Effect of indicator traits on accuracy of genetic evaluation and selection

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Why indicator traits?
Target traits are costly to measure or occur late in life

Overcome selection bias

Increase accuracy of evaluation

Examples –
Muscling and marbling
Disease resistance – vaccine response
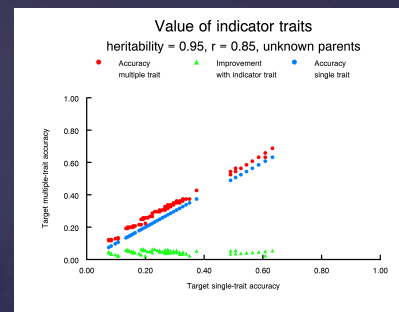Feed intake
Longevity

Methodology

Real pedigree typical of herd using natural service
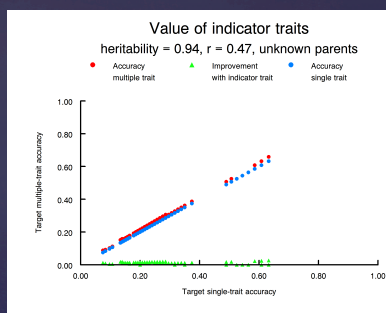Number of generations ≈ 9.2

Simulated target trait: $h^2 = 0.5$, $\sigma\downarrow a \uparrow 2 = 100$
BV = parent average + Mendelian sampling
Phenotype = µ + BV + noise

Simulated indicator trait: $h^2 = 0.95, 0.3$
BV = Parent average + Mendelian sampling + genetic regression on target trait
Phenotype = µ + BV + noise

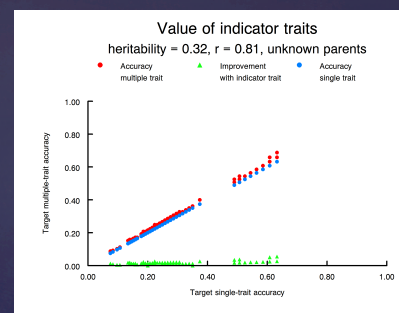Single-trait and bi-variate BLUP
BIF accuracy from PEV

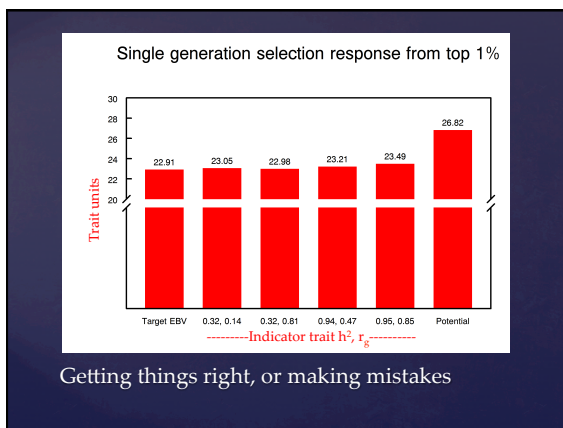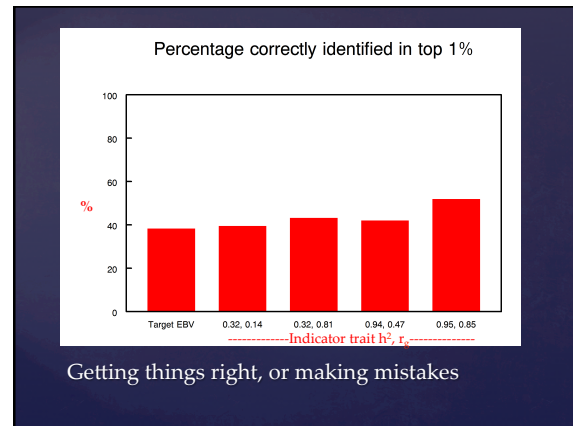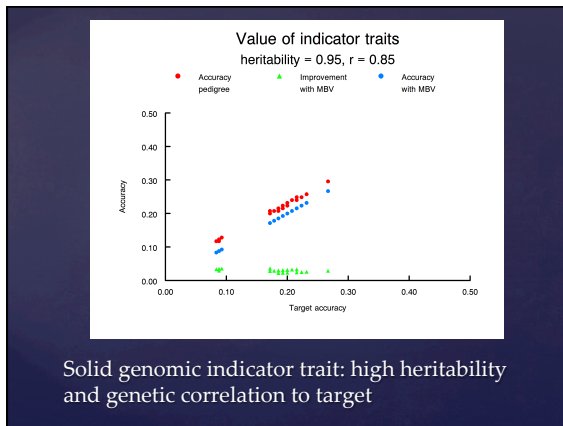Value of indicator traits
heritability = 0.95, r = 0.85, unknown parents

Solid genomic breeding value: high heritability, high genetic correlation to target

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Value of indicator traits
heritability = 0.94, r = 0.47, unknown parents

Marginal genomic breeding value: high heritability, moderate genetic correlation to target

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Value of indicator traits
heritability = 0.32, r = 0.81, unknown parents

Solid phenotypic indicator trait: moderate heritability, high genetic correlation to target

Solid genomic indicator trait: high heritability and genetic correlation to target

Getting things right, or making mistakes

Getting things right, or making mistakes

All indicator traits add accuracy to genetic evaluation of target trait

***** How much depends on the genetic regression of target trait on indicator trait

***** High value indicator traits are characterized by high heritability and large (positive or negative) genetic correlation with target trait

Still may need to progeny test to identify "best" individuals – at a cost of generation interval

Summary