

Genetic improvement For Alternative Hen-Housing

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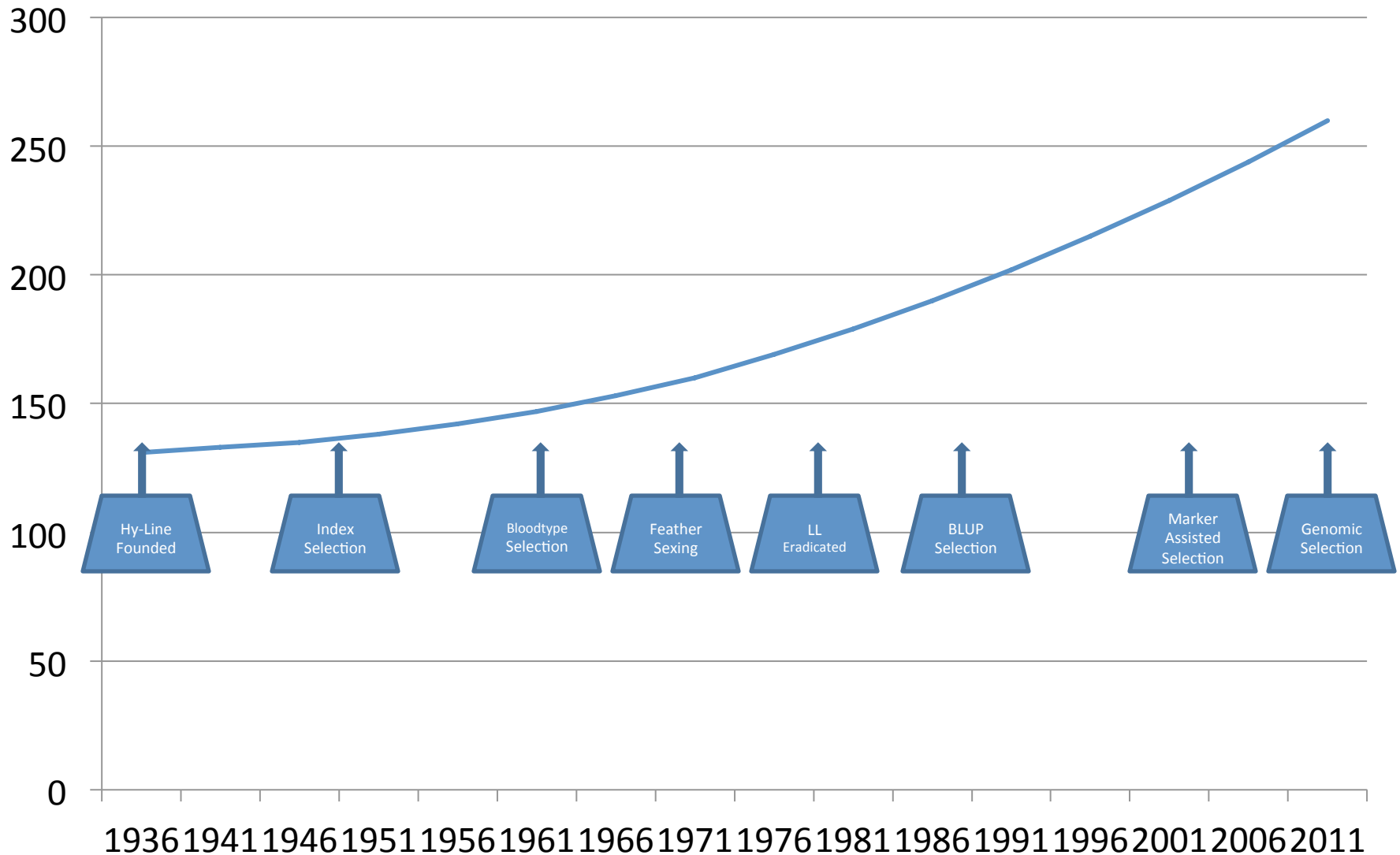
2015 Egg Industry Issues Forum

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Measured in Egg/Hen to 60 Weeks



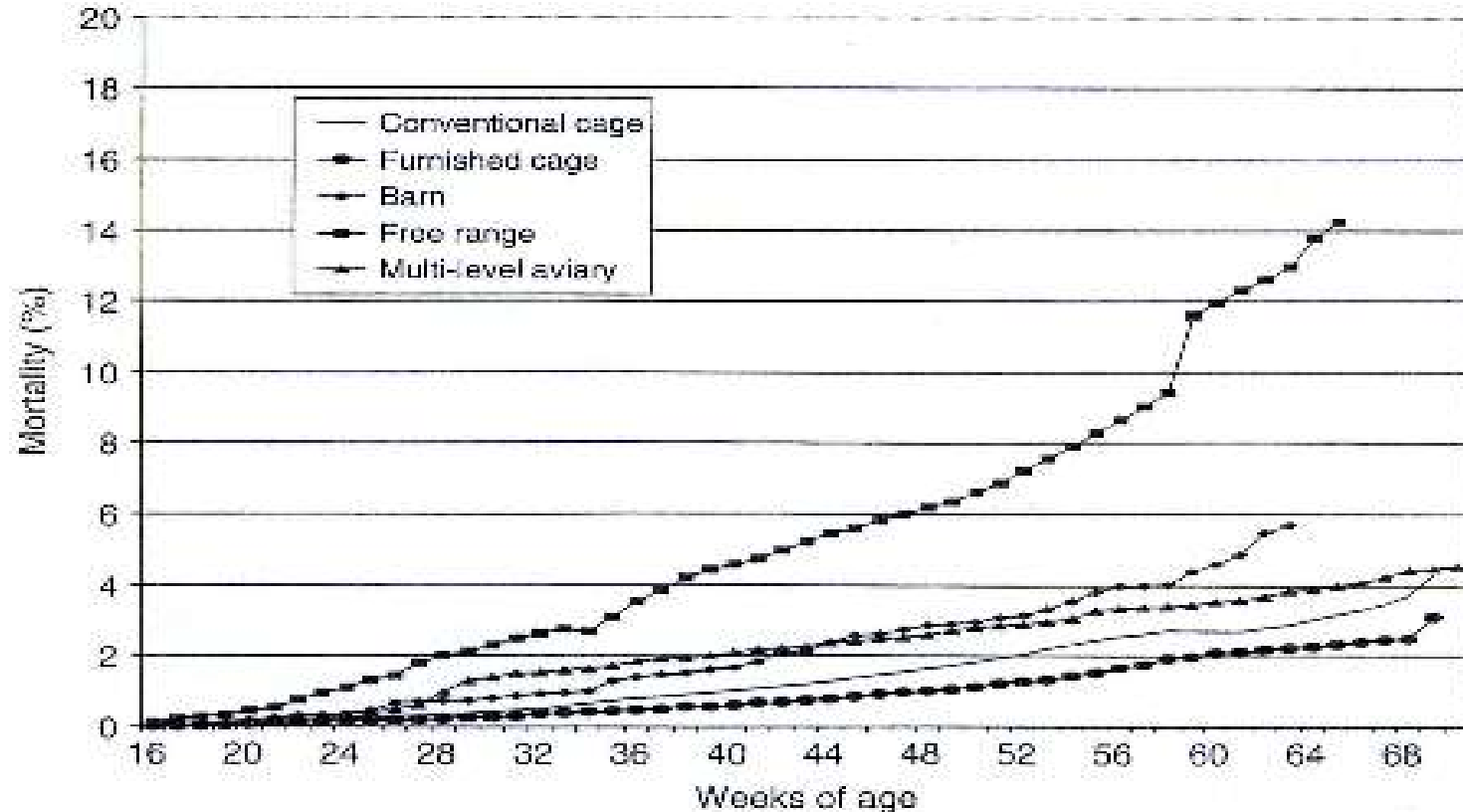
The Decision Process

Inputs:

- Evaluation of pedigreed stock in single bird cages and in family group floor pens on Research farms
- Evaluation of sire progeny groups (families) in commercial production environments - cage and cage-free
- SNP data (molecular markers) on genotypes are used for genomic selection to enhance traditional selection methods



Welfare of Hens by Production Systems



Other measures of welfare, feather cover, comb wounds, and bumblefoot incidence will change the ranking of the systems. R A Croxall & H.A. Elson, Bri. Poul. Sci. Abstracts 2007

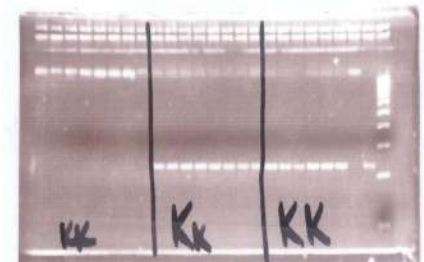
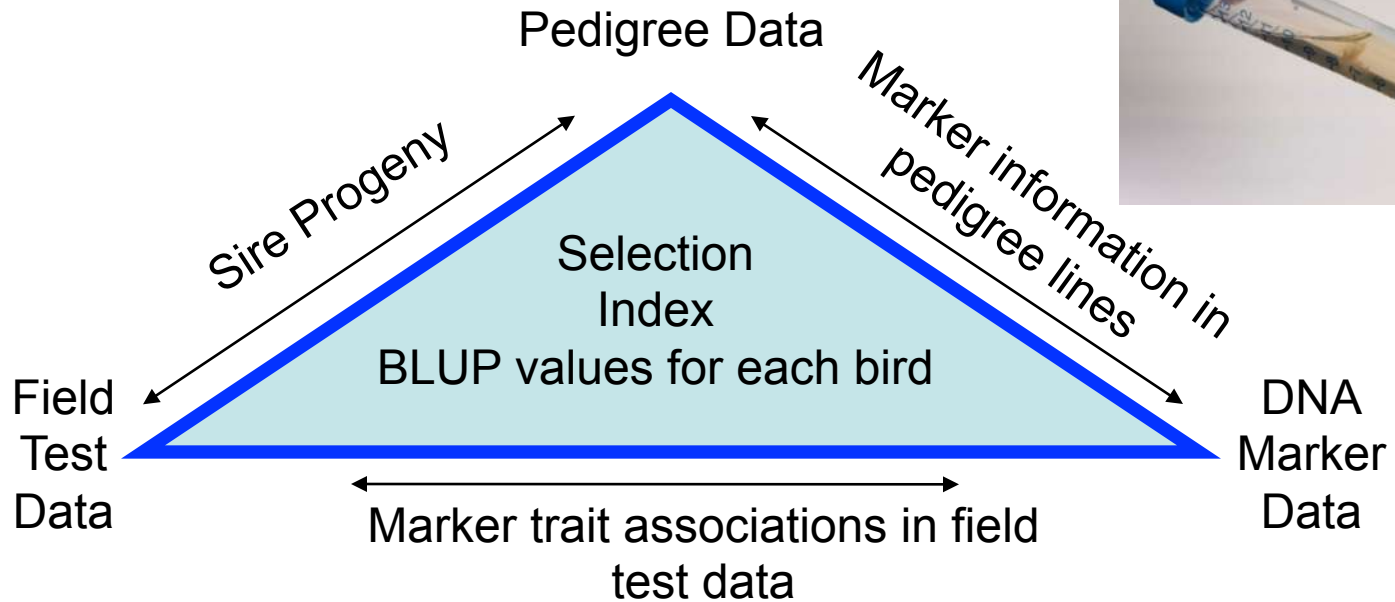
What do hens do with their time? *Sandihands et al (2007)*

	%
Standing	41 ± 1.0
Feeding	35 ± 1.0
Drinking	8 ± 0.0
Sitting	7.5 ± 0.0
Grooming etc.	8.5 ± 1.0



Standing; 55% on floor, 26% on perches

Selection Process



Traits Under Selection

Groups

Individual Trait Measured and Selected

■ Production Traits

Sexual maturity, peak egg laying rate, persistency of production, post-molt production

■ Animal Well Being

Livability of pullets and adults, specific disease resistance (Marek's disease), feather cover, social behavior, reducing fear, ranging ability, nesting behavior, perch use, bird mobility.



Traits Under Selection Cont'd

Groups

Individual Trait Measured and Selected

■ Quality Traits

Shell strength, shell color, freedom from cracks, albumen quality, egg size, yolk weight, % solid yield, freedom from blood or meat inclusions

■ Efficiency

Residual feed intake, group performances, low feed intakes, dry manure, body size, maintenance costs

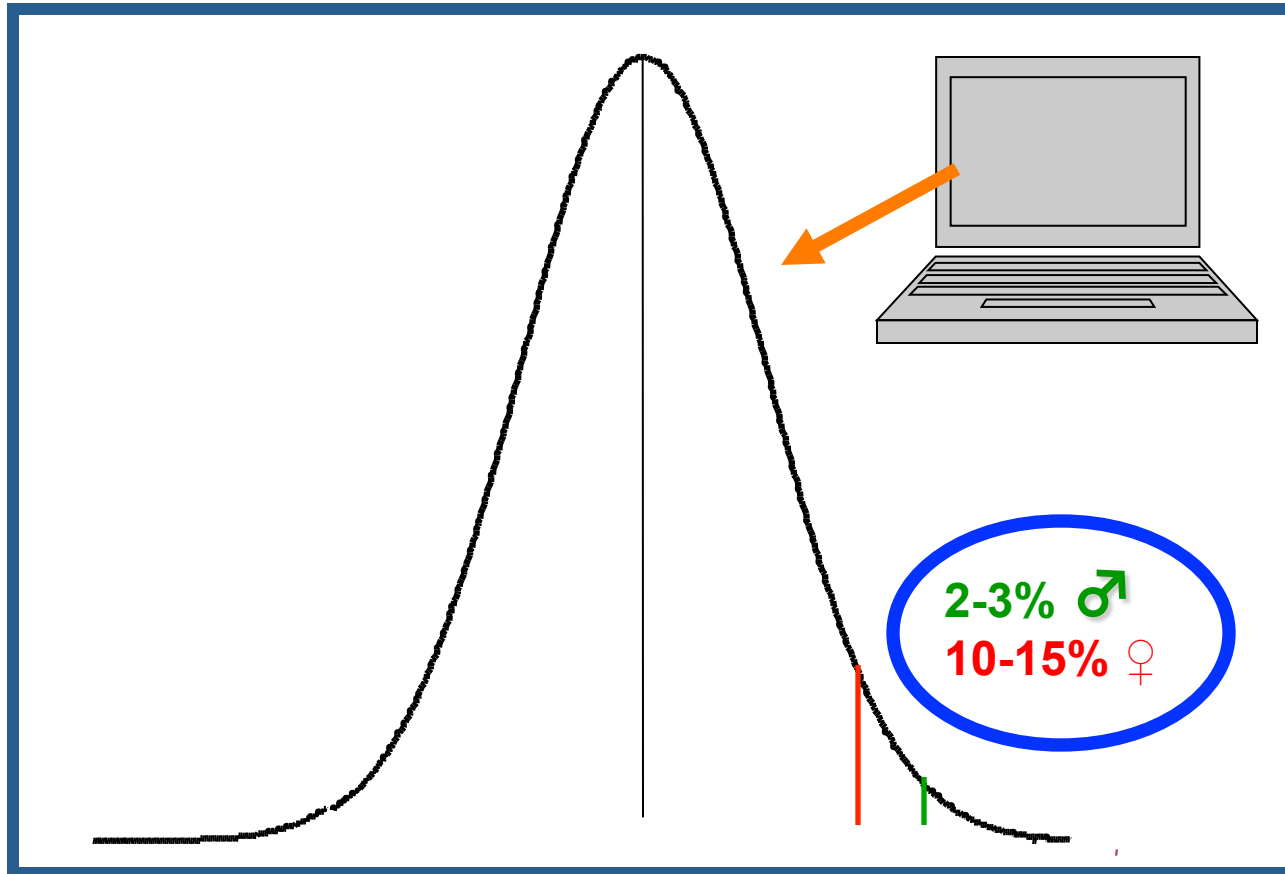
■ Reproduction

Fertility, male natural mating ability, hatchability, sperm count, sperm mobility



Final Selection*

Percent Animals







Index Value

*Elite 2-3% ♂ selected to be mated to top 8-15% ♀ to reproduce each line

Evaluation of Traits in Multiple Environments

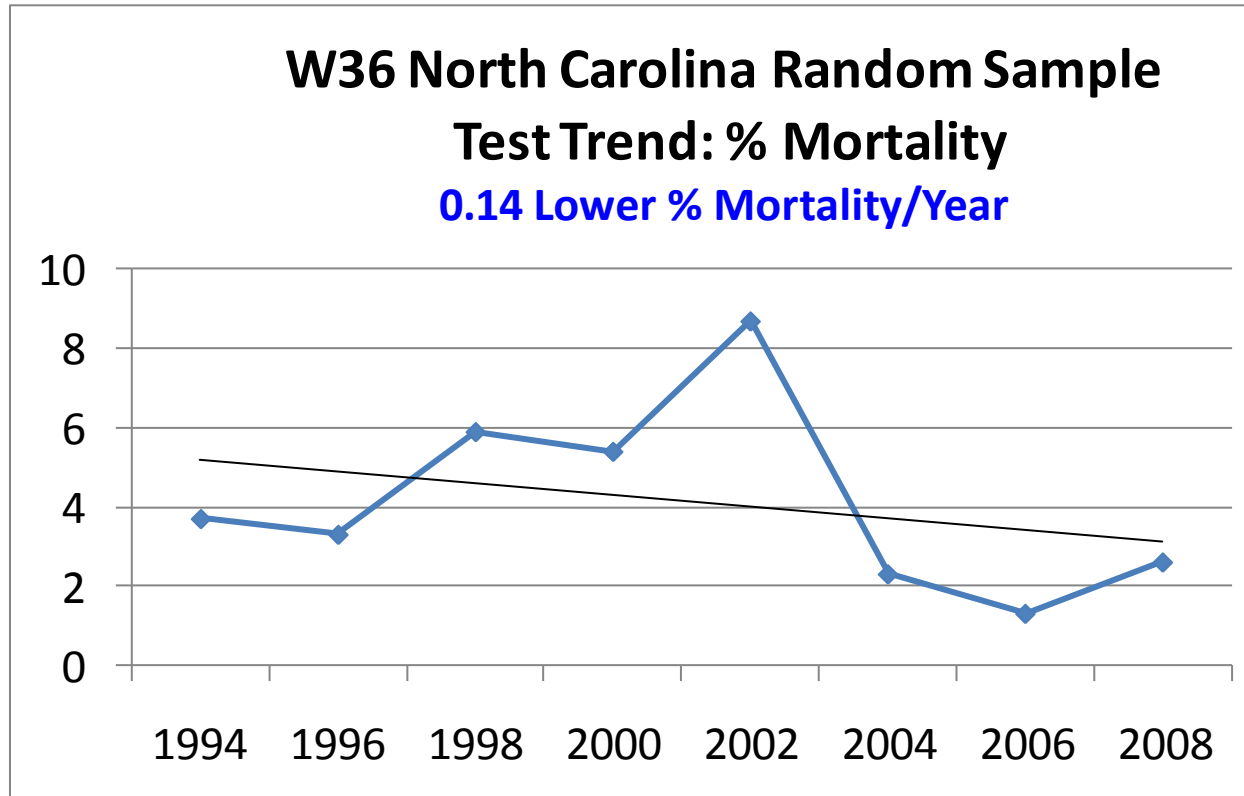
Traits such as:

-  Fear response
-  Mortality in group housing
-  Nesting behavior
-  Feather loss in group housing



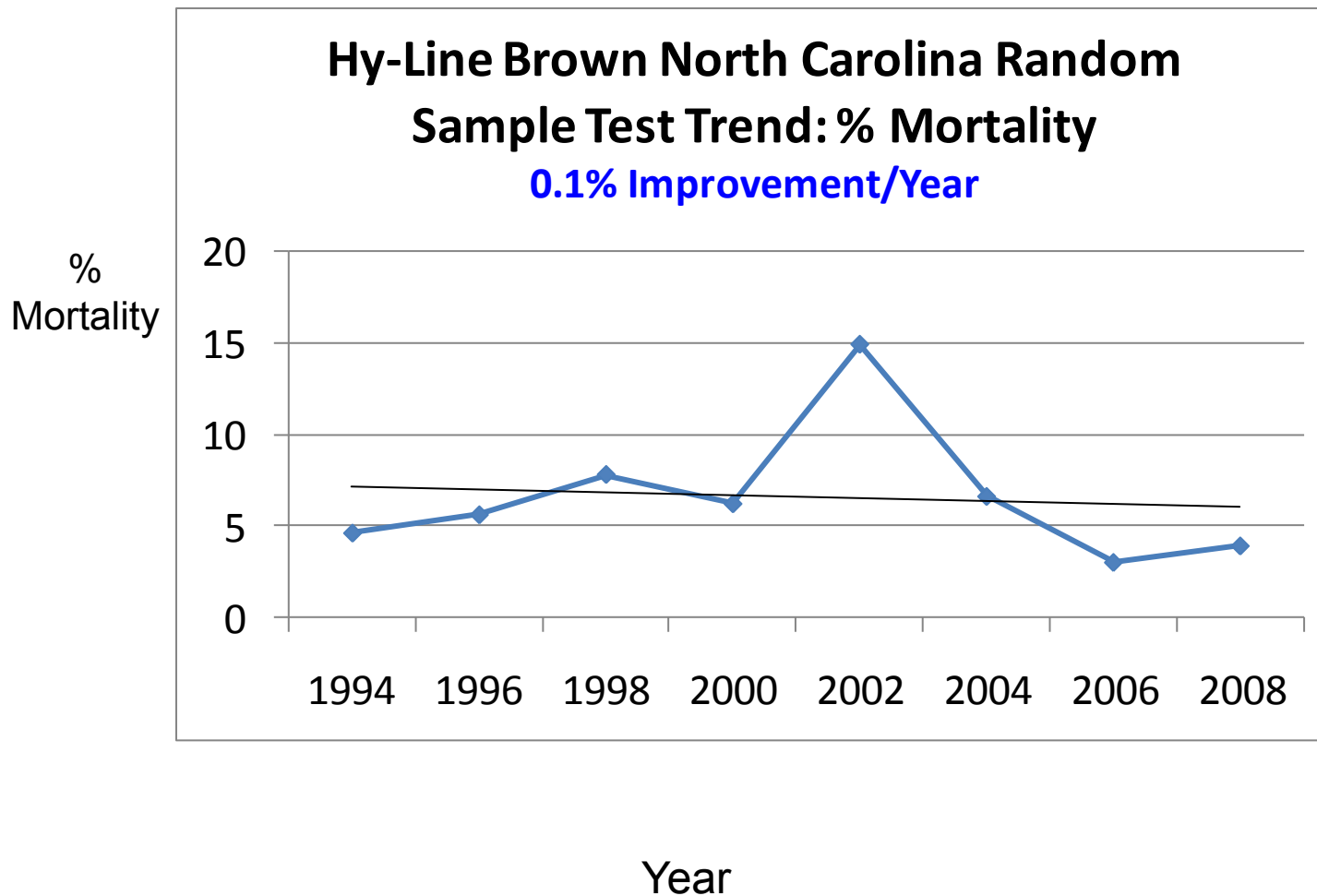
All need to be evaluated in many different environments to ensure birds respond well to complex environments.

%
Mortality



Year









Heritabilities of Traits Important in Bird Behavior

Trait	Heritabilities
Livability	0.10 – 0.14
Nesting Behavior	0.33 – 0.39
Feather Score	0.22 – 0.33
Fear Tests	0.19 – 0.24



New Technology

Genomic Selection

-  Genotyping pedigree birds with High Density Marker SNP panel.
-  Selection more accurate. Select at the DNA level.
-  Selection can occur at younger ages
-  Breeding programs redesigned



Impact of Genomic Selection

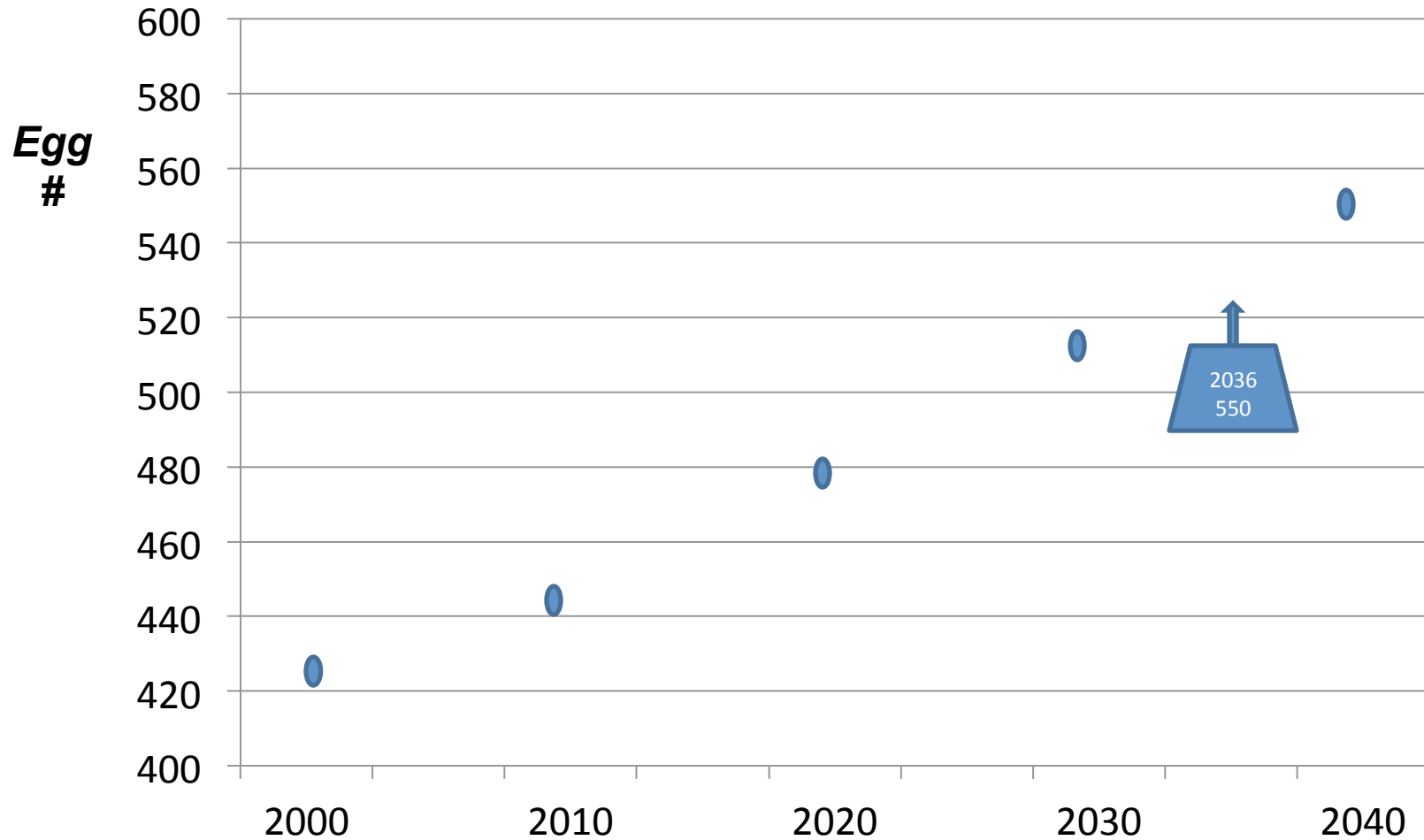
- **Group evaluated traits can now be selected at the individual bird level. Livability, and behaviors.**
- **Group evaluated traits will make more year-on-year rate of gain due to improved selection accuracy**
- **Birds will be selected which are better adapted to production systems than ever before. More adaptable hens.**



- ➔ **Genomic Selection will improve selection accuracy. Especially for males. Individuals will be distinguished based on their genotypes. No longer family Ave.**
- ➔ **Picking the best genotypes means picking those with the best genes. Every year improving the performance.**
- ➔ **Currently we improve egg number by more than 3 eggs per year. ➔ If this improves by 15% than we will increase at more than 3.5 eggs per year.**

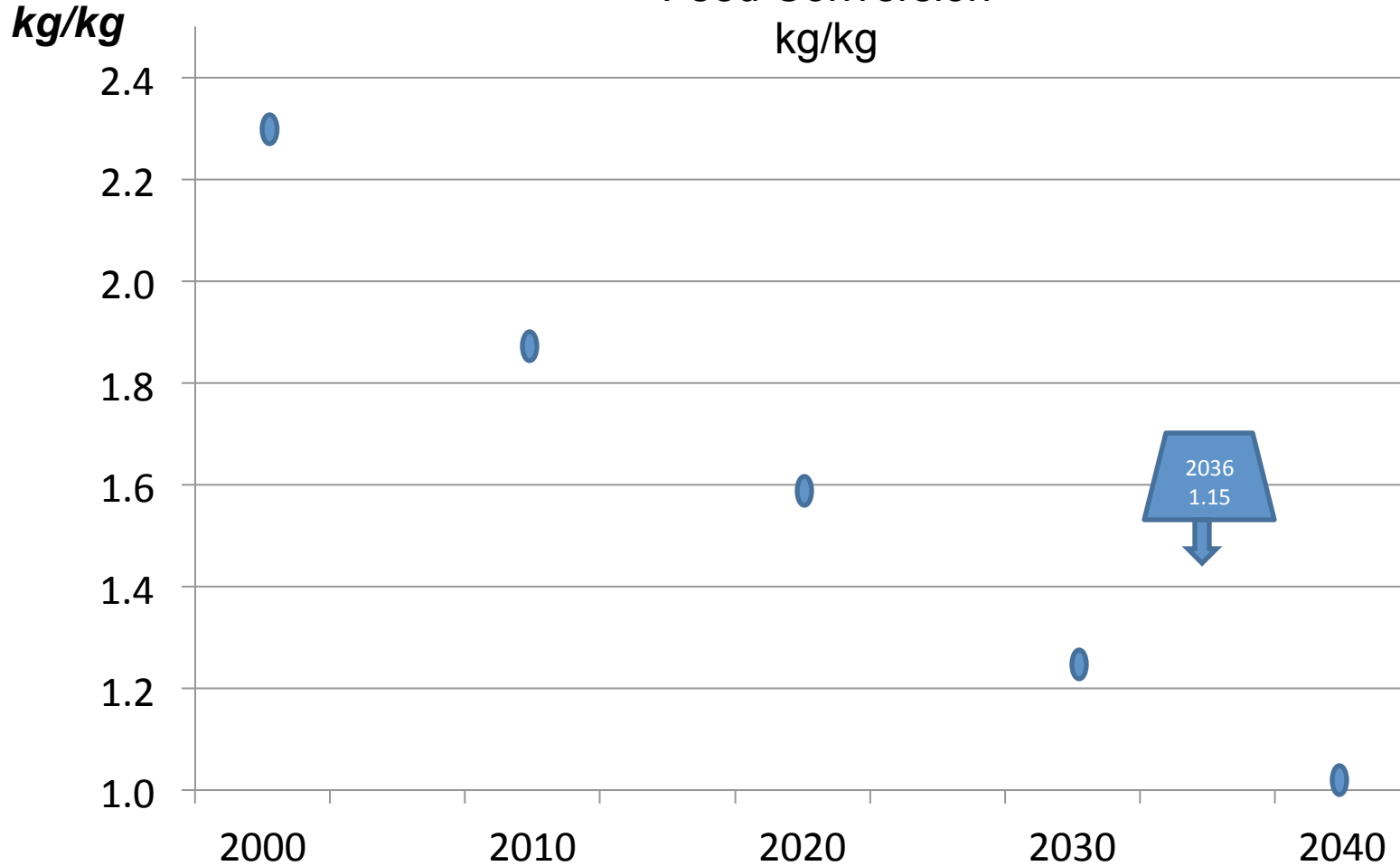
Genomic Selection will radically improve traits selected by family group information.

- ➔ Livability - 1-2% better per decade**
- ➔ Feather picking – Fully feathered hens to end of lay at 100 weeks.**
- ➔ Marek's Disease resistance – Genetic resistance evolves faster than virus mutates.**
- ➔ Social behavior – No social vices, no piling, no picking.**
- ➔ Nesting behavior – All eggs nest laid.**
- ➔ Response to stress – Bomb proof hen.**



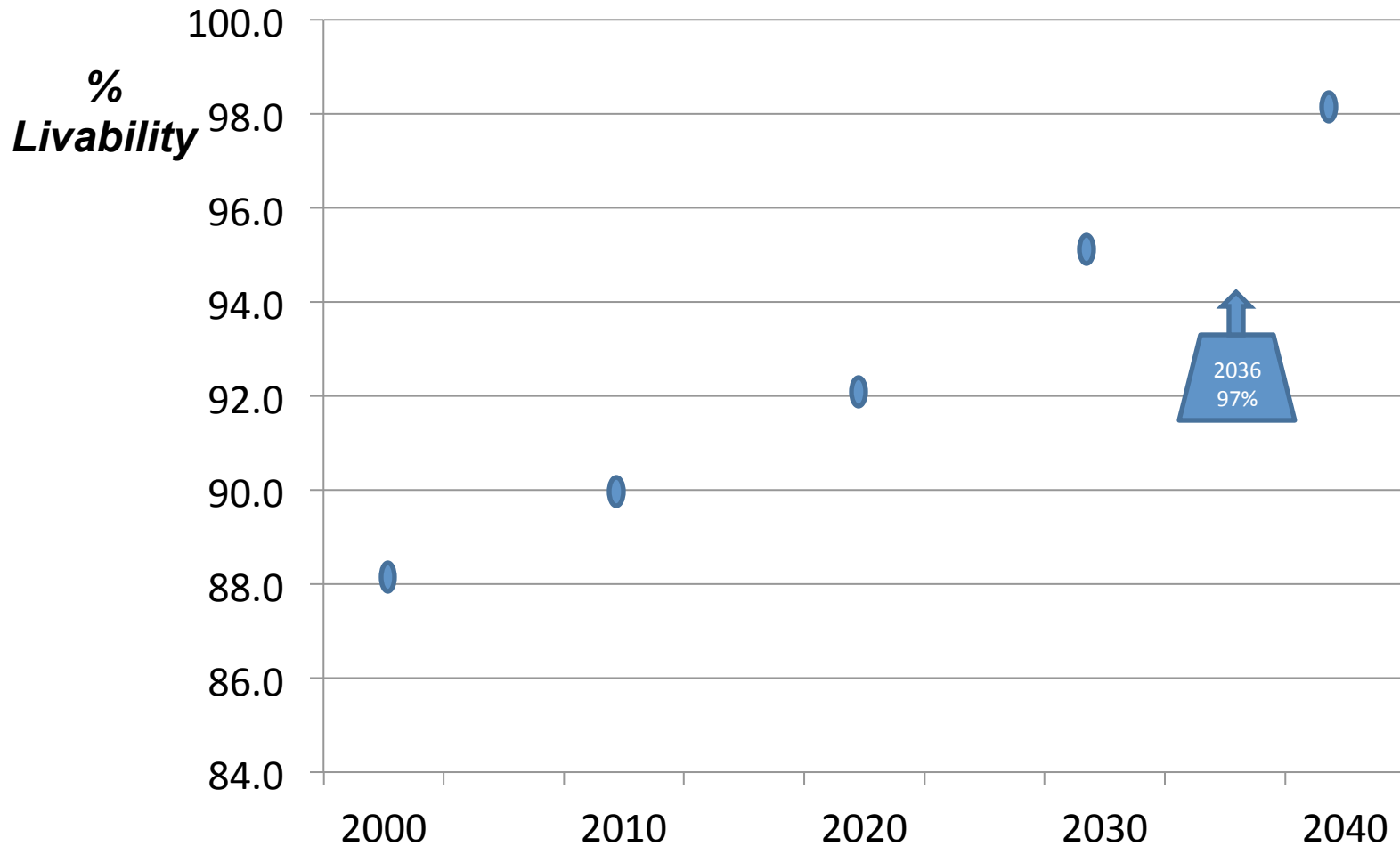
***Hy-Line will celebrate 100 years
with our hens laying 550 eggs to
100 weeks of age***

100 Weeks
Feed Conversion
kg/kg



***Hy-Line will celebrate 100 years
with our hens converting 1.15 kg
feed into 1.0kg eggs to 100 weeks***

100 Week Livability



***Hy-Line will celebrate 100 years with
our hens living at 97% to 100 weeks***

Summary

- **Breeders select routinely on over 30 traits**
- **Traits are measured on birds housed in multiple different systems**
- **Measureable progress is made in all traits every generation**
- **Genomic selection will boost selection for the group expressed traits**
- **Breeders will continue to innovate to accelerate rate of genetic gain**

Genetics Loads The Gun

Environment Pulls The Trigger

Thank You

