
MODELLING ANIMAL SYSTEMS PAPER

Modelling egg production and nutrient responses in broiler breeder hens

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SUMMARY

The model described simulates the response of a population of broiler breeders to a daily allowance of a feed of specified composition for up to 280 days from sexual maturity. The population is generated using normally distributed values for initial bodyweight, initial body lipid and protein weight, age at first egg, yolk weight constant and ‘aggressiveness’, the latter producing different feed intakes around the controlled mean. Age at sexual maturity for each bird is predicted from bodyweight and from information about rearing lighting programmes. Egg production, clutch patterns, yolk weights, egg component weights, double-yolked eggs, internal laying and soft-shelled eggs are predicted. Body protein growth, including feathers, is assumed to cease at sexual maturity, thus bodyweight changes after maturity are due entirely to accumulation or utilization of lipid.

Energy transactions are expressed in units of effective energy. Protein required for egg production is calculated from the composition of the next egg to be laid and an assumed fixed chemical composition. Assumptions for protein partition rules are that maintenance has highest priority, yolk protein deposition second and albumen protein third. Provided that sufficient energy and nutrients are available, yolk protein deposition is assumed to occur continuously to meet the predicted growth rate, unless inter-clutch intervals exceed 2 days (user defined), when yolk growth ceases. Energy and nutrients (amino acids) for albumen production accumulate in a pool which has some controlling influence over ovulation. If the energy and nutrients in the albumen pool will support the predicted development of the next egg then ovulation will occur, otherwise ovulation is delayed until sufficient energy and nutrients are available. All events are timed within a 24 h day assuming that feeding is at one time in the morning.

The desired feed intake is calculated each day according to the supply of the first limiting energy or nutrient (invariably an amino acid) in relation to potential need. Actual feed intake is either the desired intake or the feed allowance, whichever is the lower. The additional energy required for thermogenesis is taken into account, but not the constraining effects of high temperature or the bulkiness of the food as a constraint to voluntary food intake.

Some shortcomings of the current model are discussed, these being areas suitable for further research on broiler breeder nutrition.