Impact of pedigree depth in the Australian strawberry breeding program: variance component estimation, prediction accuracies and estimation of clonal and breeding values

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Abstract

Key message: Less than 30 words summarising the main achievement. Abstract should be around 200 words.

Keywords: A matrix, relatedness, yield

1 Introduction

Ways of finding the best depth. What other people have found.

Atkin 2009 and Yang 2016

Various papers analysing strawbery data have included relationship matrices constructed of somewhat arbitrary pedigree generation depths, ranging from four to 20 (Whitaker et al, 2012; Kennedy et al, 2014; Osorio et al, 2014; Paynter et al, 2014).

Repeated measures or longitudinal analysis of yield data does not appear to be standard practice in strawberry, with research groups instead summing individual harvests to obtain a total season yield (e.g. Cockerton et al (2021); Gezan et al (2017);

Fan et al (2024); Osorio et al (2021)). Similarly for fruit weight, a common method is to divide total (marketable) yield by the total number of (marketable) fruit across a season (e.g. Sleper et al (2025); Osorio et al (2021); Whitaker et al (2012)), or average across all harvests to obtain a mean weight (e.g. Prohaska et al (2024)).

Repeated measures analyses have been used in other horticultural crops to model traits measured temporally, for example in macadamia (Hardner and De Faveri, ????), sweet cherry (Piaskowski et al, 2018) and.... *Ky to insert her favourite examples (though perhaps we need to reword "horticultural").*

Yield and fruit weight are two of the most important traits in driving profitability in strawberry (Herrington et al, 2012). Increases in yield lead to an increase in gross margin (Herrington et al, 2012). In the subtropical region, increased early season (in April and May) production is a current aim of the ASBP due to the high market punnet prices compared to the rest of the season (Herrington et al, 2012). Large fruit sizes lead to substantial increases in gross margin, as the time to pick and pack a fruit does not change with size, but larger fruit will result in more punnets and thus be more profitable for growers compared to fewer punnets of small fruit (Herrington et al, 2012). Fruit weight tends to decrease as temperatures increase (Menzel, 2021), and so average fruit weight in August in the subtropical region and in December to February in the temperate region are particularly important factors in ASBP selection decisions. It is for these reasons that the ASBP evaluates total season yield and average fruit weight as well as for individual weeks and months.

2 Materials and methods

While early studies of inheritance in octoploid strawberry found meiotic behavior to be a mix between disomic and polysomic (e.g. Lerceteau-Köhler et al, 2003), more recent studies have found that inheritance is disomic (Rousseau-Gueutin et al, 2008; Tennessen et al, 2014; Sargent et al, 2016; Hardigan et al, 2020) and that analyses employing diploid Mendelian genetics are appropriate (Pincot et al, 2021). Therefore, we used the option ploidy = 2 when constructing the A matrix in AGHmatrix.

If we do explore an octoploid A matrix and find that it is a better fit than diploid, then we should explore different levels of double reduction (the probability that two sister chromatids pass into the same gamete), as per Amadeu et al (2016).

Recent studies have found that a small amount of genetic variance could be attributed to dominance (Feldmann et al, 2024; Sleper et al, 2025). Thus, we also constructed a dominance relationship matrix in AGHmatrix using the option dominance = TRUE.

3 Results

Figures and tables are labeled with a prefix (fig or tab, respectively) plus the chunk label. Other environments such as equation and align can be labelled via the `\label{#label}` command inside or just below the `\caption{}` command. You can then use the label for cross-reference. As an example, consider the chunk label declared for Figure **??** which is fig1. To cross-reference it, use the command `Figure \ref{fig:fig1}`, for which it comes up as "Figure **??**".

To reference line numbers in an algorithm, consider the label declared for the line number 2 of Algorithm **??** is `\label{algln2}`. To cross-reference it, use the command `\ref{algln2}` for which it comes up as line **??** of Algorithm **??**.

4 Discussion

5 Conclusions

We found...

Supplementary information. If your article has accompanying supplementary file/s please state so here.

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Declarations

5.1 Funding

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5.2 Competing Interestions

The authors have no relevant financial or non-financial interests to disclose.

5.3 Authors' Contributions

KM and KO developed the idea. KM wrote analytical R code. etc etc.

5.4 Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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