was observed earlier. The total number of offspring with HbAA type is in accordance with the expectations. Lambing rate data also support this. No difference can be observed between average lambing performance af the HbAA, HbAB and HbBB ewes.

On S.F.3.χ^2 values were significant in all mating types. HbAA ewes had fewer lambs than HbAB or HbBB ones.

On S.F.3. there might be two possible causes for the low Hb^A gene frequency : 1 /because of the effect of an unknown factor or factors, fewer HbAA lambs are born than expected; 2 /HbAA ewes, because of their lower lambing performance, are culled at younger ages.

IV. — Bases génétiques et nutritionnelles de l'efficience alimentaire

GENETICS AND FEED EFFICIENCY

Alan ROBERTSON

Institute of Animal Genetics, Edinburgh

Recent advances in the understanding of the energetics of growth are a challenge to the geneticist. It is his task to unravel the genetic relationships of different aspects of the growth process in order to be better able to predict the probable consequences of different kinds of selection. To do this he has to interpret three different kinds of evidence. The first comes from selection experiments themselves (and also from genetic analyses of random breeding populations), the second from the observation of major mutants such as *obese* in the mouse and *fatty* in the rat, and the third from variation between existing breeds of domestics animals. All these lines of evidence have to be treated with some caution. The problem in interpreting the behaviour of selection lines is that we know that lines selected in the same way do not show the same response and that replication is therefore essential. Each major mutant may have its own pattern of changes and may be irrelevant to random breeding populations because there is no variation in these populations at that locus. Breeds have to be viewed as selection lines, whose criteria of selection we do not know (with consequent uncertainty in analysis).

Growth is a complicated process in time, and we need to understand the interaction between different variables, as, for instance, between food intake when fed *ad libitum* and partition of intake at fixed levels. We must further be aware that the effect of selection may depend on the age at which it is carried out. I would emphasise three points as being important in our future work.

i) We must take proper account of the level of food intake in the interpretation of selection results. Gain in broiler selection may be entirely due to the appetite control mechanism.

ii) We need more information on the effect of age at selection and on the possibility and consequences of "bending" birth curves.

iii) We need to measure the genetic variation in different aspects of the growth process, as well as the co-variation between them as for instance :

a) heat output

b) rates of protein synthesis and degradation, the former being certainly related to heat output. Could we increase the efficiency of growth by reducing the rate of protein degradation ?

c) appetite control.

THE ENERGETIC EFFICIENCY OF GROWTH

A. J. J. WEBSTER

Dept of Animal Husbandry Langford House, Langford Bristol BS 18.7, DU England

Metabolizable energy consumed by a growing animal is partitioned between heat production and gains in body tissues, principally protein and fat. The laws of growth that govern this partition are discussed. The apparent energy costs of protein and fat deposition in rats and pigs are about 53 kJ/g. Heat production is, however, related much more closely to total protein synthesis, most of which takes place in tissues other than "meat". Ways and means of manipulating protein synthesis and the energy cost of growth by nutrition, anabolic agents and antimicrobial growth promoters are considered.

GENETIC IMPROVEMENT OF FEED EFFICIENCY OF GRAZING LIVESTOCK

A. H. CARTER

Ruakura Agricultural Research Center Hamilton, N. 2

Livestock production under grazing is characterised by inability to directly measure feed intake, an interactive pasture-animal complex, marked seasonal fluctuation in feed quantity and quality, high animal maintenance costs and relatively low production levels. Harvesting ability of the animal, resilience to feed fluctuations, resistance to disease or stress and voluntary feed intake contribute importantly to total feed efficiency. Greatest scope for genetic improvement however is through increasing feed conversion efficiency.

The high proportion of maintenance to total feed requirements in a free-grazing system calls into question the effectiveness in improving total productivity of traditional evaluation and selection on yields per animal. An "efficiency index", equivalent to the yield of an animal of average liveweight having similar predicted efficiency, is proposed for adjusting observed yields for the effect of liveweight on feed conversion efficiency. In many situations the efficiency index can be approximated by a linear function of yield and liveweight, to which standard selection index methods can be applied to optimise genetic progress, given appropriate genetic parameters for liveweight and production traits. The procedure is illustrated for single-purpose dairy production using New Zealand data.

FEED EFFICIENCY DURING EARLY LACTATION IN COWS OF SPECIALIZED AND DUAL PURPOSE GENOTYPES

J. J. COLLEAU, M. JOURNET, A. HODEN and A. MULLER

Centre national de Recherches zootechniques, I.N.R.A., 78350 Jouy-en-Josas, France

Feed efficiency analysis of dairy cows feed according to their peoduction potential and belonging to extremely different genotypes (from the *Holstein* to the *Charolais* breed) show that both between and within genotypes, the very first factor of variation is the milk production yield. The second factor observed is the magnitude of weight loss after calving which is related to a mobilization of energy stores.

Using the energy system of Leroy, it was not possible according to the analysis of between and within genotype variations to determine the exact contribution of body store mobilization to milk production. The energy equivalence of the weight change seems to vary from one genotype to another; it should be more accurately defined by taking into account the variations in the feeding level and in the proportion of concentrates in the diet which affects the utilization rate of the rations.

GENETIC DIFFERENCES IN FEED UTILIZATION BY DAIRY CATTLE

A. E. FREEMAN

Dept of Animal Science, Iowa State University Ames, 5011 U.S.A.

Selection for production of milk or fat corrected milk can be expected to result in an automatic increase in gross feed efficiency. The effectiveness of indirect selection is expected to be 70 to 95 per cent as great as direct selection. Correlated responses of body weight change are less well known. Magnitude of genotype by environmental interactions, de finedby energy in the diet, from most work seems negligible or small, but may be real for some comparisons.