Title:

Effects of two forage-based nutritional regimens on intake and weight gain of three genotypes of young red deer (*Cervus elaphus*) during autumn, winter and spring in New Zealand.

Summary: *Your summary text must use Times Roman 10 point font and **MUST NOT** be longer than this box*

Introduction The farming of red deer is a major enterprise in New Zealand agriculture. Recent developments in the industry have seen the inclusion of a range of genotypes from different regions of the world. There is potential for each of these genotypes to respond differently to seasonal signals of day length and temperature, and to nutritional regimen, based on their evolutionary circumstance. The experiment aims to improve the understanding of this variation to develop profitable farming systems that reflect this variation.

Materials and Methods One hundred and twenty six 5-month-old red deer were assigned to one of two nutritional regimens in early autumn. High and Low nutritional regimens were imposed using a leader – follower rotational grazing system, with the High treatment being allocated 1 kg barley/head/d plus approximately 0.4 kg DM as lucerne hay during autumn and winter, while the Low treatment were allocated 0.5 kg barley/head/d plus 0.2 kg DM as meadow hay during autumn and winter. During spring the leader – follower grazing system was used without supplement. Within each nutrition treatment were 21 deer of three genotypes – NZ Red (*Cervus elaphus scoticus*), Eastern European (*C. e. hippelaphus*) and Elk cross (2/3 NZ Red x 1/3 Elk *C. e. nelsoni*). In each season seven animals of each genotype were used to determine the forage intake and digestibility for each nutritional regimen using the alkane dilution technique as described by Dove and Mayes (1991). Liveweights were measured every two weeks and liveweight gain assigned to each season based on the calendar months March to May (Autumn), June to August (Winter) and September to November (Spring). Pasture yield and composition was determined at each allocation of fresh pasture. Data for each season was analysed separately by ANOVA as a 2 x 3 factorial randomised plot design with individual animals being used as replicates. The experiment was approved by the AgResearch Invermay Animal Ethics Committee in accordance with New Zealand animal welfare regulations.

Results The amount of pasture on offer differed significantly between the nutritional treatments (8.0 and 5.1 kg DM/head/d, SED: 1.7, $P<0.05$, for High and Low respectively) but not between seasons (7.2, 5.3 and 7.8 kg DM/head/d, SED: 2.3, for Autumn, Winter and Spring respectively). Pasture composition when measured as the proportion as grass leaf, clover and dead material did not differ significantly throughout. The residual pasture cover was 2060 and 1290 kg DM/ha after the High and Low treatments had grazed the pastures ($P<0.01$). During autumn no significant differences were found in deer growth rate (mean=145 g/d), though estimated forage intake was significantly lower (1.65 and 2.27 kg DM/head/d, SED: 0.15, $P<0.001$) for the High and Low treatments respectively). The addition of barley to the diet substituted for the forage, leading to similar metabolisable energy intakes on both treatments. No differences were found between the liveweight gains of the genotypes in autumn. The NZ Red and Eastern European deer were similar weights (60.6 and 57.2 kg respectively) while the Elk cross were heavier at 72.5 kg (SED: 0.18; $P<0.001$). There was an interaction between nutrition and genotype in the proportion of forage intake as hay (SED: 103, $P<0.01$) indicating that the NZ Red deer ate similarly low proportions of hay on either nutritional regimen (117 and 65 g/kg forage DM eaten on the High and Low treatments respectively), and Eastern European deer having the greatest increase in hay intake on the Low nutritional regimen (231 and 646 g/kg forage DM eaten on the High and Low treatments respectively). The Elk cross had an intermediate increase in hay intake on the Low nutrition treatment. During Winter significant differences were found in growth rate, average live weight, forage intake, and hay intake between the High and Low treatments. The NZ Red and Elk cross deer had higher growth rates than the Eastern European deer in winter (129, 134 and 92 g/d, SED: 17, $P<0.05$, respectively). The Elk cross were the heaviest ($P<0.001$) and had the highest forage intake ($P<0.001$), greatest hay intake ($P<0.05$) and metabolisable energy intake ($P<0.001$), while the NZ Red and Eastern European deer were similar for these measurements. In Spring significant interactions emerged between nutrition and genetics. NZ Red deer grew at a similar rate on both High and Low treatments (250 and 251 g/d respectively), while the Elk cross deer responding the most to the High treatment compared to the Low treatment (368 and 260 g/d respectively) with the Eastern European deer being intermediate (311 and 259 g/d, SED: 29, $P<0.05$ for High and Low respectively). This was reflected in forage intake ($P<0.05$) and metabolisable energy intake ($P<0.05$).

Conclusions The red deer genotypes currently being used in New Zealand deer farming have different forage use habits and exhibited different growth profiles in different seasons. Few differences were found in Autumn, but by Winter the NZ Red and Elk cross genotypes grew faster than the Eastern European genotype. The only interaction between nutrition and genotype in the Autumn was in the proportion of hay in the diet indicating some variation in forage use habits. No interactions were evident in Winter. In Spring, however, the NZ Red genotype did not respond to increasing feed availability, while the Eastern European and Elk cross deer increased growth rate by approximately 50 g/d and 100 g/d respectively in response to increased feed availability. This was matched by increases in forage and metabolisable energy intake. Understanding these interactions provide the researcher and farmer with information that will enable tailored feeding systems to be developed to improve on-farm resource use efficiency.

References

Dove, H., Mayes, R.W. 1991. Australian Journal of Agricultural Research. 42, 913-952.