Managing Inbreeding Levels And Genetic Defects Using EliteHerd Pro Nucleus Breeding Herd Software Tools

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Introduction

EliteHerd Pro is a software package that was developed to facilitate management of nucleus-bred sows and boars, their pedigrees and inbreeding levels, recording of reproductive events, use of artificial insemination across several herd units, recording and monitoring of genetic defects, and on-farm management of individual progeny testing and selection. The program is widely used on nucleus pig breeding farms in New Zealand and Australia and can be easily adapted for use in nucleus pig breeding systems specific to other countries. Specialised software tools have been developed to control levels of inbreeding in progeny from future matings and to avoid selection of nucleus replacements from litters affected by the genetic defects. EliteHerd software can be closely integrated with a range of external best linear unbiased prediction (BLUP) engines for multi-trait, multi-herd genetic evaluation, allowing across-herd performance comparisons and genetic trends analysis. This fully featured farm information system can be used to manage both nucleus and commercial pig breeding and progeny growing herds.

Design

Monitoring levels of inbreeding. EliteHerd Pro management system includes a powerful nucleus herd management tool designed to control the levels of inbreeding in progeny from future matings. Inbreeding Coefficients Monitor produces a cross-tabulation report of all possible mating combinations and their prospective inbreeding values for the available (active) nucleus parents, within the selected breed. The inbreeding coefficient algorithm used in the calculations is based on Quaas (1976).

The selection of nucleus sires and dams can be fully customised (filtered) by the user. The colour-coding of individual inbreeding cells helps users in making the correct mating decisions (Figure 1). Inbreeding coefficients can be displayed together with the pedigree and genetic performance information, providing an essential tool for the nucleus breeder to control nucleus herd inbreeding levels and manage pure-bred matings.

The completeness and integrity of the pedigree database is assured by the built-in Export/Import pedigrees facility, which allows electronic transfer of full pedigrees of nucleus
sires and dams and their ancestors between linked nucleus herds. The Export/Import tool is particularly useful for the management of artificial insemination (AI), where distribution of boar semen from a central AI station is a requirement (Skorupski, 2006).

### Genetic Defects

EliteHerd Pro allows recording of genetic defects for the nucleus-bred progeny records. Multiple genetic defects can be recorded for each individual progeny litter. They can be displayed in Sow and Boar Data Entry screens, Progeny Lists, Sow and Boar Status reports, Inbreeding Coefficients Monitor report, and in Sow and Boar Cards, providing important management information about the nucleus parents and their progeny affected by the genetic abnormalities. This information helps nucleus breeders to avoid selecting replacement progeny from affected litters. It can also be used to make the culling decisions within the nucleus parent population.

Genetic defects summary reports can be obtained for selected boars and sows (Figure 2), displaying the list of recorded genetic defects, the sow parity, Litter ID, Sire or Dam ID of the litter with defects, number of progeny affected, the farrowing date, the number of pigs born alive, and the percentage of affected progeny, as compared to the number born alive.

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**Figure 1:** Inbreeding Coefficients Monitor report screen with the Future Mating Details popup screen

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EliteHerd Pro supports a range of external BLUP engines for multi-trait, multi-herd genetic evaluation, with built-in tools for automatic export of BLUP input files and the import of BLUP output files containing calculated EBVs (Skorupski, 2006). Users can select a combination of breeds and nucleus herds for simultaneous data export/import and BLUP analysis. The imported EBVs are combined with user-defined economic values and are used to calculate a range of EBV Index values for each nucleus animal, as required for different breeding goals set for each genetic line or breed.

Future development

EliteHerd Pro management system is continuously developed and improved. The range of genetic evaluation tools and reports will be extended, as required by individual users of the program. One of the planned improvements is the development of the special reporting tools to analyse the genetic defects using the pivot tables (cross-tabulation) reporting technology.

Conclusion

An advanced nucleus pig breeding management system was developed to facilitate management of nucleus-bred sows and boars, their pedigrees and inbreeding levels, recording of reproductive events, use of artificial insemination across several herd units, recording and monitoring of genetic defects, and on-farm management of individual progeny testing and selection. It incorporates the latest technological advances in both genetic evaluation techniques and in software interface tools and data entry techniques. Future planned developments will assure on-going benefits to the pig industry in Australia and New Zealand, with possible extensions for use in other countries.
References
