

Genomic selection and parentage testing

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Genomic selection

- Associates (currently) 54,001 SNPs genotyped on many thousands of animals to performance
 - “SNP Key” - performance per SNP
- Genotype newborn and merge genotype with SNP key
 - Genomic breeding value

Holstein-Friesians genotyped

- Proven Bulls
 - 20,739 (*including US & CAN*)
 - 11,801 (*excluding US and CAN*)
 - >16,000 (*Eurogenomics*)
- Young males
 - 15,714 *in the US & Canada*
 - 1,584 *elsewhere*
- Females
 - 12,704 *in the US & Canada*
 - ~800 *in Ireland*
-and rising!!!!

New technologies

- Illumina High Density (HD) chip
 - ~800,000 SNPs
- Affymetric HD chip
 - ~550,000
- Illumina low density chip
 - ~3,000 SNPs
- Genome sequencing

Likely uptake

- Uptake of genomic selection is unprecedented
- Smaller 3k/custom chips
 - Maybe ~ US\$40 (incl. DNA extraction and service)
 - Plus cost of imputation and genomic selection (and parentage testing) maybe ~US\$50 (~€40)
- Uptake will be HUGE!

Why SNPs?

- More frequent in the genome
- Most robust and amenable to high throughput
- Low cost
- Low mutation rate
- Calling can be automated
- Work well across laboratories
- Already available as part of genomic selection breeding programs!

SNPs and parentage testing

- Li et al. (2006)
 - 59 SNPs in humans
 - Probability of Identity (PI): 9.02×10^{-15}
 - Same power as 13 microsatellites
- Rohrer et al. (2007)
 - 60 SNPs in pigs with MAF >0.15
 - PI: 4.6×10^{-23}
 - Similar power to 10 microsatellites

Slide taken from Brent Woodward's presentation at ICAR 2008



SNPs and parentage testing

- NZ study in cattle (Fischer et al. 2009)
 - 40 SNP panel with MAF >0.35 is equivalent to 14 microsatellite panel from NZ
- Heaton et al. (2002)
 - 32 SNPs
 - PI: 2.0×10^{-13}
 - Probability a randomly chosen candidate sire is excluded from paternity was 99.4% to 99.9%

Conclusions

- SNPs will be the method of parentage testing in the very near future (are already used in genomic selection software)
- Genomic selection, although early days, is proving successful