# Genetics of Feed Efficiency in Laying Hens

### A.S. Leaflet R2894

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### Summary and Implications

Feed efficiency data from multiple generations of a brown egg layer line were analyzed with pedigree- and marker-based methods. Marker information improved accuracy of estimated breeding values (EBV), especially for long-term prediction. Several regions in the genome were found to be associated with feed consumption and efficiency.

### Introduction

The long-term challenges for animal breeders are to improve the productivity of major livestock species to feed the growing human population, while at the same time minimizing environmental impacts (Hume et al., 2011; Van Arendonk, 2011). One step in this direction can be improving feed efficiency in farm animals, which at the same time improves profitability. Laying hens have for many years been selected for feed efficiency and substantial response has been achieved. However, newly developed tools, such as high-density SNP chips, which allow animals to be genotyped for tens of thousands of genetic markers across the genome, can provide additional information on the genetic basis of efficiency and thus enhance selection progress. The objectives of this study were: 1) to estimate heritabilities of average feed intake (AFI) and residual feed intake (RFI) and their genetic correlations with production and egg quality traits; 2) to evaluate accuracies of EBV from pedigree and marker based models; and 3) to identify genomic regions associated with feed efficiency.

### Materials and Methods

Eight generations of feed intake data were collected on approximately 6,000 hens from a brown egg layer line during two week trials at Hy-Line International. Of these, 1,555 hens were genotyped using a 42K SNP chip. Phenotypes of other hens were included in the analysis as family means. Genetic correlations between feed efficiency and production and egg quality traits were estimated using a multi-trait animal model in ASReml (Gilmour et al., 2008). Marker effects and genomic EBV were estimated using the GenSel software developed at Iowa State University (Fernando and Garrick, 2009).

### Results and Discussion

Heritability estimates of AFI and RFI were moderate ($h^2$=0.46 and 0.47). Hens that consumed more feed and had greater RFI tended to lay slightly more eggs and those eggs had greater yolk weights and albumen heights. Genomic EBV for AFI and RFI were found to be more accurate and more persistent across generations than pedigree-based EBV (0.26 *vs.* 0.21 for RFI and 0.31 *vs.* 0.21 for AFI). Regions on chromosomes 1, 2, 4, 7, 13 and Z were found to be associated with feed intake and efficiency in laying hens.

### Acknowledgments