Conclusion – simulation indicated:

For a successful MAS among clone populations for economic value:

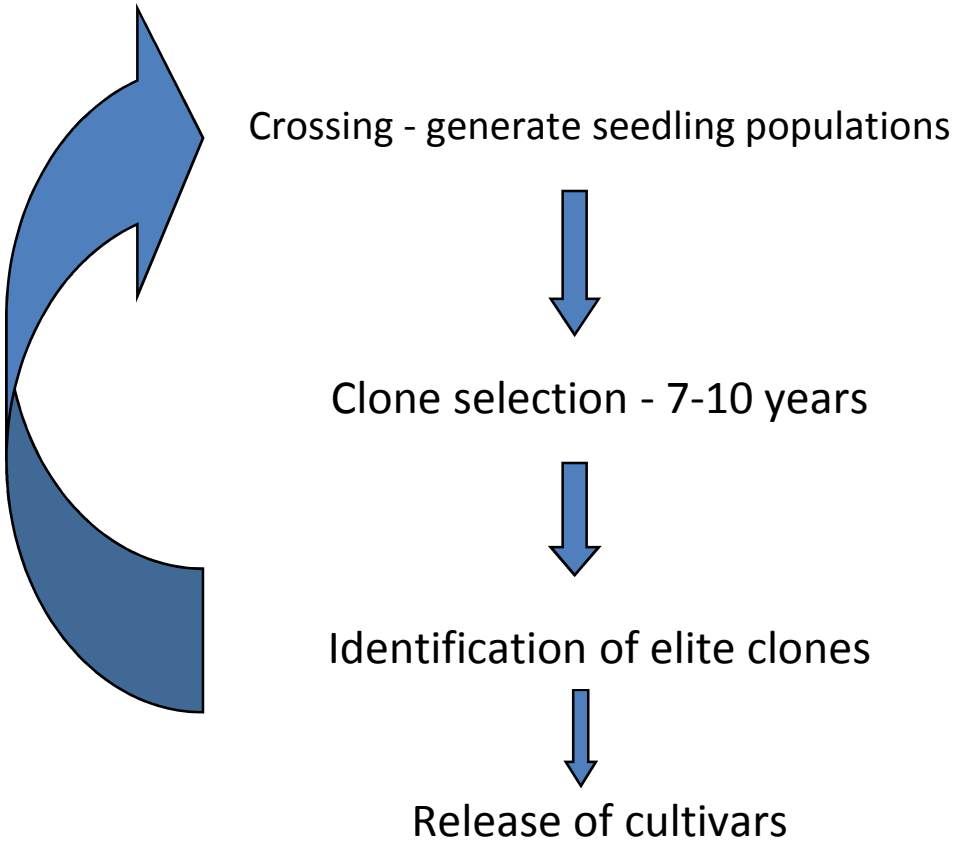
- Medium to high marker effects
  - >30% variation accounted for using a set of markers
- Low genotyping costs
  - <$5/genotype

- Not likely in next few years

- Conclusion - we could not make marker assisted selection look cost effective within a single cycle of clonal selection (ie. seedlings to release)
  - Ie. From a breeding program perspective, putting additional investment $ into phenotypic selection will give as good if not much better results than doing MAS

But attention turned to parental improvement…

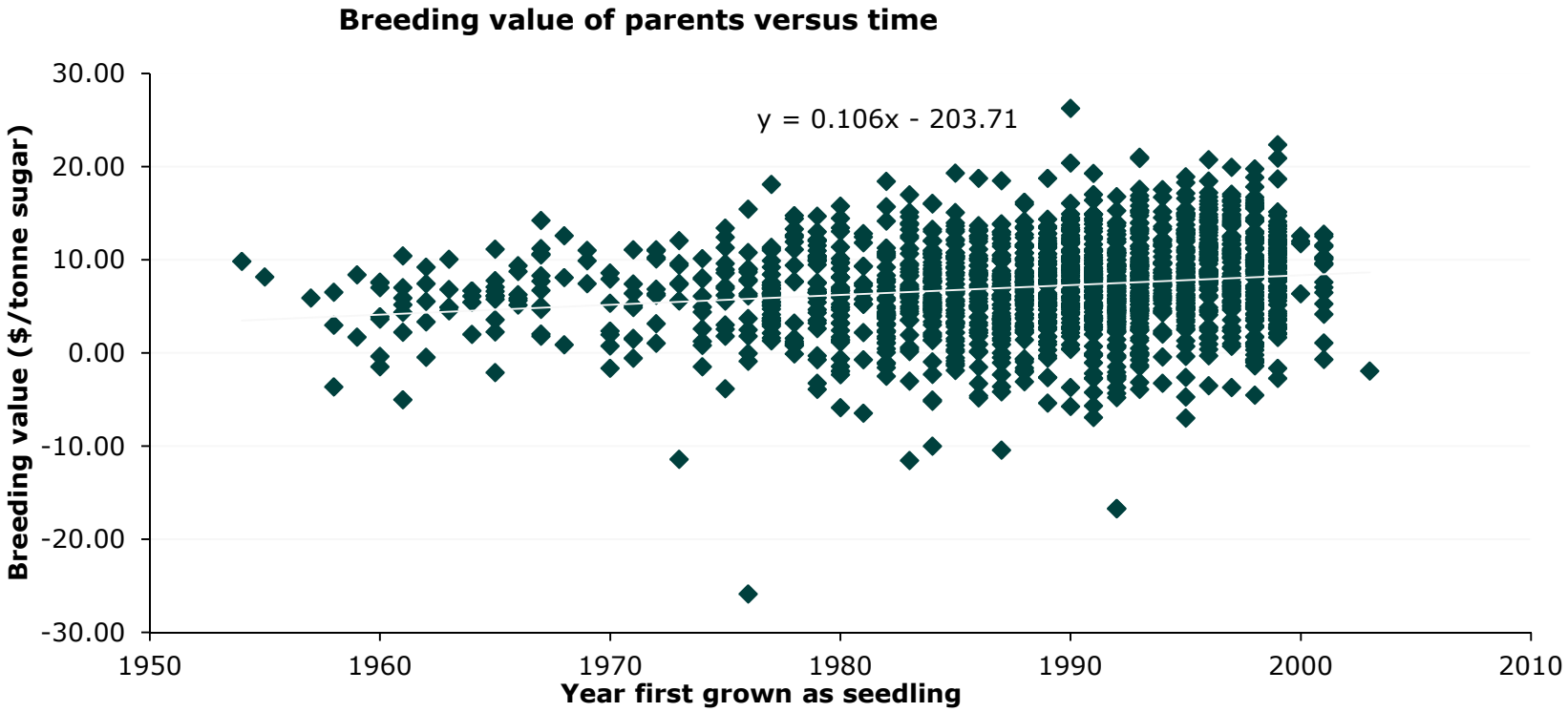
- Theory suggests parental improvement from conventional selection is slow/difficult where non-additive genetic variance is important (like sugarcane)
  - And empircal results also show this
  - Our modelling suggested a potential strong role for markers


Crossing - generate seedling populations
Clone selection - 7-10 years
Identification of elite clones
Release of cultivars

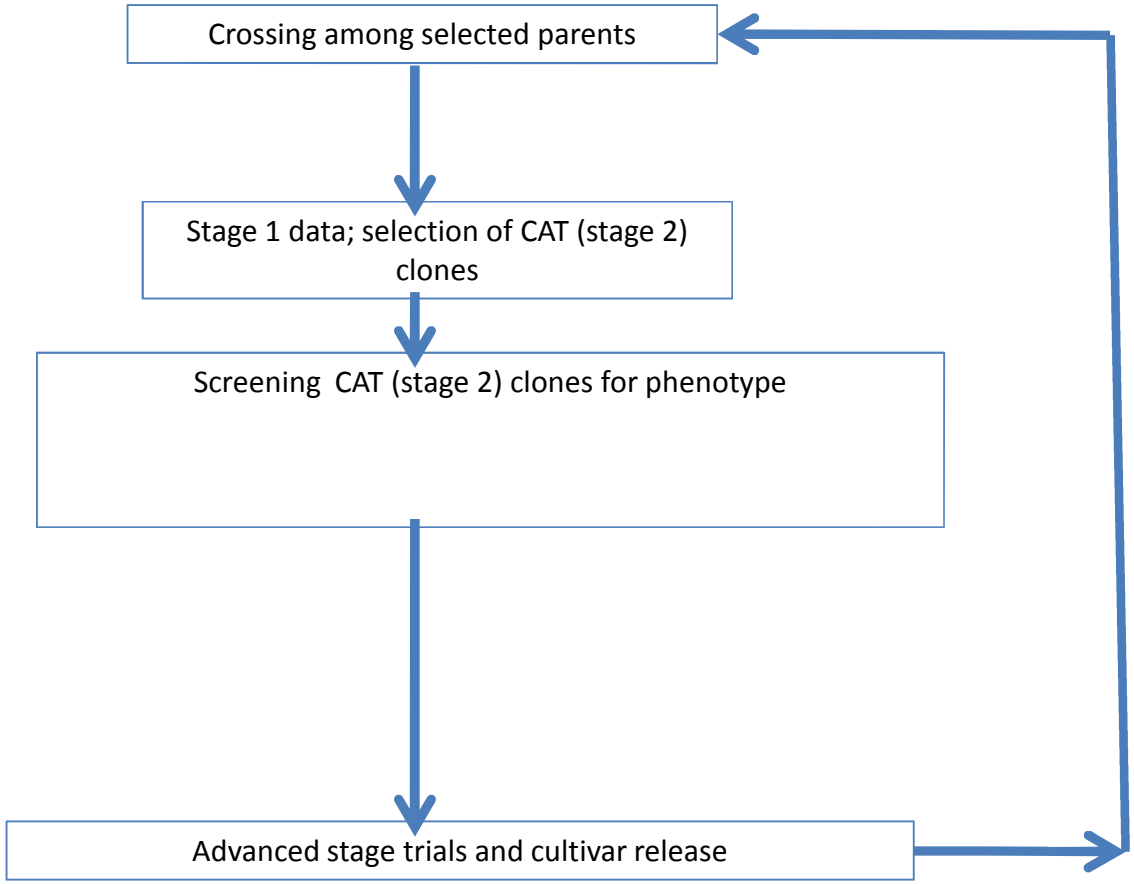
Top 6 varieties (by cane supply) Australia - 2013 season

Clone	Female year	Male year	Average age of parents
Q208	1969	1961	49
KQ228	1980	1974	37
Q183	1969	1956	52
Q200	1963	1966	49
Q232	1980	1972	38
MQ239	1959	1977	46

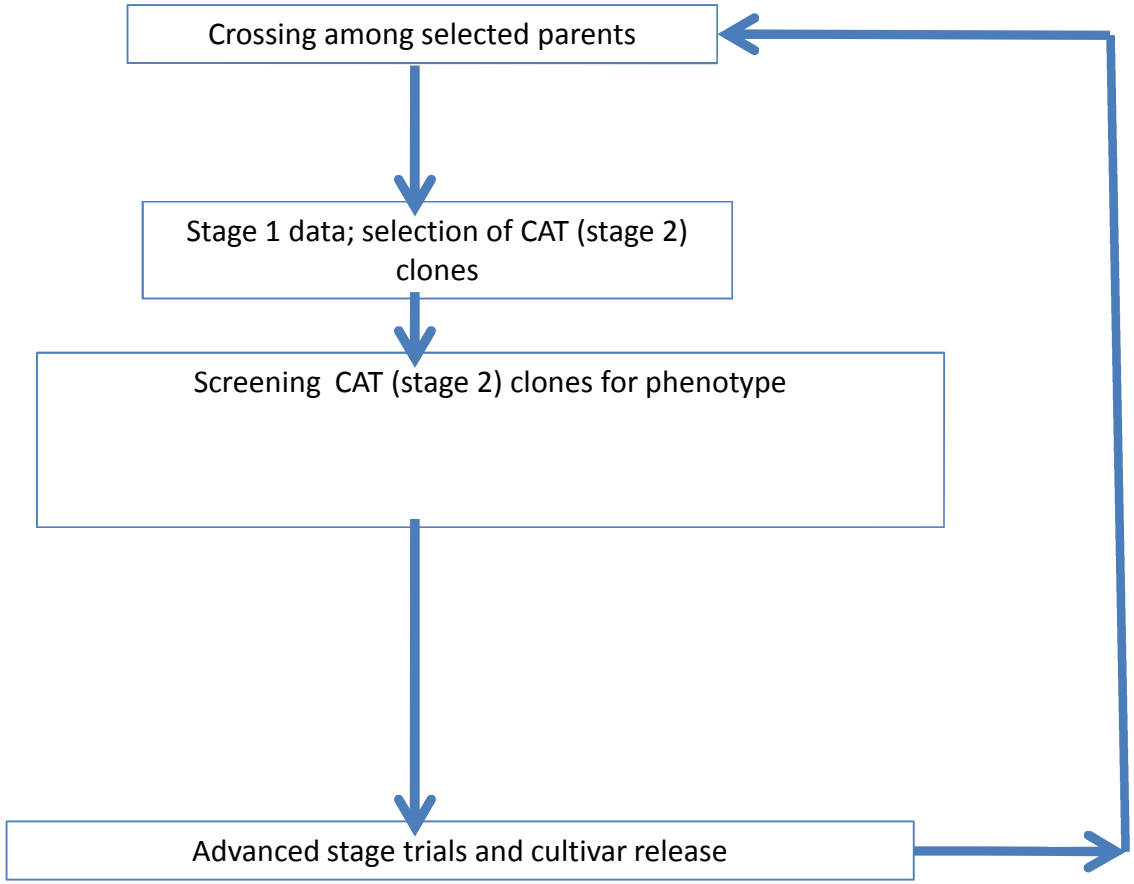
How fast is our BREEDING progress?



Current system



Current system

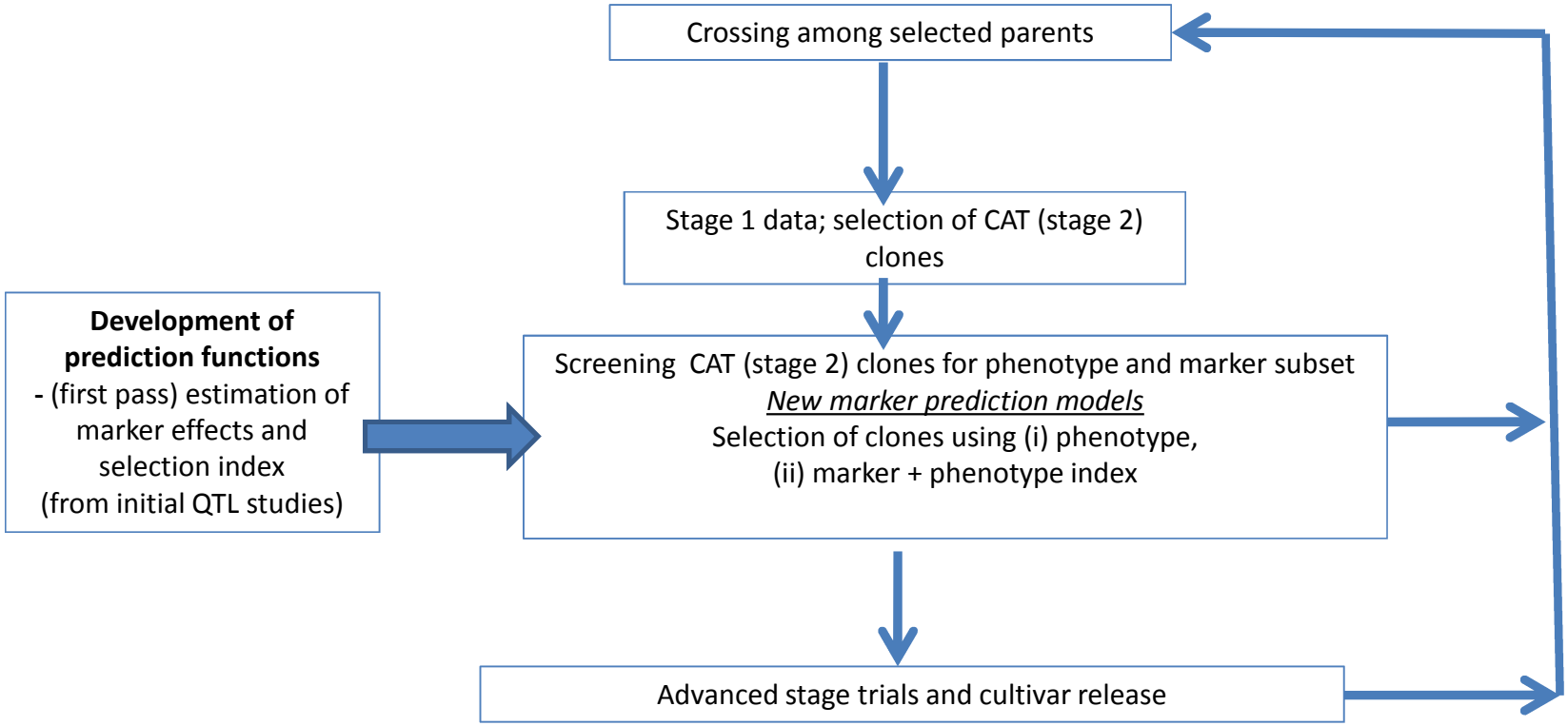


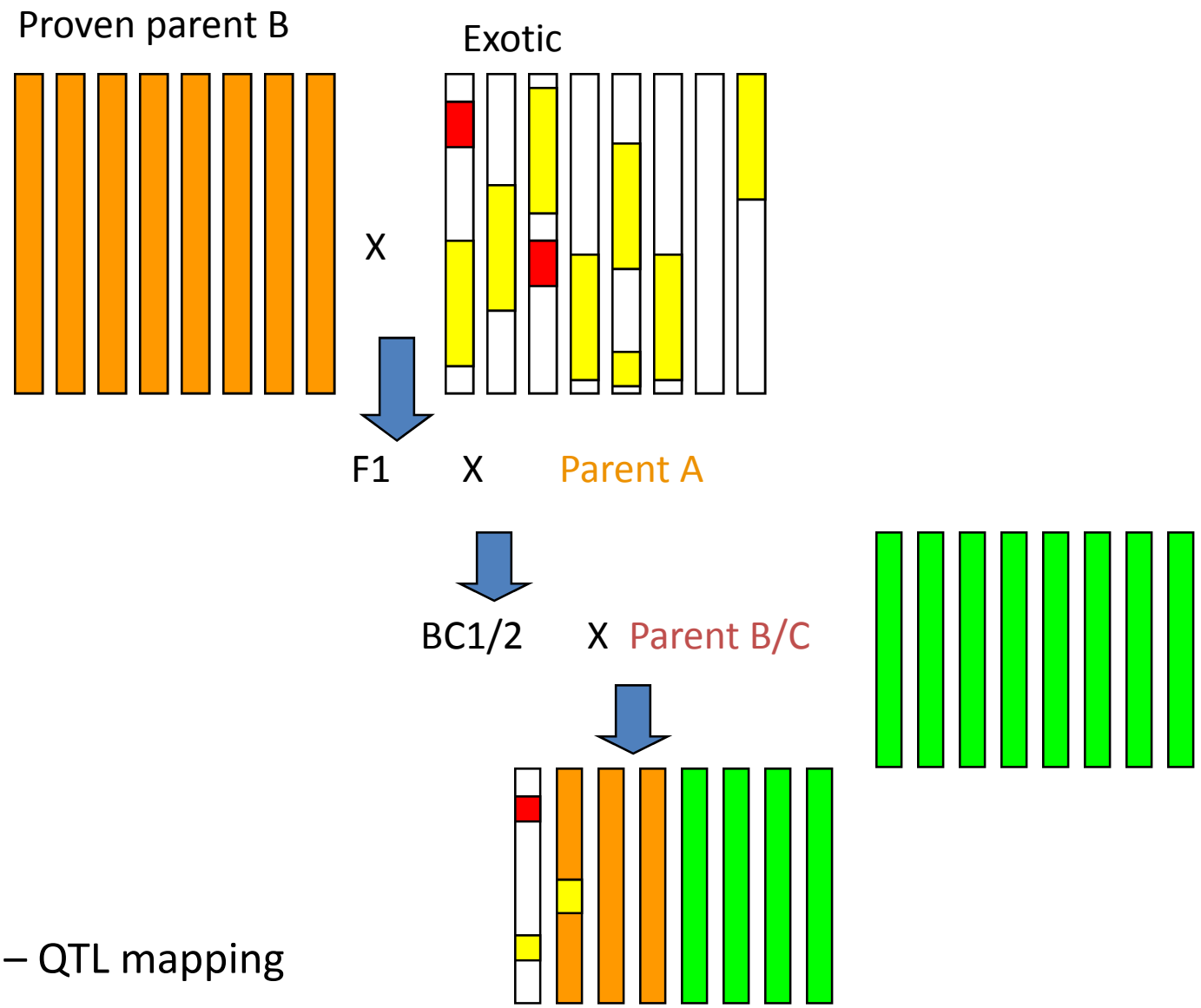
Problems:

1. **Low narrow sense heritability**
   - Phenotype of clones in trials poorly predicts their breeding values
   - Due to non additive variation + other effects
   - Therefore – poor accuracy (r) and small gains from selection

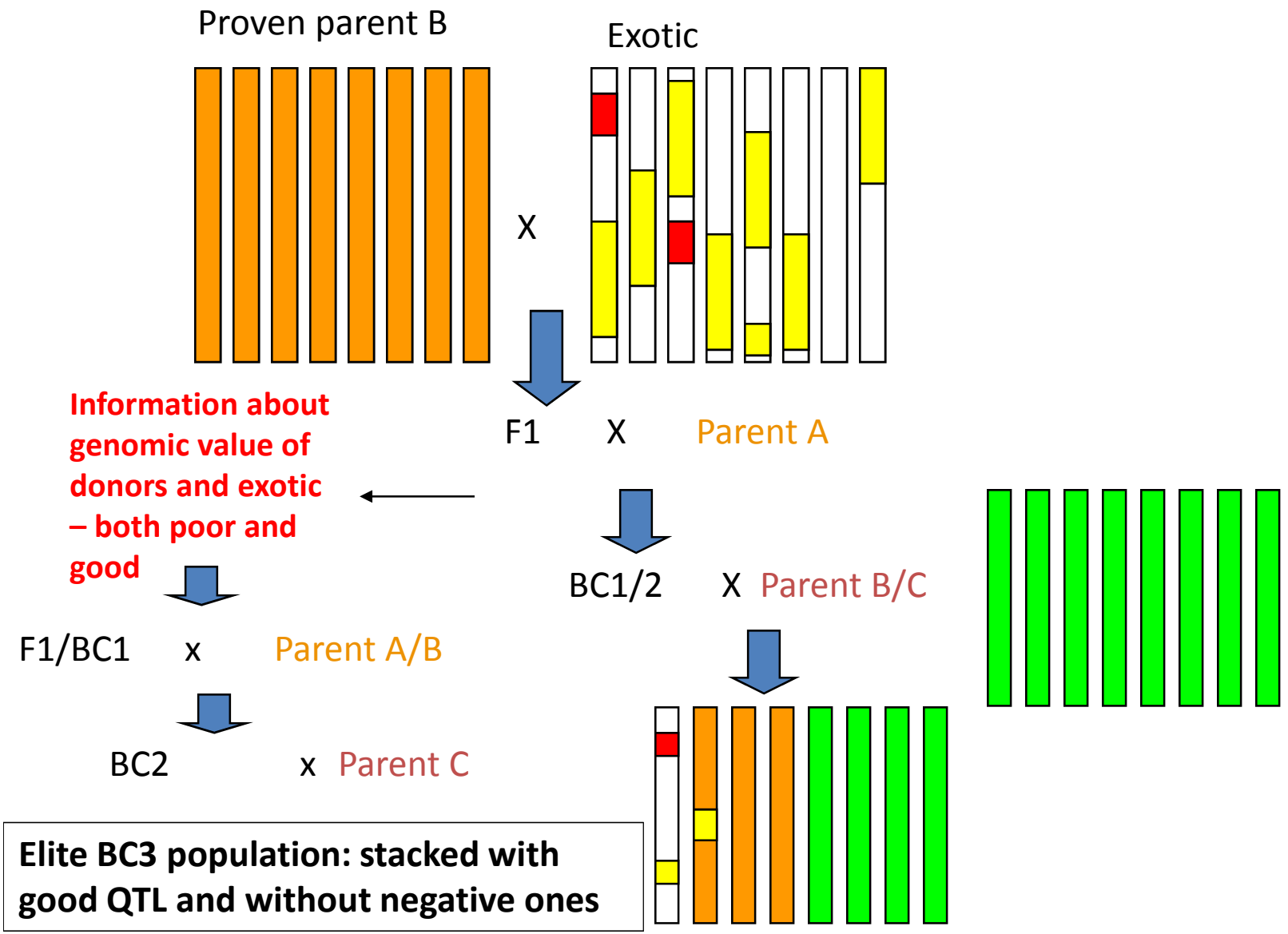
2. **Long generation intervals** generally 9 or more years cycle

Using marker/genomic based selection to (i) improve accuracy of predicting breeding value and (ii) speed up cycles





BC3 – QTL mapping


Proven parent B
Exotic
X
F1
X
Parent A
Information about genomic value of donors and exotic – both poor and good
BC1/2
X
Parent B/C
F1/BC1
x
Parent A/B
BC2
x
Parent C
Elite BC3 population: stacked with good QTL and without negative ones