Report: Increasing accuracy and reducing cycle length in IITA yam

EIB-Roslin Collaboration
June 12th, 2020

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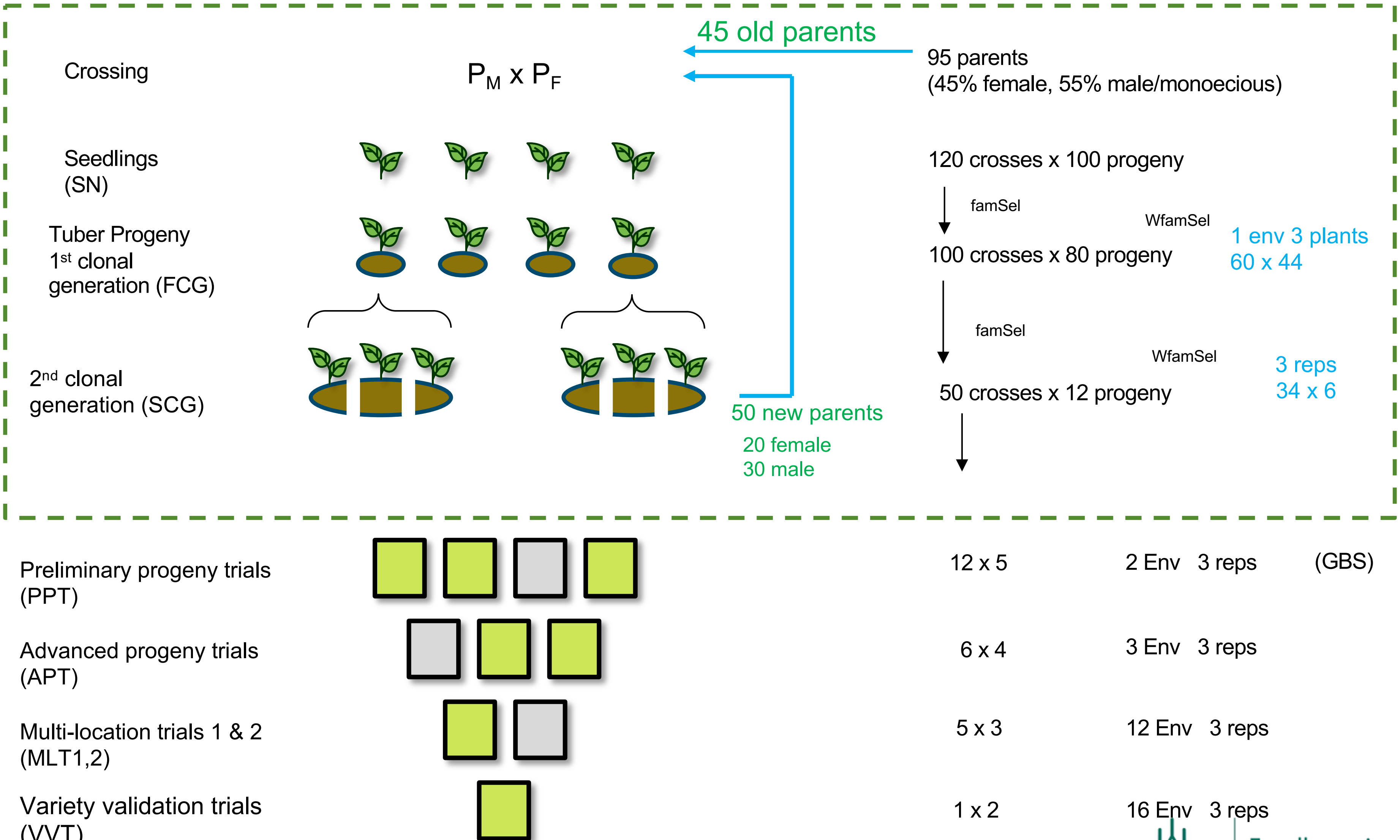
Baseline



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1. Introduction to the problem

Crop by Region

IITA-Yam

Problem Specification

Currently, parents are recycled at the SCG step with only one replication, which may not be optimal. Additionally, about half of parents for the new cycle are old parents

Breeding strategy component tackled

Crossing / ***Evaluation*** / Selection

Breeders' equation terms tackled

L, r, σ_a

Hypothesis

Increasing accuracy, reducing cycle time and using all new parents will increase the rate of genetic gain

2. Materials and Methods

Treat	Description
T1 (Baseline)	Current scheme (50 new parents selected from SCG + 45 old parents to make the next cycle)
T2 (SCG_3reps)	Current scheme (50 new parents selected at SCG + 45 old parents + three additional reps)
T3 (Baseline_2)	Current scheme minus old parents (50 new parents are selected at SCG but without the old parents)
T4 (SCG_3reps_2)	Baseline_2 + 3reps (50 new parents at SCG + no old parents + three additional reps)
T5 (FCG_parents)	50 new parents selected at FCG + no old parents + 3 plants at FCG
T6 (PPT_VVT_parents)	50 new parents selected from pooling PPT, APT, MLT1, MLT2 and VVT.

- Simulation: 20-year burnin based on the current scheme (Baseline), and followed by 20 year breeding for each treatment
- varGxY assumed = varG
- Genetic gain and relative variance tracked at SCG

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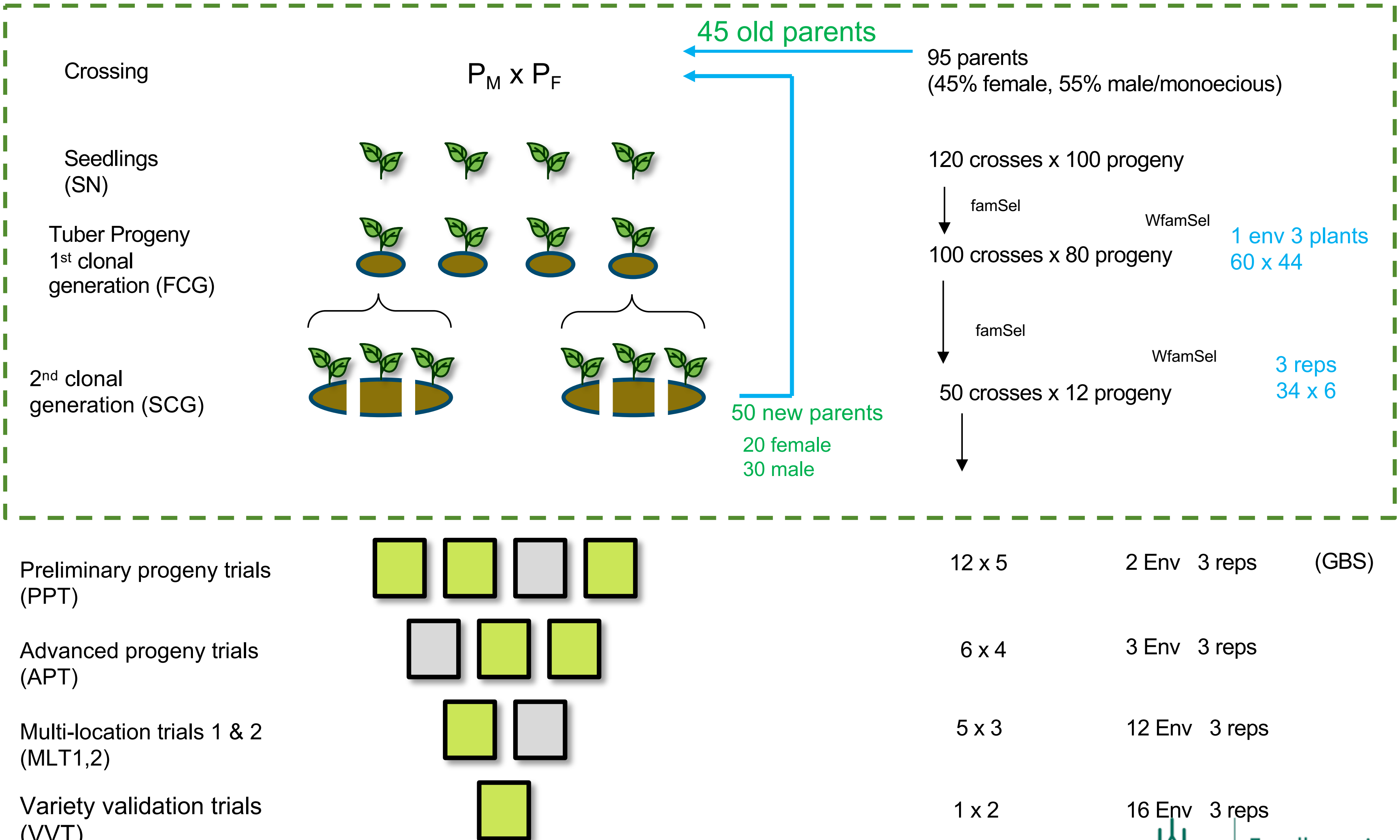
Baseline



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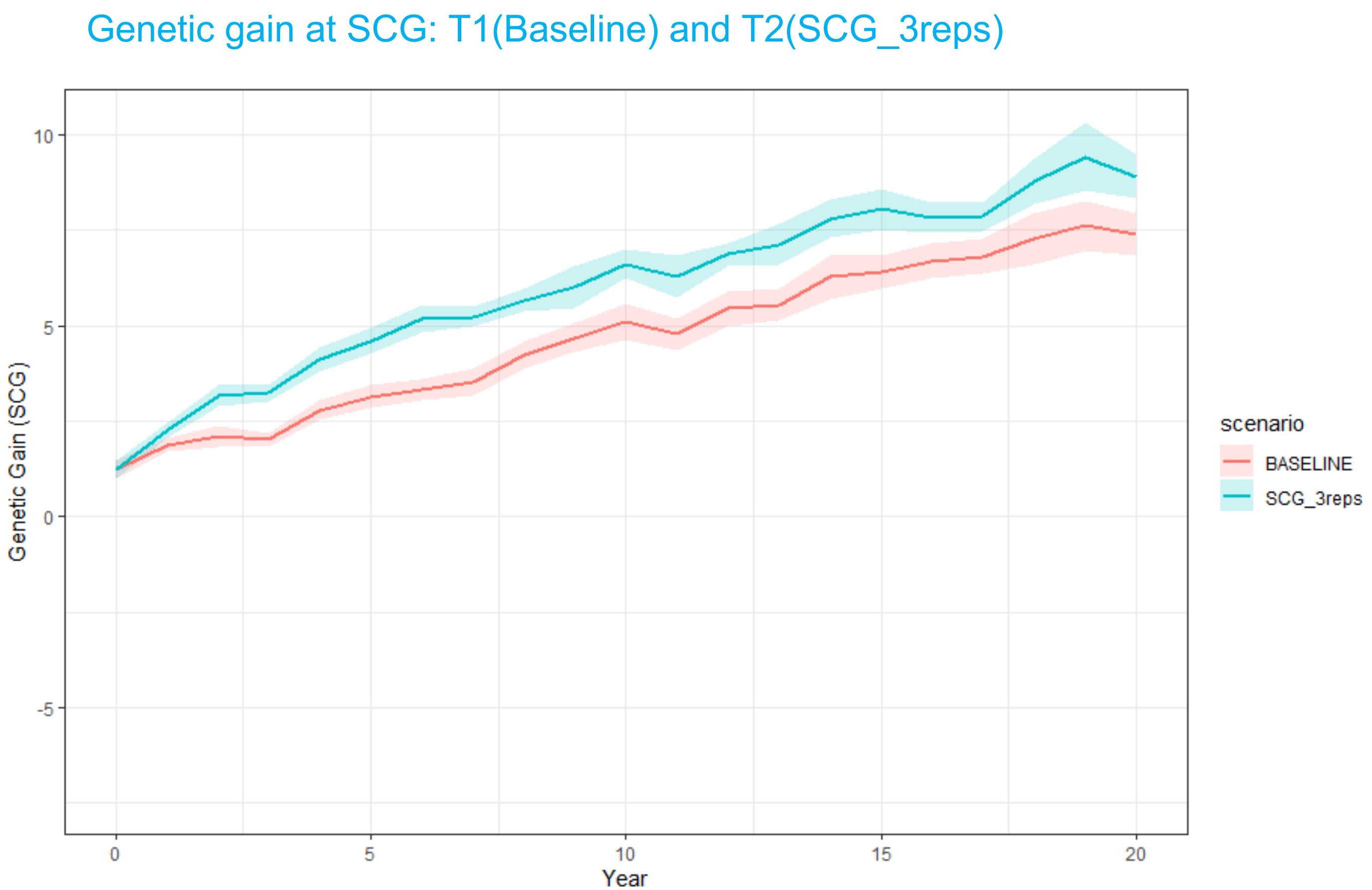
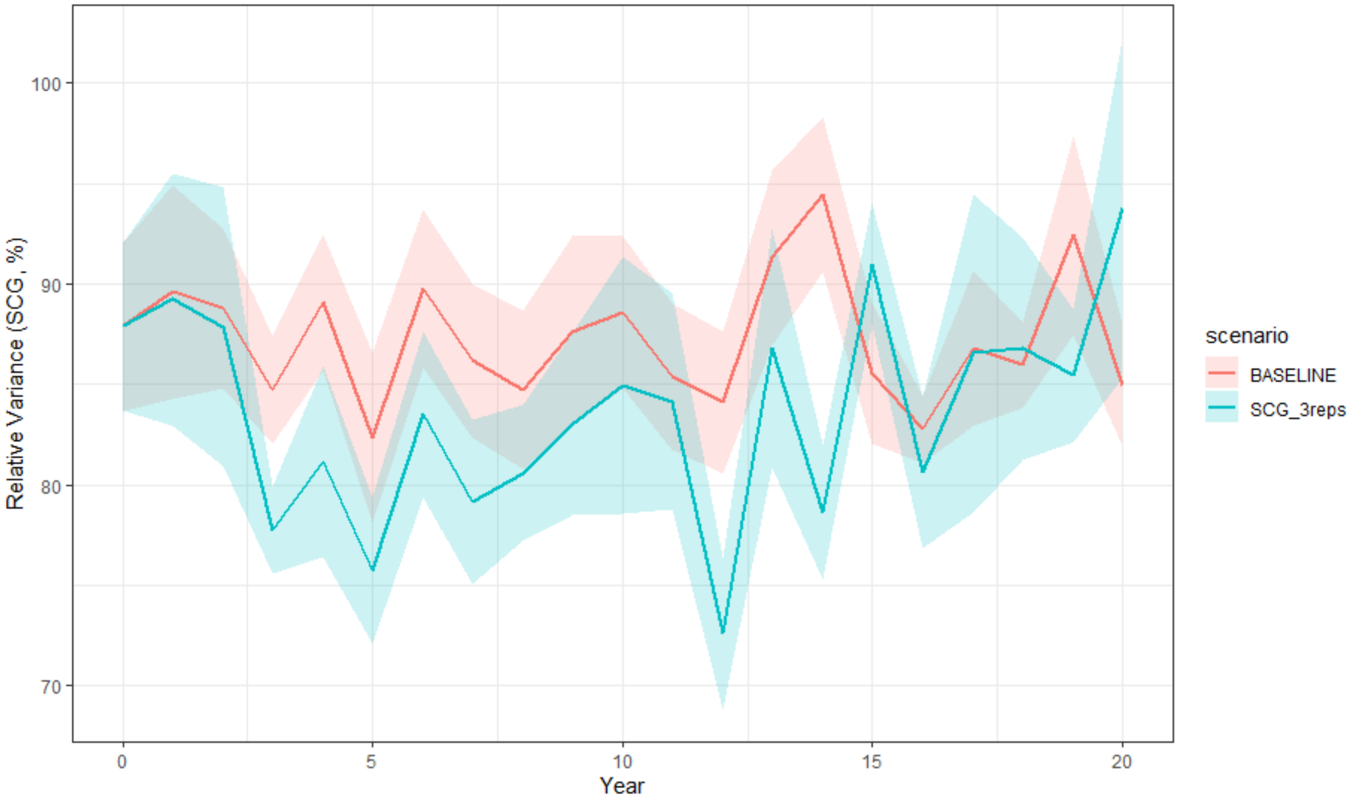
3. Results



- ➢ Increasing accuracy increased GG by about 13% over the baseline
- ➢ Higher accuracy increased genetic gain over selection intensity

3. Results

Relative variance at SCG: T1(Baseline) and T2(SCG_3reps)



- ➢ Relative variance not behaving as expected: should go down over time.
- ➢ Effect of old parents?

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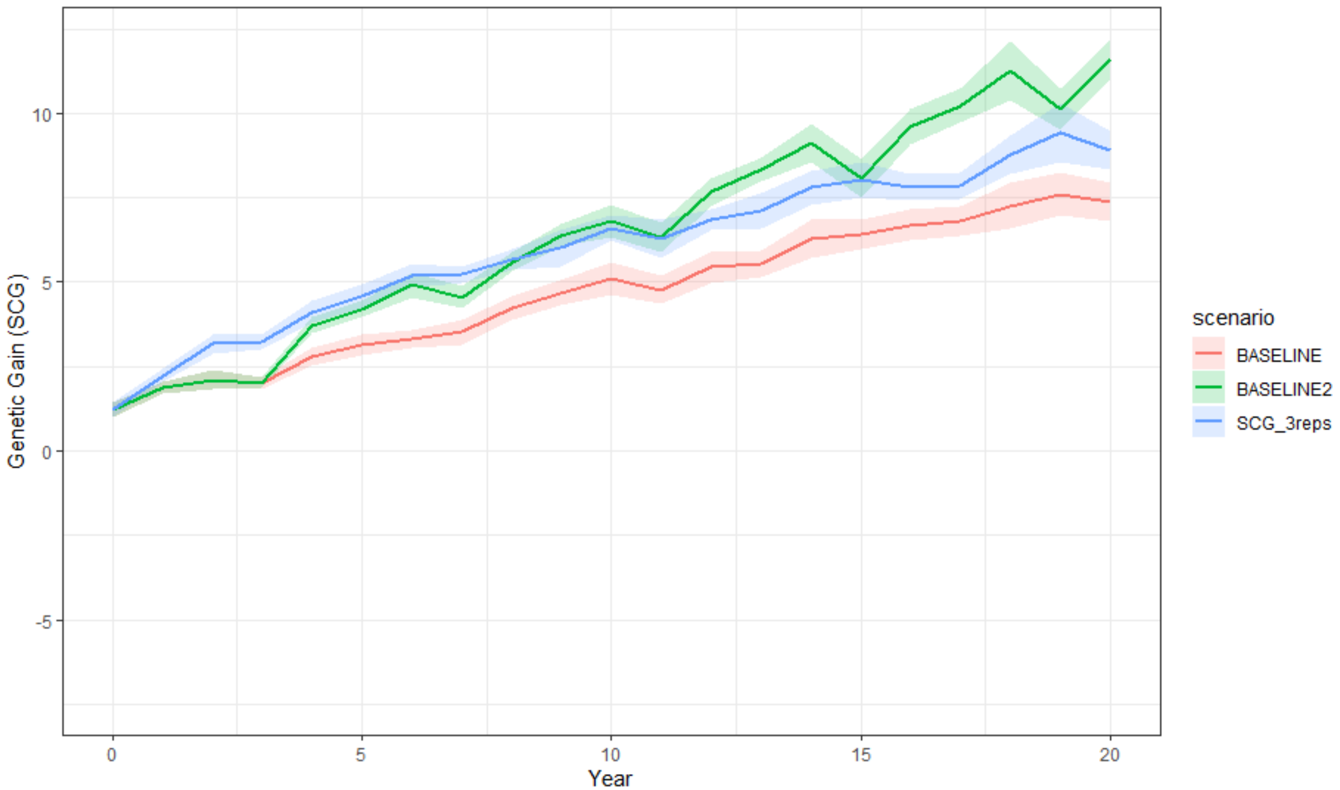
3. Results

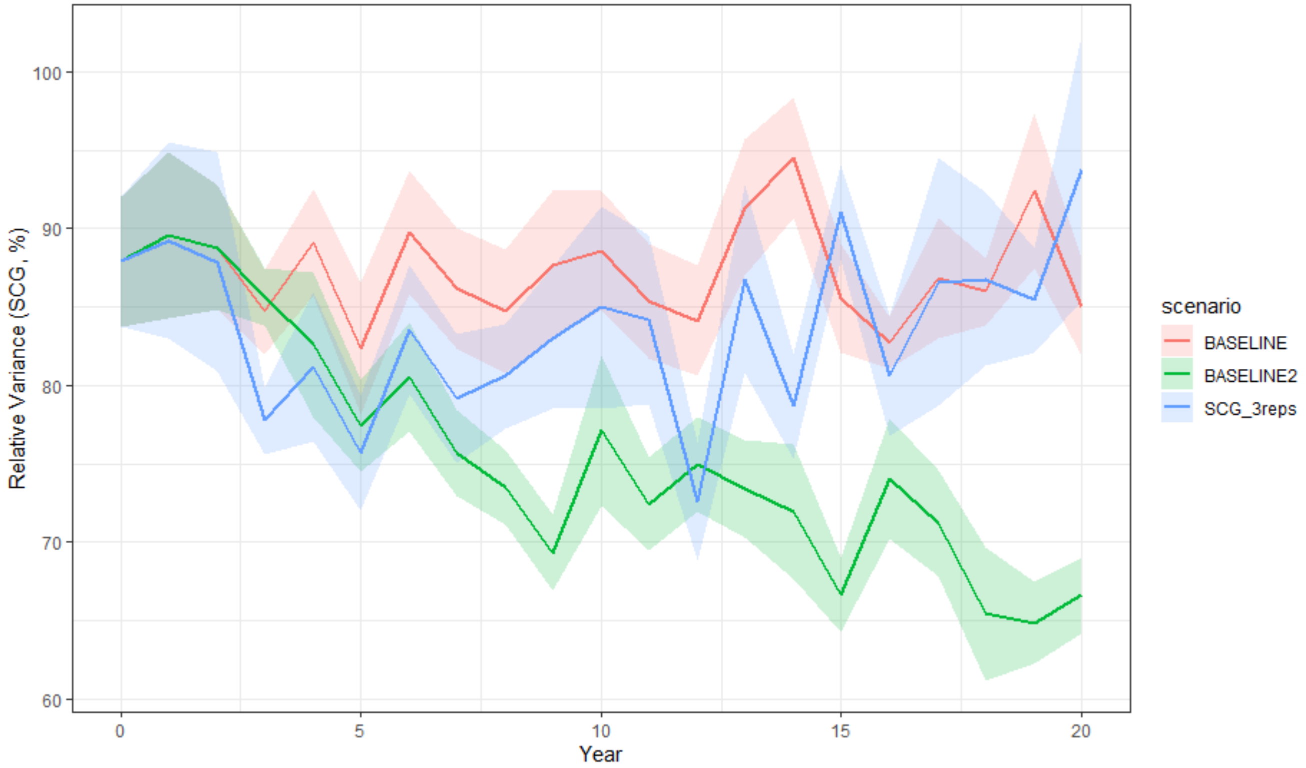
Genetic gain at SCG: T1(Baseline), T2(SCG_3reps), and T3(Baseline_2)



- ➢ Selecting only new parents increases genetic gain twice as much as improving accuracy

3. Results

Relative variance at SCG: T1(Baseline), T2(SCG_3reps), and T3(Baseline_2)



- ➢ Relative variance now behaving as expected with T3 where only new parents are used.

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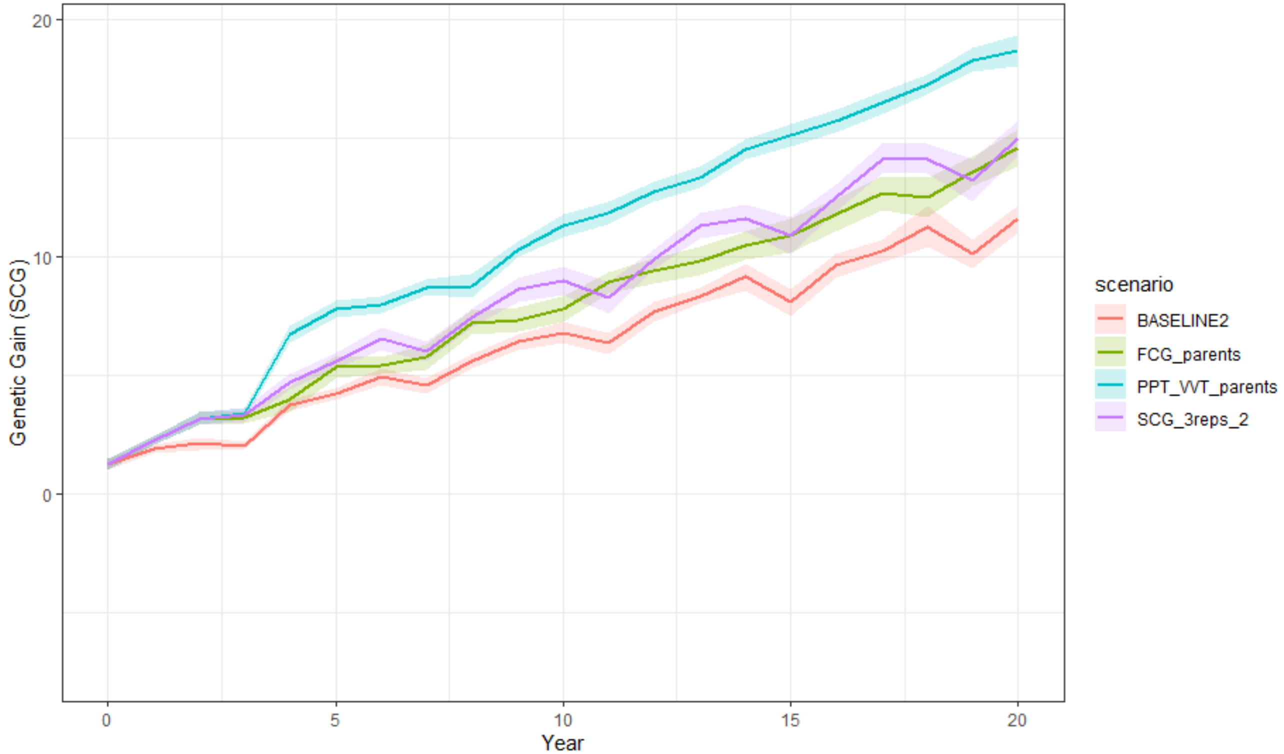
3. Results

Genetic gain at SCG: T3(Baseline_2), T4(SCG_3reps_2), T5(FCG_parents), T6(PPT_VVT_parents)



- Increasing accuracy and reducing cycle time both increased genetic gain, but in this case, increasing accuracy was always better

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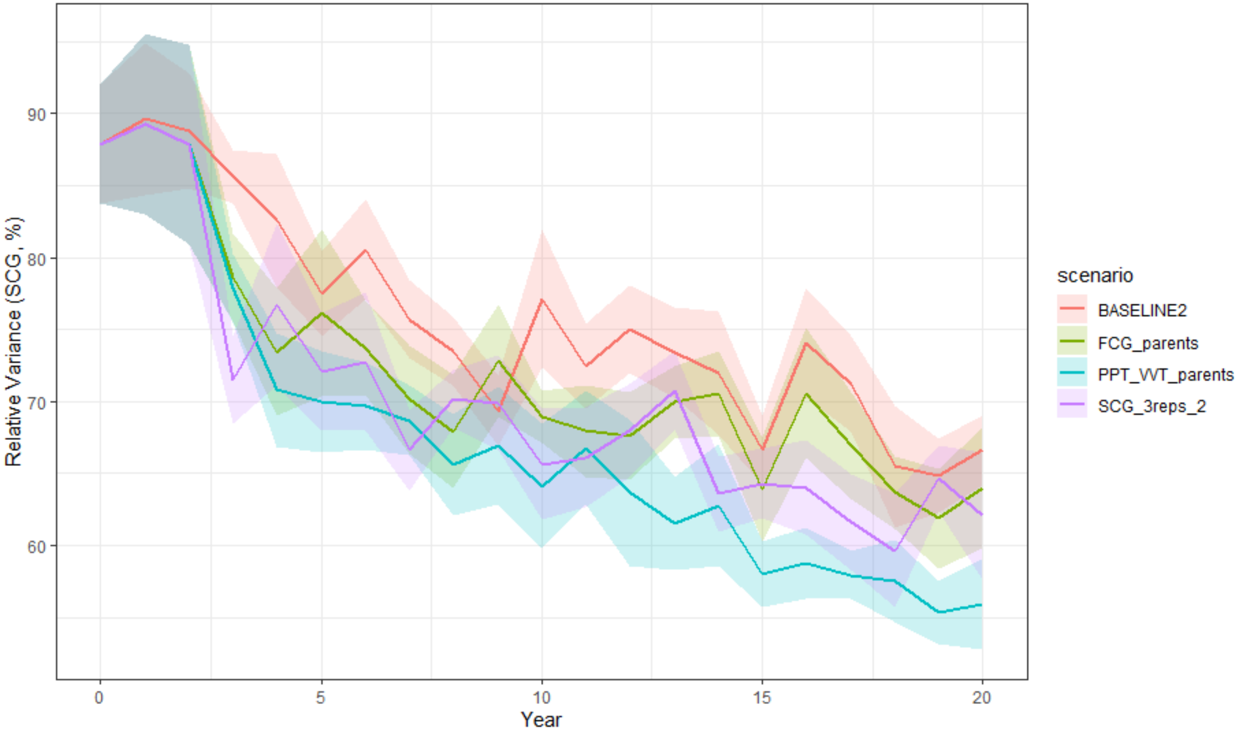
3. Results

Relative variance at SCG: T3(Baseline_2), T4(SCG_3reps_2), T5(FCG_parents), T6(PPT_VVT_parents)



- As expected, relative variance goes down over time for all scenarios as genetic gains increase
- Can be managed according to breeding objectives

4. Conclusion

We recommend using only new parents within a closed population improvement pipeline. Trait introgression could be achieved from a separate pipeline of pre-breeding.

Increasing accuracy and reducing cycle length increased genetic gains. However results indicate that the number of replications simulated here are still too low to allow maximum benefits from rapid cycling. There is therefore need to still increase number of replications at FCG and SCG in order to recycle faster. This will of course necessitate other improvement plans for rapid tuber multiplication and re-allocation of resources.

As number of replications increase at FCG and SCG, the total numbers will need to be optimized. Another simulation-based future improvement plan would be to determine the optimal number of parents, crosses and progeny.

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Thank you for your interest!

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