Benchmarking Best Performing Semi-clonal Seeds Against *Tenera* Clones: Avenue For Superior Clonal Ortet Identification

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Abstract

Clonal seeds either semi- or bi-clonal seeds are technical definitions, which do not indicate the performance of planting material. The clonal seeds approach enables bulk reproduction of best/top crosses as commercial planting material. The oil yield performance of realized oil palm DxP top cross is 130% of DxP commercial planting material or standard control. Reproduction of top cross in bulk is viable through clonal seeds technology and hence translates fully the performance from trial to field, which could become the latest DxP commercial planting material. On average, the performance of commercial *tenera* clones (comprising a basket of clones), in terms of oil yield is 115% of the DxP commercial planting material or standard control at the same generation. The variation within the basket of clones, shown in clonal trial performance results, enables selection of the superior clones, which yield better than the potential future DxP commercial planting material (the reproduced top cross clonal seeds). Trial results suggested only 10% of the primary clones are suitable for recloning so to maintain their edge against the commercial DxP of the generation when the ramets are released as commercial planting material. To embark on recloning program, clonal performance trial cannot be overemphasized in order to identify superior clones for recloning

Key word: Oil palm clonal seeds, semi- or bi- clonal seeds, bulk reproduction, top cross, *tenera* clones, recloning

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Introduction

One of the applications of tissue culture technology as a breeding tool is cloning the parents for semi-clonal or bi-clonal seeds production; in order to recreate in bulk the top crosses as commercial planting materials. Semi- or bi-clonal seeds are technical definitions indicating the seeds were produced either by having one ramet-parent and a sexual-parent or both ramet-parents. Hence the definition of semi- or bi-clonal seeds does not imply the performance of planting materials. In the context of oil palm, clonal DxP seeds can be produced in large quantities via three approaches: Semi-clonal seeds via clonal *dura*, Semi-clonal seeds via clonal *pisifera* and Bi-clonal seeds.

Semi-clonal seeds via clonal *dura*

Pros:

In context of oil palm, *dura* is female fertile and all palm's attributes can be quantified or recorded. The clonal *dura* attributes can be evaluated and quantified in the ortet. Deviants can be eliminated from seed production. The exact cross can be reproduced in bulk because pollen is usually not a limiting factor.

Cons:
Such approach limits the number of seed produced if *pisifera* pollen is insufficient.

Semi-clonal seeds via clonal *pisifera*

Pros:
Pisifera pollen is always sufficient.

Cons:
Full attributes of a *pisifera* cannot be examined, especially bunch characters because *pisifera*s are commonly female sterile. Progeny testing is required to ensure no abnormalities are transmitted to the offsprings. One *pisifera* can pollinate many *dura*s. Therefore if the clonal *pisifera* transmits abnormalities to its offsprings, a large number of seedlings will be affected because of its ability to pollinate many *dura*s at any one time. Technically, using selfs *dura*s as mothers and clonal *pisifera*s pollen, the exact cross is not reproduced. If dominance exists, contributing to the good performance to the top crosses, recapturing the dominance is not possible due to segregation within the selfed *dura*s.

Bi-clonal seeds

Pros:
The exact top cross is reproduced. Limitation in reproduction is not expected.

Cons:
Bi-clonal seeds, both parents are clones, it possesses higher risk then semi-clonal seeds in the context of negative somaclonal variation, unless, every individual clonal *dura*s and *pisifera*s were progeny tested, showing no abnormalities was transmitted to its offsprings.

Clonal seeds enable bulk reproduction of top cross(es)
Applied Agricultural Resources Sdn Bhd (AAR) adopted the approach of semi-clonal seeds via clonal *dura* and the strategy to *Dura* x *Pisifera* (DxP) progeny test and cloning the respective *dura* simultaneously. Hence, when the progeny test results are ready, which shall enable the identification of the top DxP crosses, the top crosses can immediately be recreated in bulk using the corresponding *dura* ramets for commercial exploitation.

Some additional advantages of semi-clonal seeds are uniformity as all the seeds were related as full sib if only one cross is recreated, and the ability to recapture dominance existing within a cross, if any.

Such an approach poses a question, where does the *tenera* clones stand in view of their performance against the top crosses.

Clonal performance against top crosses.
In AAR, when clones are produced as commercial planting material, trials results suggested primary ortet selection was well carried out because in terms of oil yield (OY), clones performed (average across clones) 15% better than the AAR commercial DxP.

One of the strategies to achieve the large numbers of ramets required in commercial clonal propagation is recloning. Identification of clonal ortets for recloning and at the same time to maintain its edge against commercial DxP seeds is tricky. This is because recloning, or even resample, is usually carried out after clonal evaluation trial. By the time the reclones can be reproduced in large numbers, which is about 13 years (10 years for clonal trial evaluation and 3 years for recloning), conventional DxP seeds are expected to make improvement. In our experience, the foreseeable AAR commercial DxP that will be released at generation similar as the reclones, via the semi-clonal seed strategy, suggested 30% better in OY than the current AAR Standard Dy AVROS DxP Control Cross. In other words, to reclone, the clonal ortets selected (according to their clonal performance evaluation results) need to achieve at least 145% of OY against the AAR Standard Dy AVROS DxP Control Cross, to maintain a performance of 110% or more against the AAR commercial DxP of the same generation.

Our clonal trial experience suggested that there are only limited numbers of such clones. The trial results suggested only about 10% of the primary clones tested meet this criterion and are suitable for recloning.

Ortet Garden Strategy: its workability is questioned

Such a scenario brings into doubt the proposal of having ortet garden where the best cross of the generation is planted in bulk as garden for ortet selection. Two generations of yield recordings are required before ortets can be selected; one generation to identify the best cross and another generation to yield record the individual palms in the garden. By the time the results in the ortet garden are ready, a new generation of best cross is already identified from the existing plant breeding program. Conservatively in a well tailored breeding program, we can expect 1.0 – 1.5% of improvement per year (Soh et al. 2003) and one generation is 7-10 years. At best, the clones produced from the ortet garden would most probably have performance similar to the best cross from the new generation, reproducible in bulk as commercial DxP seeds via clonal seeds strategy. Therefore the clones produced from the ortet garden would have no real advantage against the latest generation of commercial DxP seeds.

Concluding remarks

Clonal seeds, either semi- or bi-, enable bulk reproduction of the best/top crosses as commercial planting material. With the clonal seeds strategies, the realized trial performance results, theoretically, are translated fully to commercial fields. A good breeding program emphasizing progeny test results, is expected to give on average 1.0-1.5% per year of improvement.

Clonal performance trial is essential for the following info:

1. How are the clones performing against the commercial DxP at that particular time?
2. How are the clones performing against the standard control that benchmarks the performance of potential future DxP?

With clonal performance trial results, selection for clonal ortets for recloning is possible: by selecting clones that are better than the best potential DxP, which is foreseeable to be reproduced in bulk by semi- or bi- clonal seeds for commercial planting at the similar generation as the reclones. Ortet selection standards need to be

reviewed, generation-by-generation, in order to maintain the advantage of clones against the continuously improving commercial DxP seeds.

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