintenance requirement (ME_m) per unit metabolic weight than red deer and this may reflect proportionately in the hybrid. On the other hand, the ME requirement for liveweight gain appears to be slightly lower on average for elk and hybrids than red deer. This probably reflects both, a slightly lower energy content of the gain in hybrids, and the statistical artefact that computing a high ME_m almost inevitably leads to lower estimates for the ME requirement for liveweight gain.

The only estimates of the additional energy costs to deer of a grazing over a pen-fed environment are with pure elk (in Canada) or red deer at Invermay (South Island, NZ) (Table 3). Even these are not ideal comparisons as they either refer to only one season or are confounded by age of the deer. However the increase in ME_m of between 20 and 50% compare with values for sheep and cattle. If the mean values of ME_m for young hybrid and red deer stags, when they were directly compared in pens (483 and 370 kJ ME/$W^{0.75}$/day respectively), are increased by 40% to include the costs of a grazing environment, the ME requirements of young hybrid and red deer stags over a range of daily liveweight gain can be derived (Table 4).

The tentative recommendation from this limited data set is that although the ME requirements of hybrids appear higher than those of red deer at low levels of liveweight gain, there may not be a need for a different set of ME requirement tables for the two types. If the ME requirements of young hybrid and red deer are calculated from a common base (the mean of values for hybrids and red deer), a footnote should be added which states 'for liveweight gain below 50 g/day, ME requirements should be increased by 10% for hybrids and decreased by 10% for red deer'. Further comparisons of the ME requirements of grazing hybrid and red deer are needed to substantiate these figures.

No studies have been made of the metabolisable protein requirements of young deer. It is possible that, as with the early-weaned lamb (Barry, 1981, Fraser *et al.*, 1991), the metabolisable protein (MP) supply from ryegrass/white clover pasture may be insufficient to meet the MP requirements of young deer below perhaps 40 kg.

Levels of pasture availability

It seems that hybrid and red deer show similar proportional changes in liveweight gain (and thus feed intake) to changes in pasture availability (Nicol & Barry, 2003). However, it has been suggested that hybrids need higher pasture allowances (almost twice) to express fully their maximum liveweight gain particularly in spring (Judson & Nicol, 1997). This observation adds further weight to the suggestion above of separate grazing of hybrids and red deer during periods of rapid liveweight gain.

Ewes and beef cows (Nicol, 1976) suckling fast growing crossbred progeny, produce more milk than when purebred offspring are suckled. On this basis, red deer hinds suckling hybrid fawns will no doubt require higher levels of feeding during lactation if maternal liveweight is to be maintained than when they suckle red deer sired progeny.

TABLE 4: The metabolisable energy requirements[1] of young hybrid and red deer (70 kg) over a range of daily liveweight gain (g/day)

		Live weight(kg) 70			Deviation (+ and -)
		red	hybrid	average	from average (%)
Liveweight gain (kg)	0	12.1	16.2	14.2	14.5
	50	15.3	18.7	17.0	10.0
	150	21.7	23.6	22.7	4.3
	250	28.1	28.6	28.3	0.9
	350	34.5	33.5	34.0	-1.4

[1] based on ME^m of 0.50 and 0.67 MJ ME/kg W0.75 and 64 and 35 MJ ME/kg liveweight gain for red deer and hybrids respectively (Table 3).

Reproductive rate

Venison production is a function of the number of animals slaughtered and their carcass weight. This paper is not specifically concerned with the relative reproductive performance of hinds joined with red or elk/elk x red deer stags or with hinds that themselves are hybrids as this will be considered elsewhere (see Asher, 2003). One farm survey (Walker *et al.*, 2001) reported a 5-10% lower weaning % to joining hinds with hybrid rather than red stags although this has not been a universal finding (Deer Master, 2000). A reduction of more than 10% in reproductive rate of hinds producing hybrid offspring would more than offset the advantage to hybrids in weaning weight.

Animal health and temperament

Hybrids appear a little less robust than red deer to nutritional and disease challenge and stress (Scott, 1991; Mackintosh, 1991) and their systems of production must take this into account. Specific issues of animal health and trace mineral nutrition are dealt with elsewhere.

Elk require more substantial and different handling facilities than red deer. However, young hybrids (<150 kg live weight) are little different to handle than their red deer cohorts and standard red deer facilities suffice.

System productivity

On the basis of the relative productivity of elk and red deer, elk are an obvious choice as a 'terminal' sire for venison production where their greater size and liveweight gain can be exploited to increase the efficiency of venison production by producing faster growing progeny from red deer hinds. However, the two-fold difference in mature live weight of elk and red deer is much larger than the difference in mature body weight between terminal sire and dam breeds in either the beef (~1.5x) or sheep (~1.4x). So, to limit the incidence of dystocia, and because of the low libido of a significant proportion of elk males in the company of red hinds (Fennessy & Pearse, 1990), most of the terminal sire stags used are only 50-88% elk.

There are no formal long-term production system trials comparing hybrids and red deer. Based on short-term grazing trials, Judson & Nicol (1997) suggested that as much venison could be produced per ha in a finishing system by growing young red deer at a proportionately higher stocking rate than hybrids, although they took no account of the effects of carcass weight and slaughter date

TABLE 5: Body composition of red and hybrid (25 E:75 R) stags predicted from CAT scanning (Source: Judson, 2003)

Carcass weight range (kg)	Number	Average carcass weight		% lean		% bone		% fat		Lean:bone	
		red deer	hybrid	red deer	hybrid	red deer	hybrid	red deer	hybrid	Red	Hybrid
<45	12	43.9		79.0		16.8		4.2		4.72	
>45-50	9	48.5		79.2		17.0		3.8		4.68	
<50	8		49.8		78.2		18.3		3.5		4.27
>50-55	12		53.2		78.8		17.7		3.5		4.45
>50	7	55.3		80.4		15.4		3.8		5.21	
>55	8		63.0		79.4		16.8		3.9		4.73
Average	28	48.3	55.0	79.4	78.8	16.5	17.6	3.97	3.59	4.84	4.50

on financial returns in the comparison. On the other hand, a biological model (including both breeding and finishing) showed a significant increase in feed conversion efficiency (11 to 23%) if a large sire was used over smaller females (Fennessy & Thompson, 1989).

A rather neat simulation of venison production from deer with faster and slower genetic potential that incorporated seasonal influences on carcass value (Skerritt & Amer, 1999) showed a significantly higher profit could be made by faster growing animals at a lower stocking rate (Figure 3). We suspect that the initial value of the animals was simply a function of live weight and if a premium for faster growing animals had been incorporated, the financial difference might not be as great. Perhaps of even more interest was the output of the model in terms of optimum slaughter live weight. The optimum slaughter live weight for the slower growing animals was 106 kg but there was very little change in profitability over a wide range of live weight (95 to 120). With the larger types, the profit continued to increase to 122 kg live weight.

As a consequence of the high price per kg for venison in the early spring, and particularly in years when this price falls at a rate greater than can be compensated for by increased carcass weight, it is likely that a significant proportion of hybrid animals are slaughtered at carcass weights lighter than ideal on the basis of saleable meat yield (Figure 2) or optimum system efficiency (Figure 3). Any success in extending the chilled venison market to include young deer slaughtered later in the season (Jan/Feb) would reduce this inefficiency but might also slightly diminish the relative advantage of hybrids over red deer

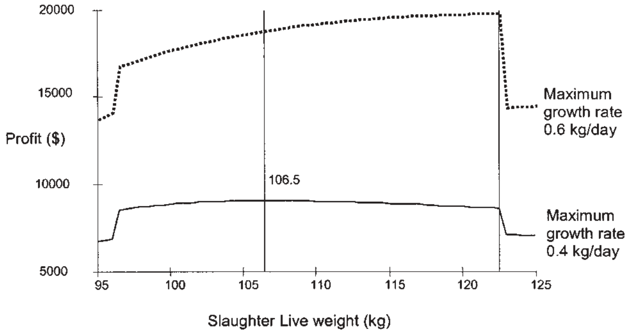
As in any production system that utilises larger terminal sires over a smaller base female, there are issues around herd structure and the source of replacement females. In many deer herds, hybrid males are used exclusively. This has lead to a premium price for young red hinds as replacements for breeding; presumably a reduction in the number of light-weight (40-45 kg) carcasses, the product of red deer hinds in a finishing operation and retention of hybrid hinds as replacement breeding hinds (see Asher, 2003).

A high proportion (around 65%) of the advantage to hybrids over red deer in terms of 12 month liveweight has accrued by weaning (Simpson, 1993) or start of winter (Judson & Nicol, 1997) and, therefore, it is the breeder, not the finisher that captures the majority of the benefit of hybridisation. Furthermore, the advantage of early slaughter date creates a premium (in $/kg live weight) at weaning for hybrids and compounded with the advantage in weaning weight, gives returns to *breeding* above those from most red deer..

Gross margin analyses of venison *finishing* systems frequently show a higher return to hybrids over red deer (Walker *et al.*, 2001). However, in a perfect market, finishers would adjust their purchase price to give equal returns to finishing either hybrids or reds. Higher gross margins for hybrids simply reflect a relative over- and under-estimate of the input value to finishing systems of red deer and hybrid weaner deer respectively.

Stags of eastern European strains of red deer, selected for body size are making some contribution as terminal sires as their mature body weight is similar to that of 50% elk x red stags. Their advantage is that their female offspring may be attractive as replacement females but the disadvantage is that their sexual dimorphism is not as great as elk and thus female progeny will be less likely to reach target slaughter weight in a similar time to hybrid hinds.

FIGURE 3: The optimum slaughter liveweight (kg) for deer with high (maximum 600 g/day) and moderate (maximum 400 g/day) potential liveweight gain (Source: Skerritt & Amer: 1999).



CONCLUSIONS

Venison production in New Zealand is markedly influenced by crossbreeding of elk and red deer. By using stags of more than 50% elk over red deer hinds, the proportion of progeny reaching target slaughter live weight early in the season (Sept/Oct) and before the second winter can be markedly increased compared with pure-bred red deer. These benefits may be partially offset by a reduced reproductive rate and a greater within-mob range in performance.

The higher potential liveweight gain of hybrids over red deer is only captured when average liveweight gain is high and systems of production utilising hybrids must be designed to recognise this. Differences between hybrid and red deer in energy requirements for maintenance or liveweight gain and in carcass composition appear to exist but are not large enough to require their distinction in energy requirement tables or carcass payment ($/kg).

The use of hybrid stags of a low % of elk (<75%) limits the potential benefits in liveweight gain and carcass weight from hybridisation of elk and red deer. Similarly, retention of hybrid hinds in the deer breeding population will decrease the male-female difference in mature size in the terminal sire system and reduce the efficiency of venison production (Fennessy & Thompson, 1989). The increasing availability of large strains of red deer may challenge the pre-eminent role of elk as terminal sires in the New Zealand venison industry but data are needed to substantiate this proposition.

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