Genetic gain

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Today's points

Share our understanding of **genetic gain**

How can we change how much gain we can get?

Where does genetic gain fit in the breeding program?

Back to the beginning of the breeding program

[story]

The data looks like this

[paper]

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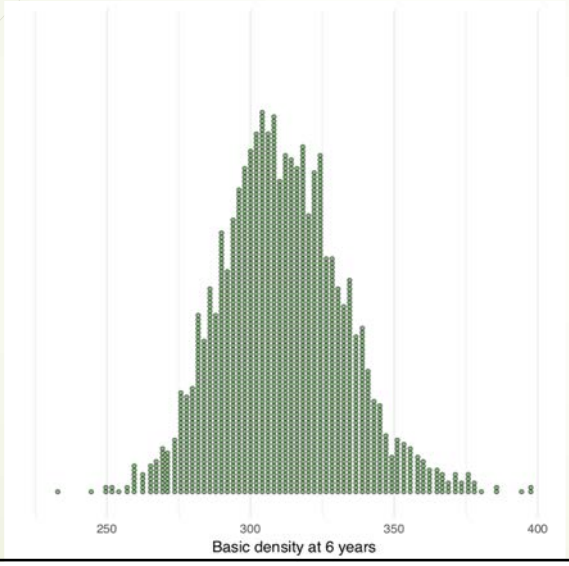
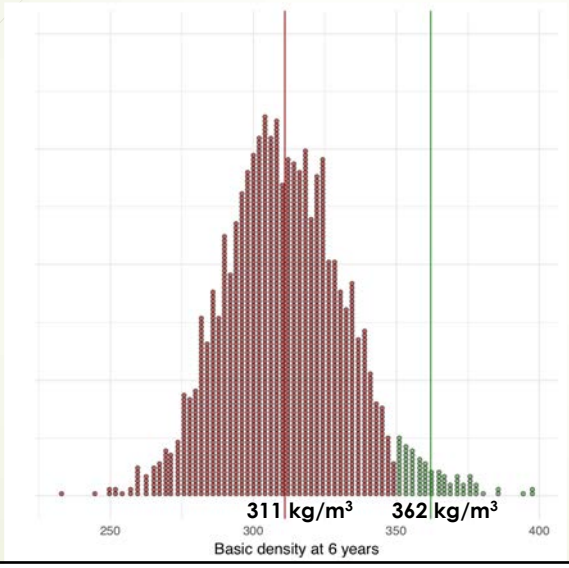
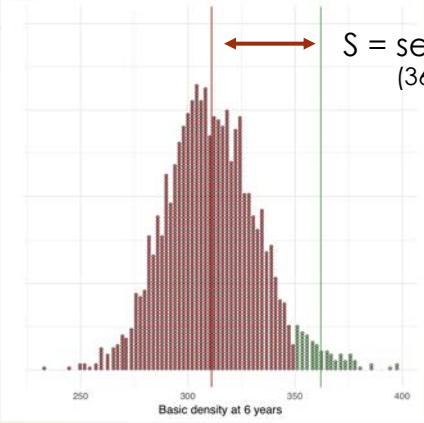


Each dot represents the value of a tree

Selecting the highest density trees



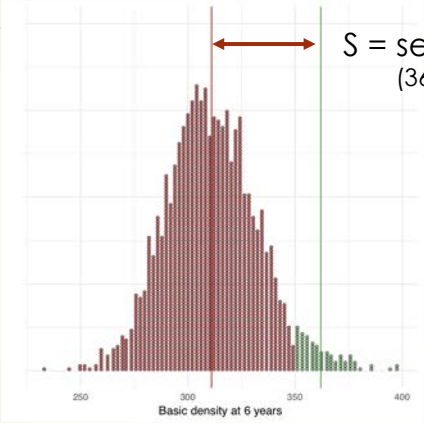
Some terminology



S = selection differential
(362 – 311 = 51 kg/m^3)

Progeny of the selected (green) population will not be 51 kg/m^3 above average

Genetic gain in progeny is a fraction of S



S = selection differential
(362 – 311 = 51 kg/m^3)

G = genetic gain (next generation)
(S x **accuracy*** how good we are at predicting genetic value)

Genetic gain: intuition

We can get more gain by:

Using a larger selection differential (S)

Getting more accurate predictions of genetic value

How can we increase S?

[hose]

How can we increase S?

Having more **variability** (wider distribution)

Selecting a smaller proportion (or, as breeders say, using higher **selection intensity**)

In fact, we can say that

S = **selection intensity** x **variability**

Genetic gain: extending intuition

$$\text{Genetic gain} = \frac{\text{selection intensity} \times \text{variability} \times \text{accuracy of selection}}{\text{time}}$$

Ta-da... Behold, this is called the breeder's equation

Genetic gain: why do we care? Example

Selecting 1 tree out of how many? 1/10, 1/1,000, 1/10,000
New assessment techniques let us have more to choose from, that is a higher intensity

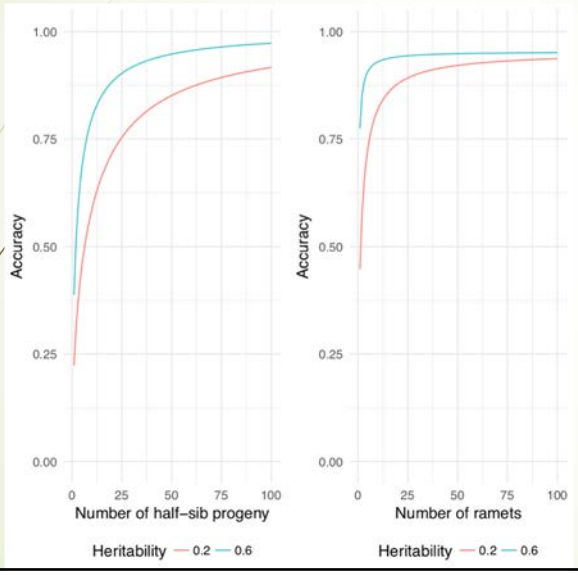
Can we bring new material to the program? Mate allocation + diversity strategy will work on this

$$\text{Genetic gain} = \frac{\text{selection intensity} \times \text{variability} \times \text{accuracy of selection}}{\text{time}}$$

Can we select earlier? Could we use 6 years instead of 8?

How well does selection reflects true genetic value? Example: Cullis & Smith's system

Genetic gain: why do we care? Example



$$\text{Genetic gain} = \frac{\text{selection intensity} \times \text{variability} \times \text{accuracy of selection}}{\text{time}}$$

How many progeny should we use?

What type of testing?

Genetic gain: why do we care?

The aim of a breeding program is to deliver gain that translates into profit

The breeding strategy has many moving parts. How they affect genetic gain is a good summary

Estimates of gain are needed for Benefit/Cost evaluation of decisions

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