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THE ESTIMATION OF PHENOTYPIC AND GENETIC PARAMETERS

FOR LIVEWEIGHT TRAITS OF RED DEER

A thesis presented in partial fulfilment of
the requirements for the degree of Master of
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Palmerston North, New Zealand

CATHERINE MARY RAPLEY

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ABSTRACT

Data for this study were uplifted from Deerplan (the New Zealand deer performance recording scheme). The data consisted of 311 birth weight records from 4 herds, 2874 March weight (approximately 3 months of age) records from 28 herds and 1225 15-month weight records from 20 herds, for Red deer. Approximately half the March and 15-month weight records had an accompanying date of birth. Dam winter weight accompanied about one-third of the fawn weight records. The objectives of this study included: least squares estimation of non-genetic effects influencing birth, March and 15-month weights; estimation of heritability of these weight traits by Henderson's Method 3 and offspring-dam regression method; estimation of phenotypic and genetic correlations between these weight traits, and development of selection indices based on the estimated parameters.

The non-genetic effects found to significantly influence birth weight, with the approximate percentage of total variation each controlled given in parenthesis, were: herd (12%); sex (15%); age of dam (13%), and dam winter weight (18%). The effects of year and date of birth were small and were not considered to be of practical importance. Approximately 50% of the total variation in birth weight was accounted for by these non-genetic effects.

The non-genetic effects found to significantly influence March weight were: herd (11%); year (2%); sex (13%); age of dam or dam winter weight (10%), and age at March weighing (25%). Approximately 63% of the total variation in March weight was accounted for by these non-genetic effects.

The non-genetic effects found to significantly influence 15-month weight were: herd (6.0%); sex (70%); age at 15-month weighing (3%), and dam winter weight (3%). The effect of year on 15-month weight could not be tested. Approximately 80% of the total variation in 15-month weight was accounted for by these non-genetic effects.

The paternal-half sib heritability estimates of birth, March, and 15-month weights were high, 0.67 ± 0.29 (\pm S.E), 0.77 ± 0.15 , 0.60 ± 0.22 , respectively.

The heritability of adjusted March weight estimated by the offspring-dam regression method was low, 0.15 ± 0.30 .

The phenotypic correlation estimates between the adjusted fawn weights were consistently positive with moderate to strong magnitude. These estimates were 0.49 for birth and March weight, 0.34 for birth and 15-month weight and 0.51 for March and 15-month weight. The phenotypic correlation estimates between dam winter weight in adjacent years were strongly positive (0.49 to 0.97).

The genetic correlation estimates between the adjusted fawn weights were moderately to strongly positive, 0.93 ± 0.24 for birth and March weight and 0.32 ± 0.44 for March and 15-month weight.

Selection indices were developed for two objectives. One was to increase venison production at 15-months of age, and the other was to increase venison production at 27-months of age and 2 year old velvet antler weight. Due to the strongly positive correlations between liveweights, negative index weighting factors were obtained for March weight. These were considered unreasonable and indicated the need for further investigation. An economic gain per generation of \$12.80 and \$24.27 could be achieved for the two objectives respectively. The economic gain in the first objective was reduced to \$12.53 by restricting genetic gain in birth weight to zero. There was little advantage in recording actual birth weights.

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LIST OF ABBREVIATIONS

<u>Abbreviation</u>	<u>Meaning</u>
age at mwt	age at the March weighing
age at wt	age at the 15-month weighing
ANOVA	analysis of variance
β	regression coefficient
bwt	birth weight
D.F.	degrees of freedom
EMS	expected mean square
kg	kilogram
kgDM/ha	kilograms of dry matter per hectare
LSE	ordinary least squares estimate
LSM	ordinary least squares mean
mwt	March weight
n	number of records in each sub-class
N	total number of records for that model
na	not applicable
NS	not significant ($P > 0.05$)
P	probability
R^2	coefficient of determination
S.D.	standard deviation
S.E.	standard error
SIGN.	significance level
ylg	15-month weight
%VC	percentage of variation controlled

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