# *Contribution of sugar cane wild relatives in the Mauritian sugar cane breeding programme*

**Santchurn D, Badaloo MGH, Dookun-Saumtally A, Zhou M, and Labuschagne MT**

**Mauritius Sugarcane Industry Research Institute**
**Mauritius Cane Industry Authority**





# Contribution of sugar cane wild relatives - Mauritius

## Motivation of study





Noble cane x Wild cane

↓

Noble cane F1 hybrid

↓

Noble cane Backcross 1(BC1) hybrid

↓

Backcross 2 (BC2) hybrid

**Nobilization: introgression breeding**

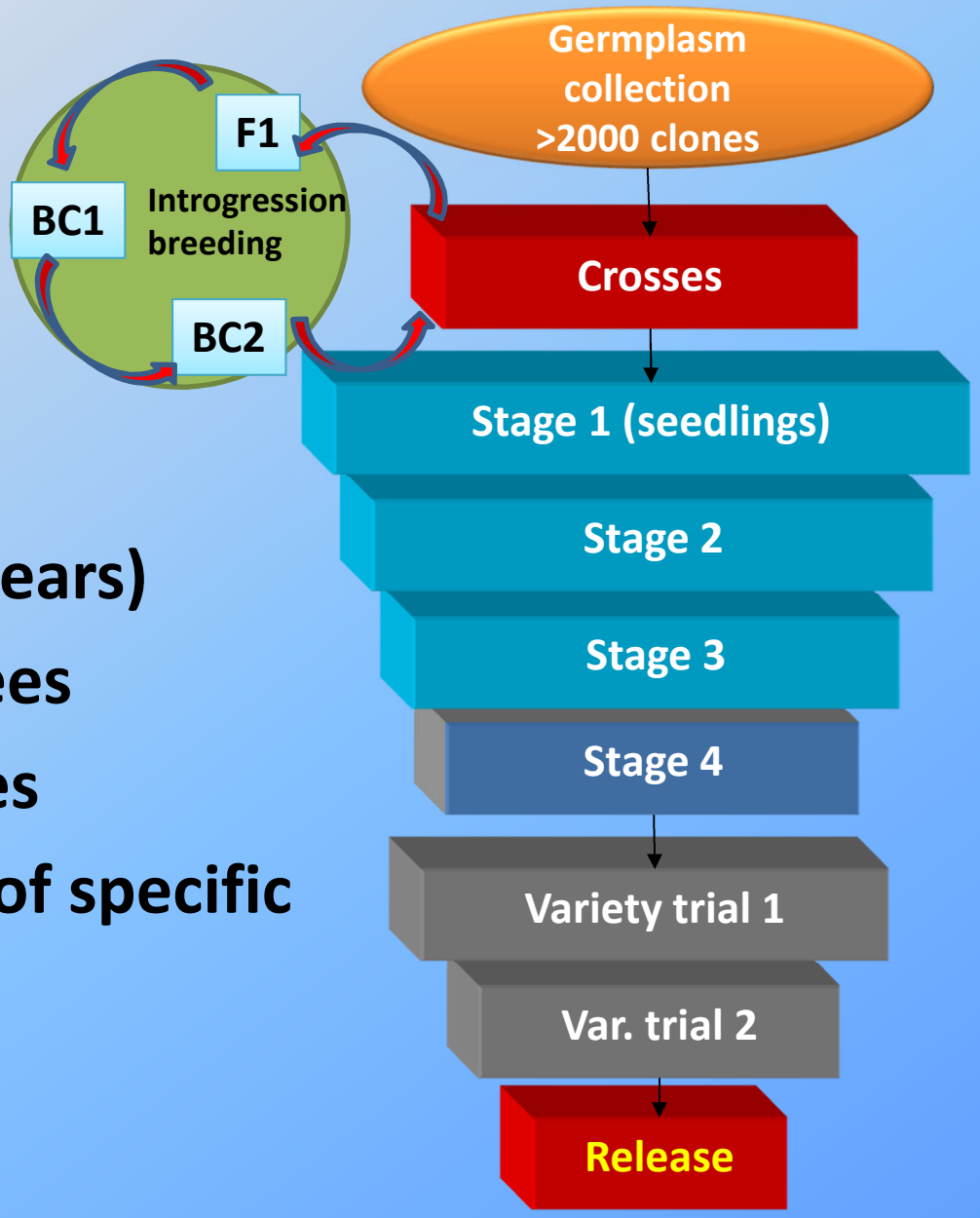
**Interspecific hybridization (IS)**

- Growing interest in high biomass canes
- High expectations: wild relatives
- Biodiversity - conservation and exploitation
- Introgression breeding – recent contributions lacking

# Contribution of sugar cane wild relatives - Mauritius

## Materials and method

- Literature on varieties
- MSIRI stored data (40 years)
- Construction of pedigrees
- Working out frequencies
- Retracing contribution of specific wild canes



# History of cultivated varieties in Mauritius

1737 — Sugar industry founded

1840 — Otaheite, Lousier

1891 — Breeding of sugar cane in Mauritius

1913 — Import of large no. of clones, incl. wonder canes; Tanna

**Noble canes era**

1931 — **Sugarcane Research Station**: 1st IS breeding

1932 — **M 134/32 1st IS hybrid created**

1950's — M 134/32: >90% of sugarcane land

1953 — **MSIRI created** Research strengthened

**Hybrids**



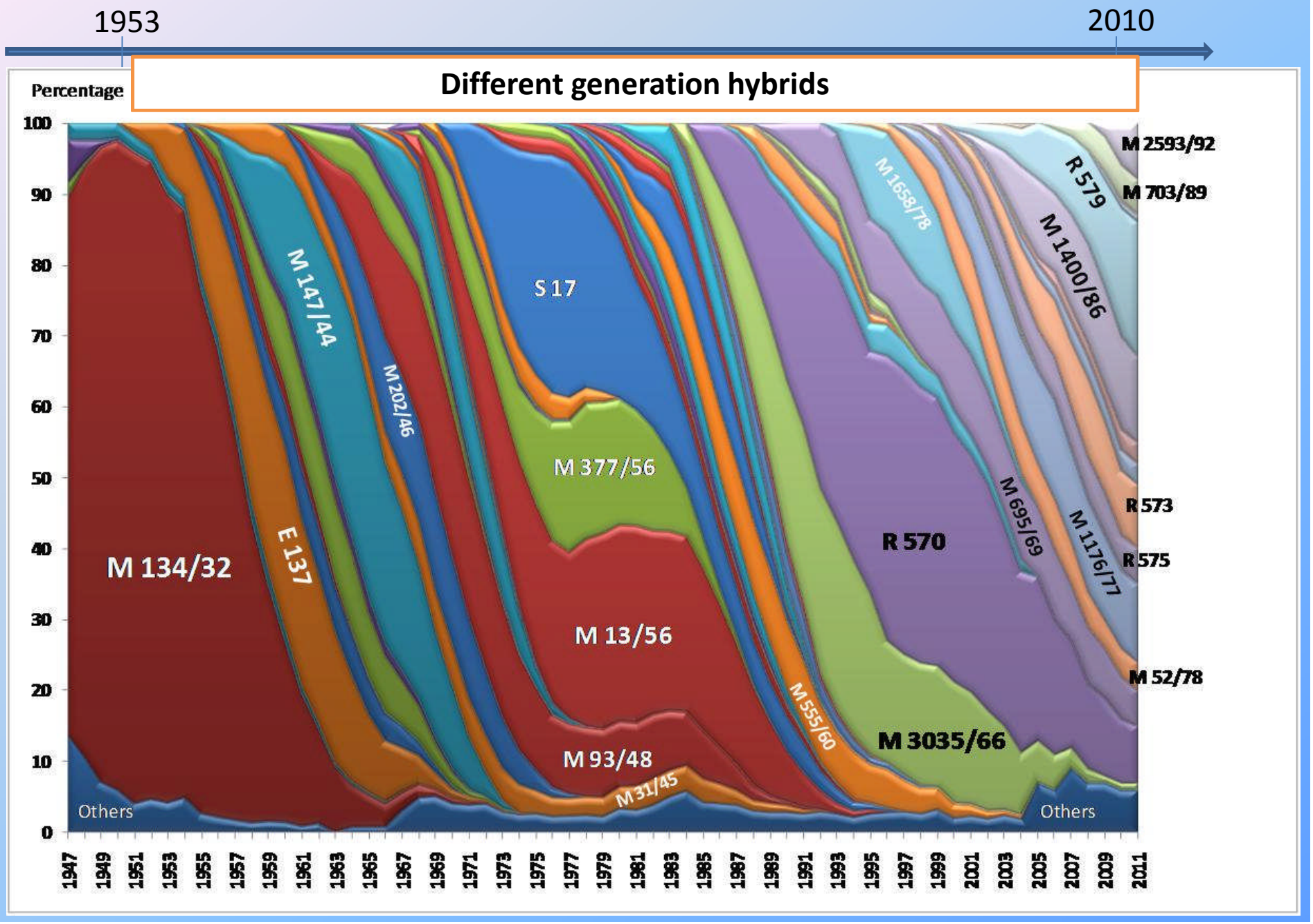
Noble cane



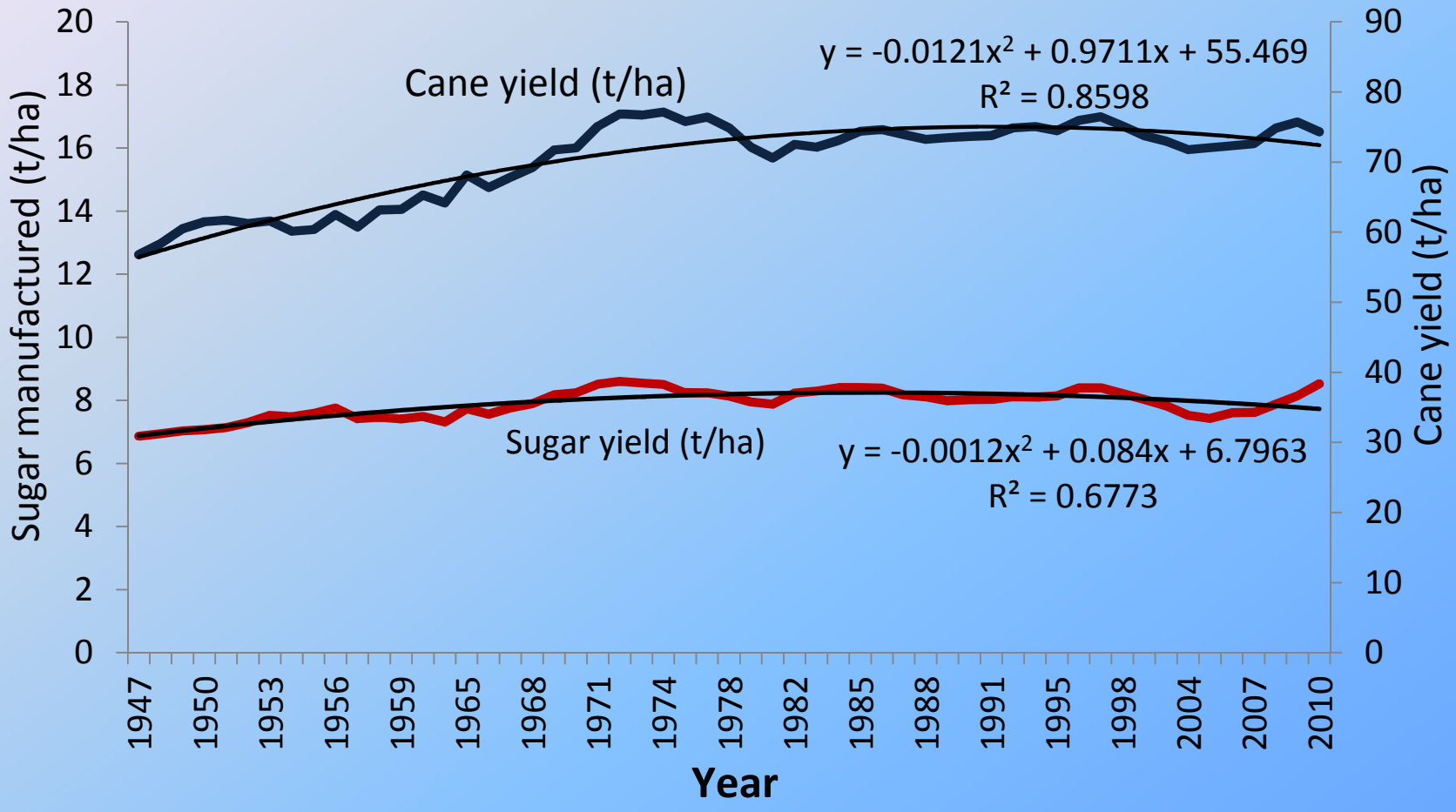




# History of cultivated varieties in Mauritius



# Progress in cane and sugar yield

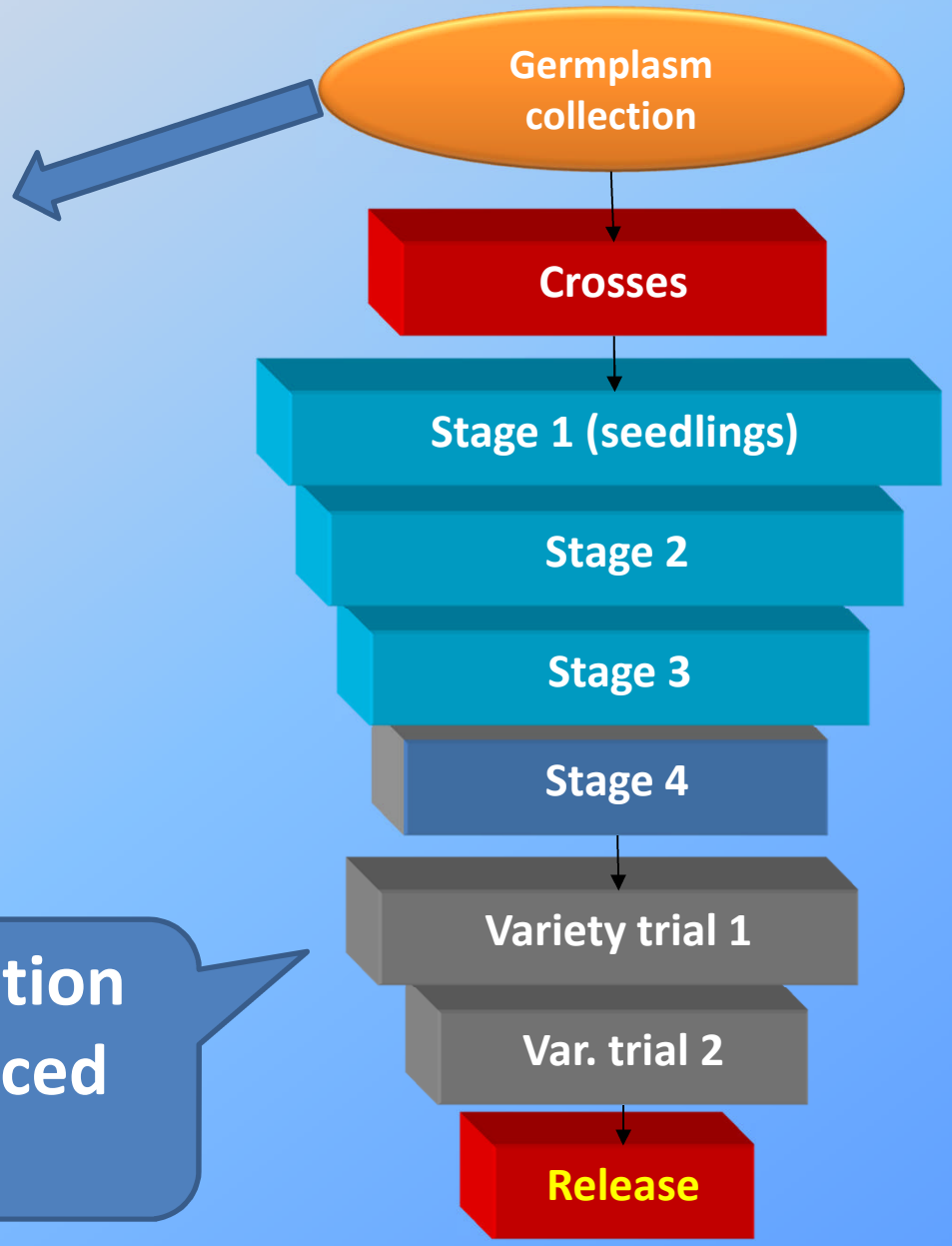



Linear increase:- cane yield: 250 kg $ha^{-1}$ $yr^{-1}$

sugar yield: 17 kg $ha^{-1}$ $yr^{-1}$

# Contribution of wild canes in last 40 years

| CATEGORY (as at 2010) | Total |
|---|---|
| Noble | 147 |
| Wild | 94 |
| Early generation hybrids | |
| F1 | 139 |
| BC1 | 129 |
| BC2 | 81 |
| BC3 | 54 |
| Commercial type | 1698 |
| Grand Total | 2342 |
| (Foreign accessions | 990) |

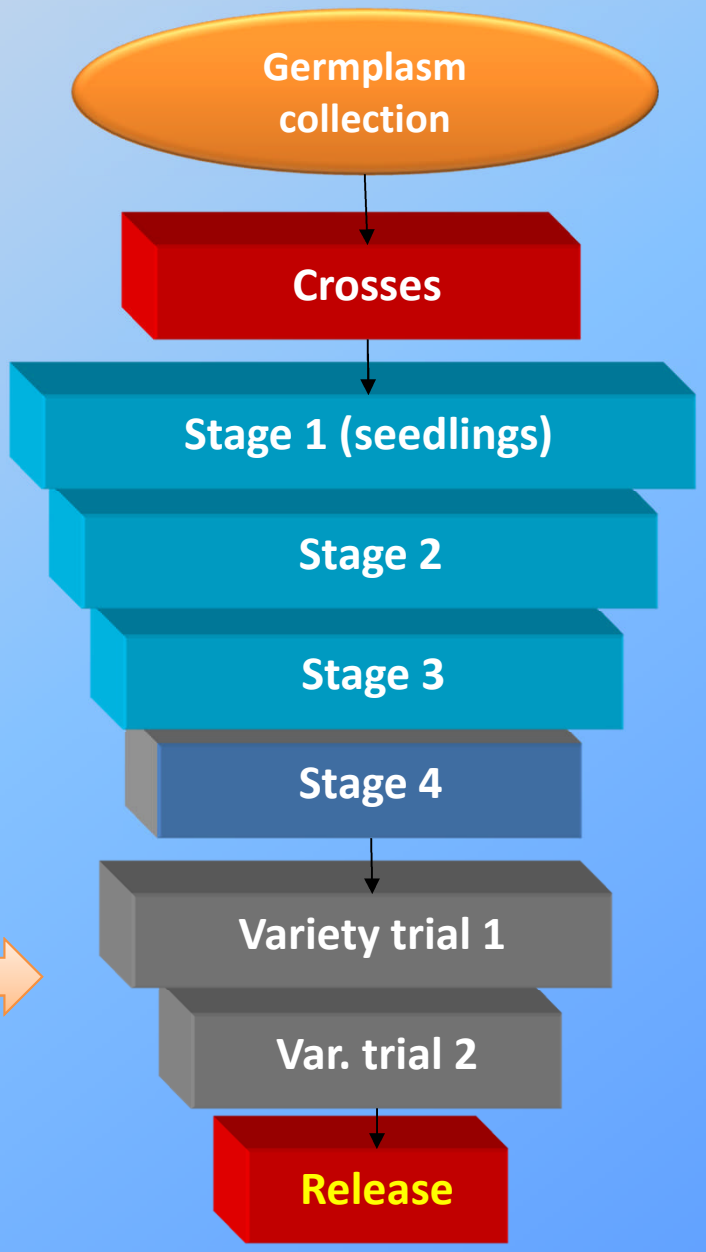



**Number of early generation hybrids reaching advanced selection stages?**

# Historical varieties

| CATEGORY | CROSS CODES | DETAILS | Total |
|---|---|---|---|
| **Noble** | **N** | Nobles | 102 |
| | **IN** | Intra-nobles | 45 |
| | | **Noble Total** | **147** |
| **Wild** | **S** | *Saccharum spontaneum* | 64 |
| | **Er** | *Erianthus spp.* | 12 |
| | **R** | *Saccharum robustum* | 9 |
| | **Sn** | *Saccharum sinense* | 6 |
| | **Se** | *Saccharum edule* | 1 |
| | **Vt** | *Vetivera sp.* | 1 |
| | **Sb** | *Saccharum barberi* | 1 |
| | | **Wild Total** | **94** |

| Year range | Category | Total | % to Total |
|---|---|---|---|
| 1970-79 | F1 | 4 | 1% |
| | BC1 | 6 | 2% |
| | BC2 | 12 | 4% |
| | BC3 | 39 | 12% |
| | Others | 270 | 82% |
| **1970-79 Total** | | **331** | **100%** |
| 1980-89 | BC1 | 19 | 5% |
| | BC2 | 18 | 5% |
| | BC3 | 12 | 3% |
| | Others | 335 | 87% |
| **1980-89 Total** | | **384** | **100%** |
| 1990-99 | BC1 | 5 | 1% |
| | BC2 | 10 | 2% |
| | BC3 | 31 | 6% |
| | Others | 502 | 92% |
| **1990-99 Total** | | **548** | **100%** |
| 2000-14 | F1 | 1 | 0.1% |
| | BC1 | 8 | 1% |
| | BC2 | 39 | 5% |
| | BC3 | 24 | 3% |
| | Others | 746 | 91% |
| **2000-09 Total** | | **817** | **100%** |
| **Grand Total** | | **2080** | |

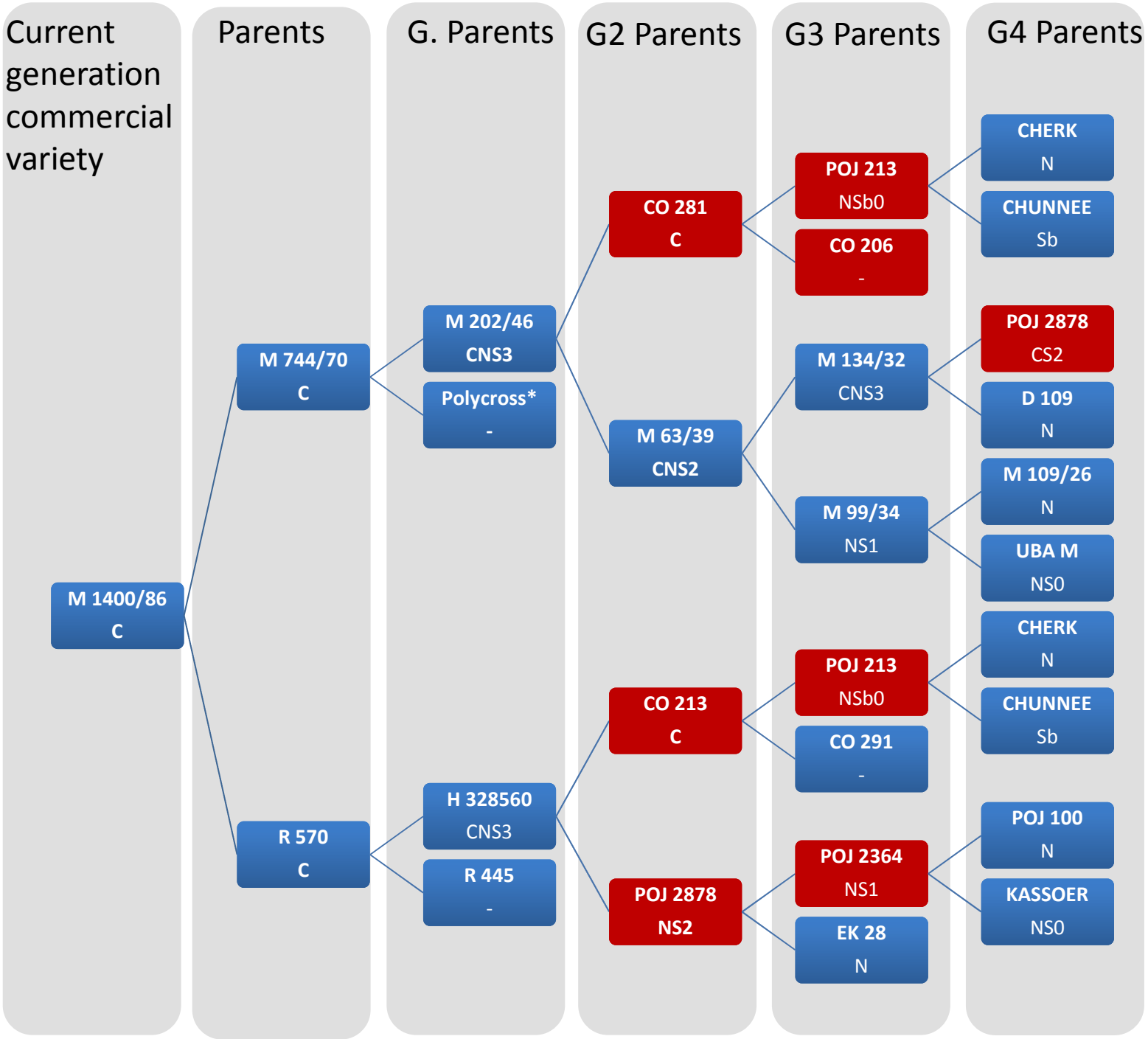


# Which specific wild clones were involved as parents?





- **Construction of Pedigrees**


Current generation commercial variety
Parents
G. Parents
G2 Parents
G3 Parents
G4 Parents
M 1400/86
C
M 744/70
C
R 570
C
M 202/46
CNS3
Polycross*
-
H 328560
CNS3
R 445
-
CO 281
C
M 63/39
CNS2
CO 213
C
POJ 2878
NS2
POJ 213
NSb0
CO 206
-
M 134/32
CNS3
M 99/34
NS1
POJ 213
NSb0
CO 291
-
POJ 2364
NS1
EK 28
N
CHERK
N
CHUNNEE
Sb
POJ 2878
CS2
D 109
N
M 109/26
N
UBA M
NS0
CHERK
N
CHUNNEE
Sb
POJ 100
N
KASSOER
NS0

# Of 2080 progenies reaching final phase trials (1970 – 2014)

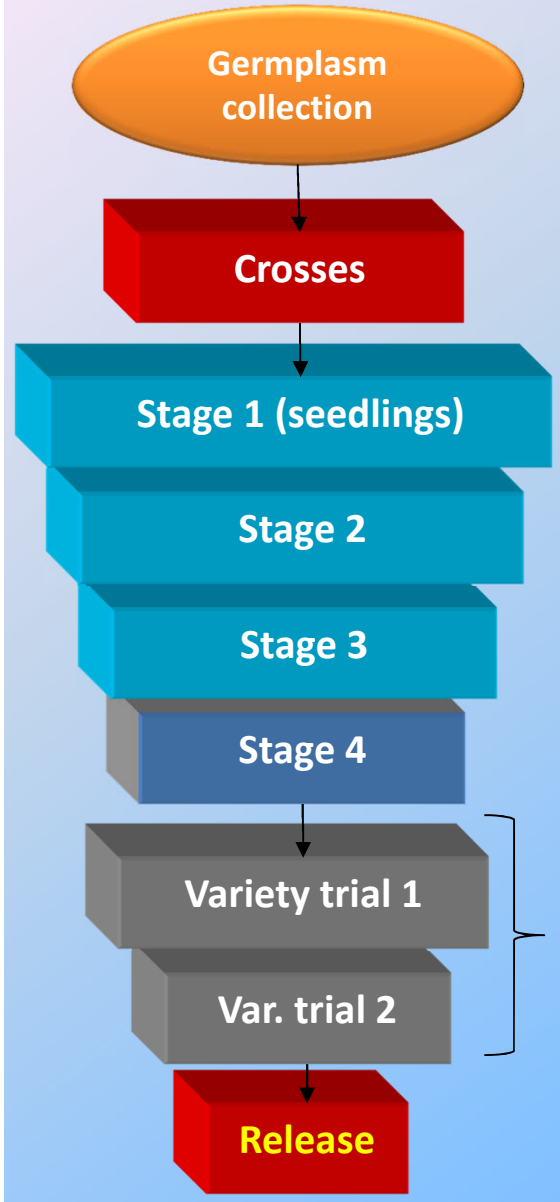
## Frequency of wild and early nobilized clones among the last 3 generation of parents

| Wild canes | Code | Freq. | F1 clones | Code | Freq. | BC1 clones | Code | Freq. | BC2 clones | Code | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NG57208** | R | 58 | **POJ213** | NSb0 | 109 | **M99/34** | NS1 | 263 | **POJ2878** | NS2 | 591 |
| **MAUR1937** | S | 13 | **UBA Marot** | NS0 | 85 | **POJ2364** | NS1 | 105 | **M63/39** | CNS2 | 309 |
| **IS76216** | S | 9 | **M5/75** | NR0 | 60 | **M196/31** | CNS1 | 80 | **M213/40** | CS2 | 200 |
| **KLETAK** | S | 5 | **M614/63** | NR0 | 19 | **M2077/78** | NR1 | 58 | **M47/38** | CNS2 | 80 |
| **CHUNNEE** | Sb | 5 | **M1000/86** | NS0 | 8 | **F153** | CNS1 | 43 | **M383/41** | CNS2 | 37 |
| **IK7610** | S | 3 | **KASSOER** | NS0 | 5 | **M168/32** | CNS1 | 35 | **F172** | CNS2 | 33 |
| **MANDALAY** | S | 2 | **M1316/64** | CR0 | 4 | **F148** | CNS1 | 20 | **M377/41** | CNS2 | 31 |
| **MOLOKAI** | R | 2 | **M386/84** | NS0 | 3 | **M783/67** | CNR1 | 18 | **M351/57** | CS2 | 20 |
| **MAUR** | S | 1 | **M1018/86** | CS0 | 2 | **M241/59** | CNS1 | 11 | **M881/80** | CNS2 | 12 |
| **DJATIRO** | S | 1 | **M398/84** | NS0 | 2 | **H507209** | CNS1 | 4 | **M423/41** | CS2 | 10 |
| **IK7647** | Er | 1 | **M679/63** | NR0 | 2 | **M422/91** | CNS1 | 4 | **M245/76** | CNS2 | 9 |
| **SROB** | R | 1 | **M376/84** | NS0 | 2 | **M809/74** | CR1 | 3 | **M84/35** | CNS2 | 7 |

*Code: N = noble, R = S. robustum; S = S. spontaneum; Sb = S. barberi, Er = Erianthus*

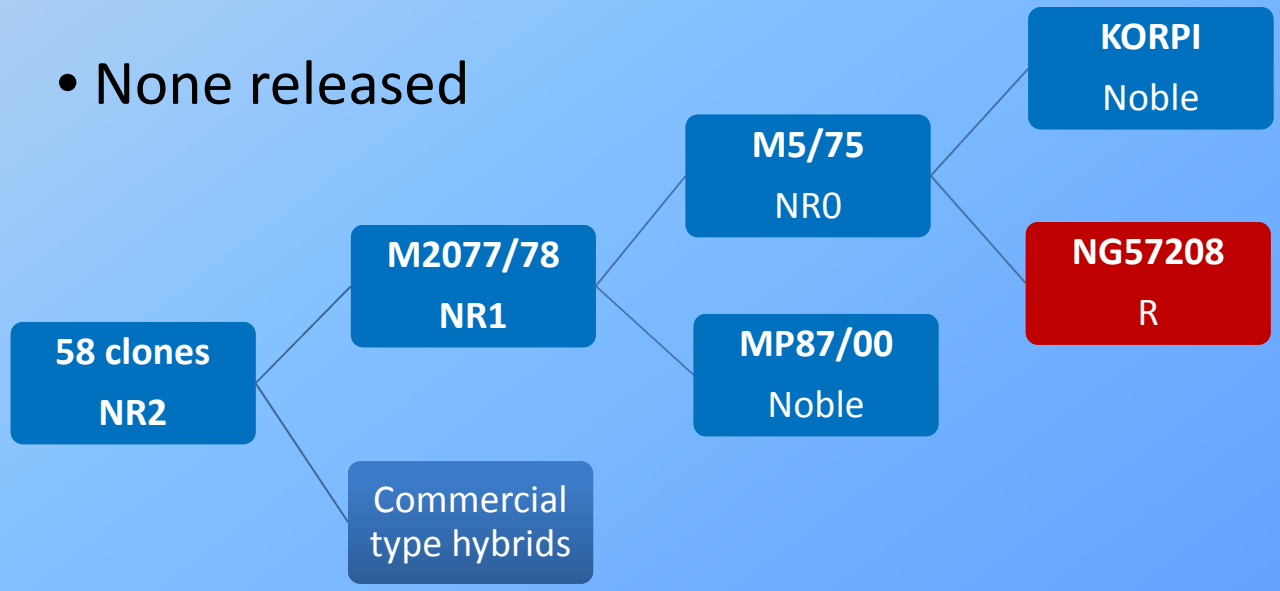
# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones



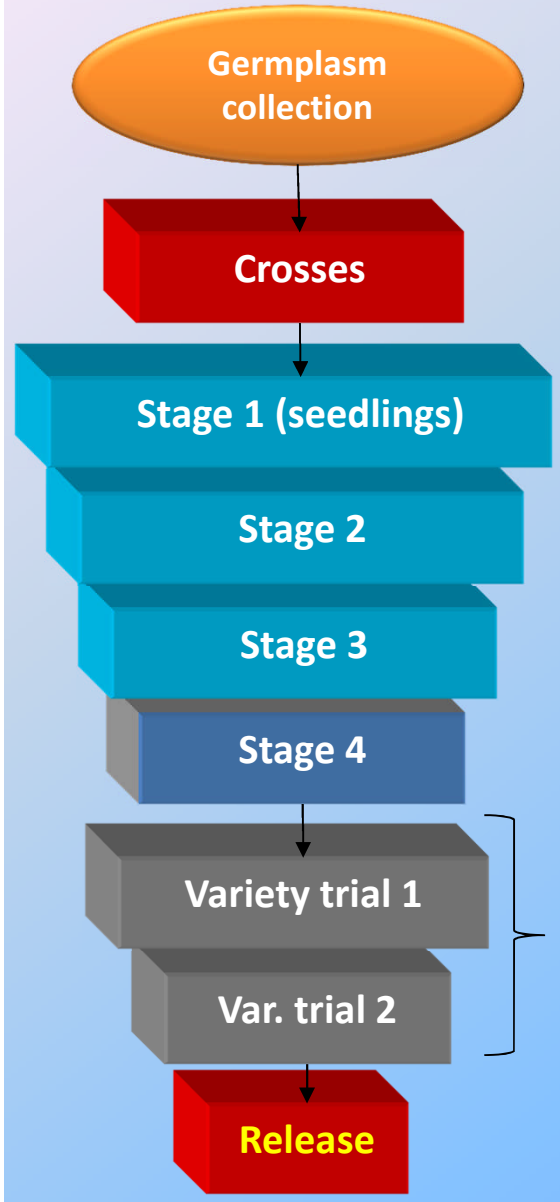

***Saccharum robustum:*** **NG 57208**

- Progenitor of M 5/75 (F1) and M 2077/78 (BC1)
- 58 BC2 clones reached final variety trials in last 2 decades
- A few still being evaluated
- None released



# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones

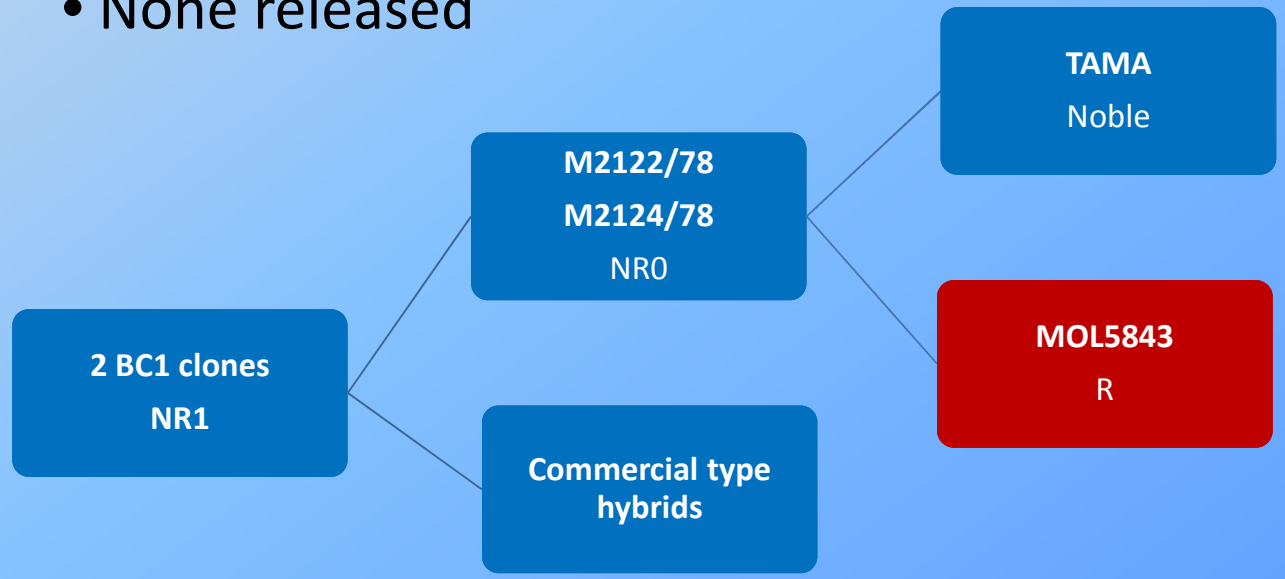



***Saccharum robustum:*** **Molokai 5843**

- Progenitor of M 2124/70 and M 2122/78 (F1)
- Two BC1 clones (M 467/84 and M 816/86)

reached final variety trials in last 2 decades

- None released

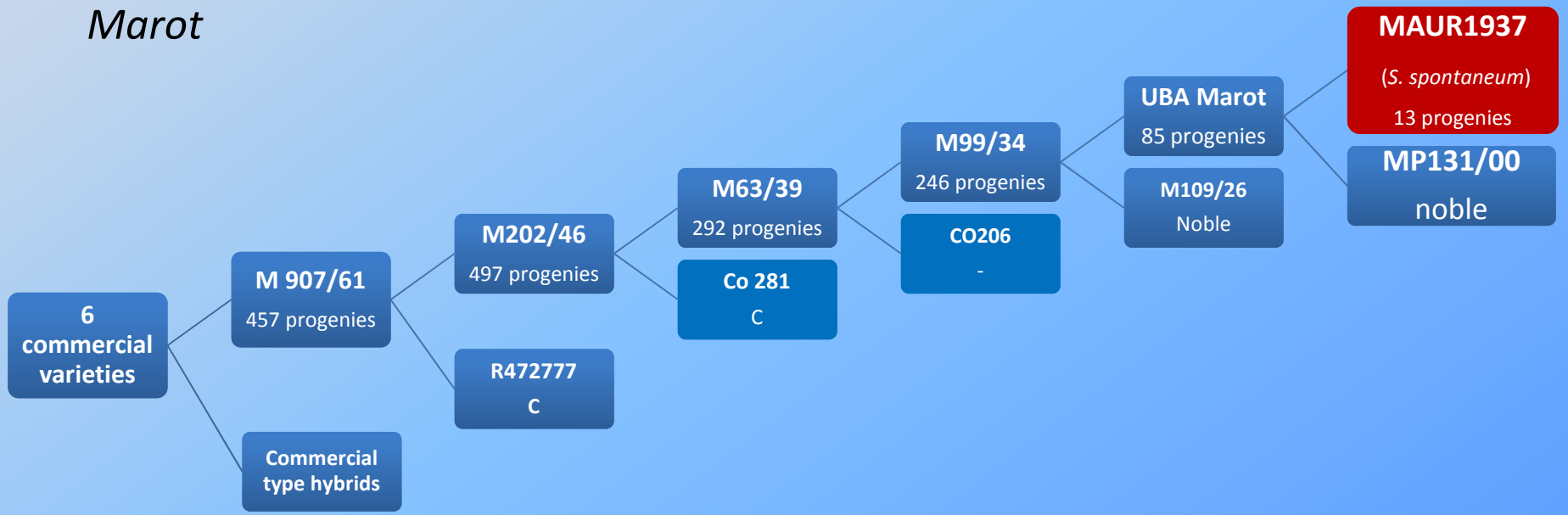


# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones

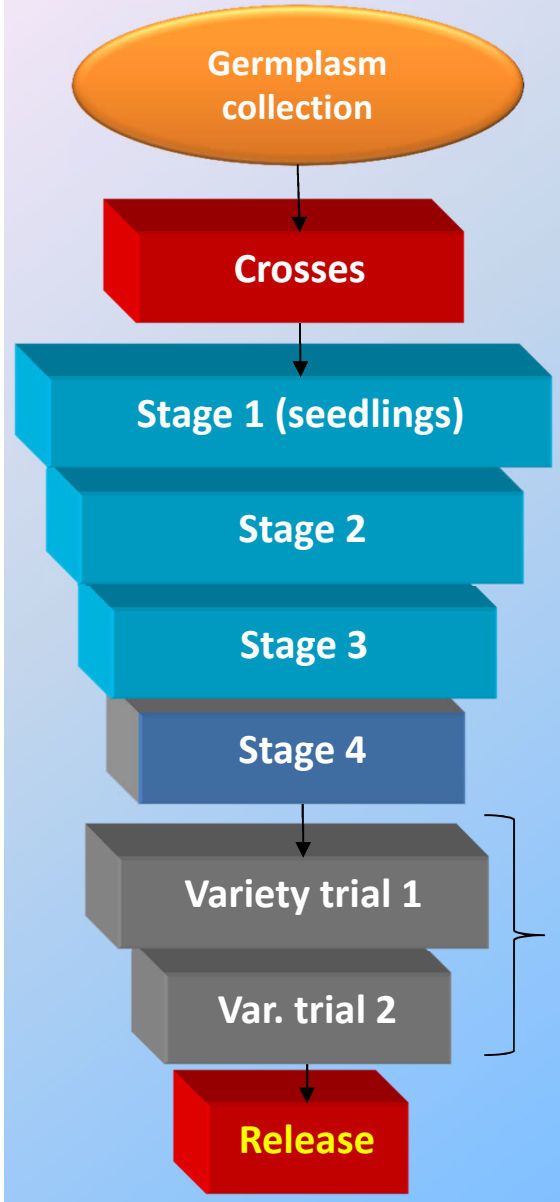
## *Saccharum spontaneum:* MAUR 1937

- Progenitor of *UBA Marot* (F1), M 99/34 (BC1) and M 63/39 (BC2)
- The early hybrids highly successful in producing elite varieties reaching final phase trials across decades
- MAUR 1937 involved in the production of **14 commercial varieties** through *UBA Marot*



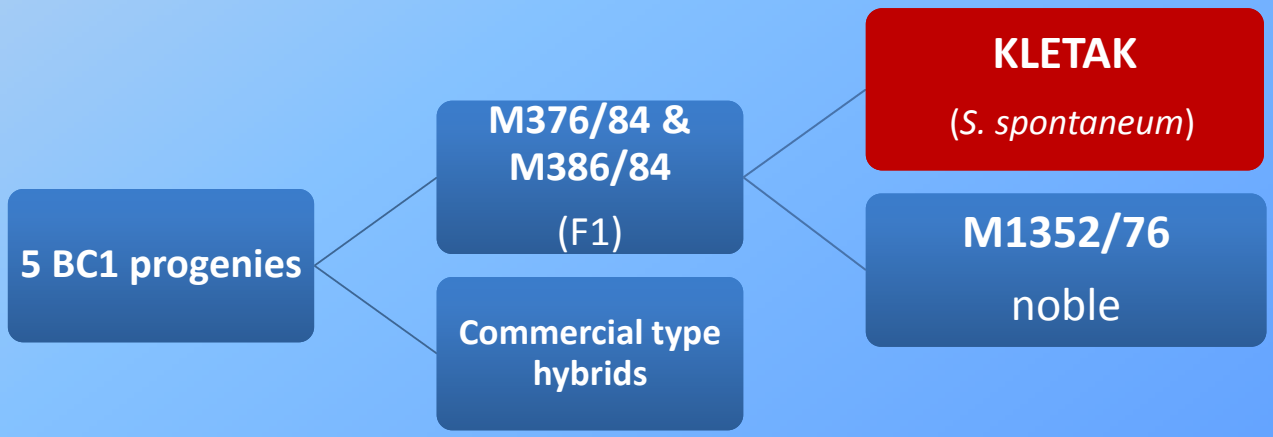
# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones



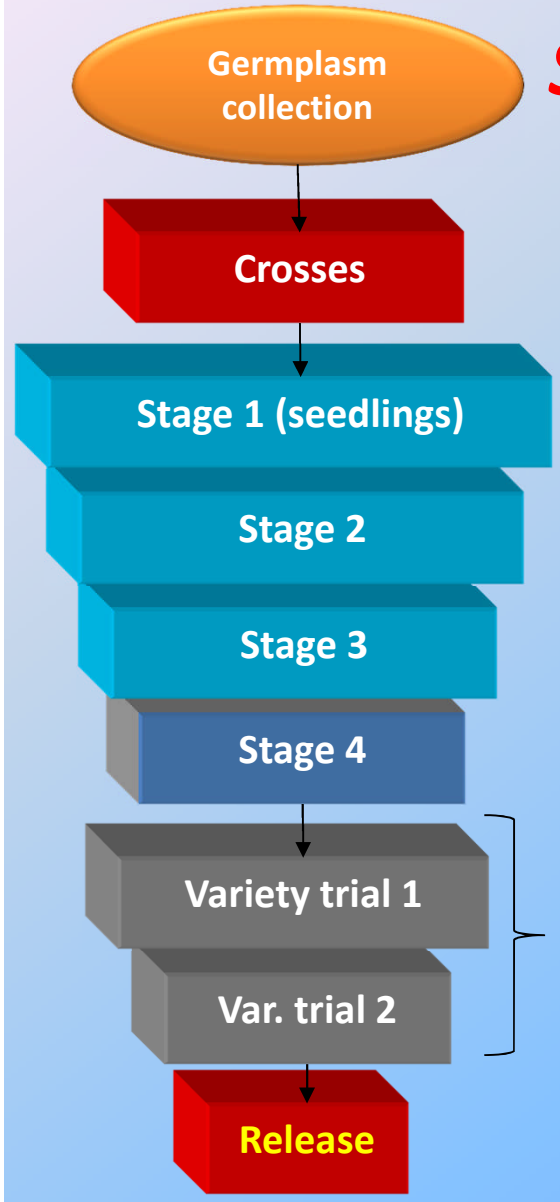

## *Saccharum spontaneum:* Kletak

- Progenitor of M 376/84 and M 386/84 (F1)
- Five BC1 progenies evaluated in final phase trials in 2009
- High fibre clones
- Two progenies seem to have high biomass yield



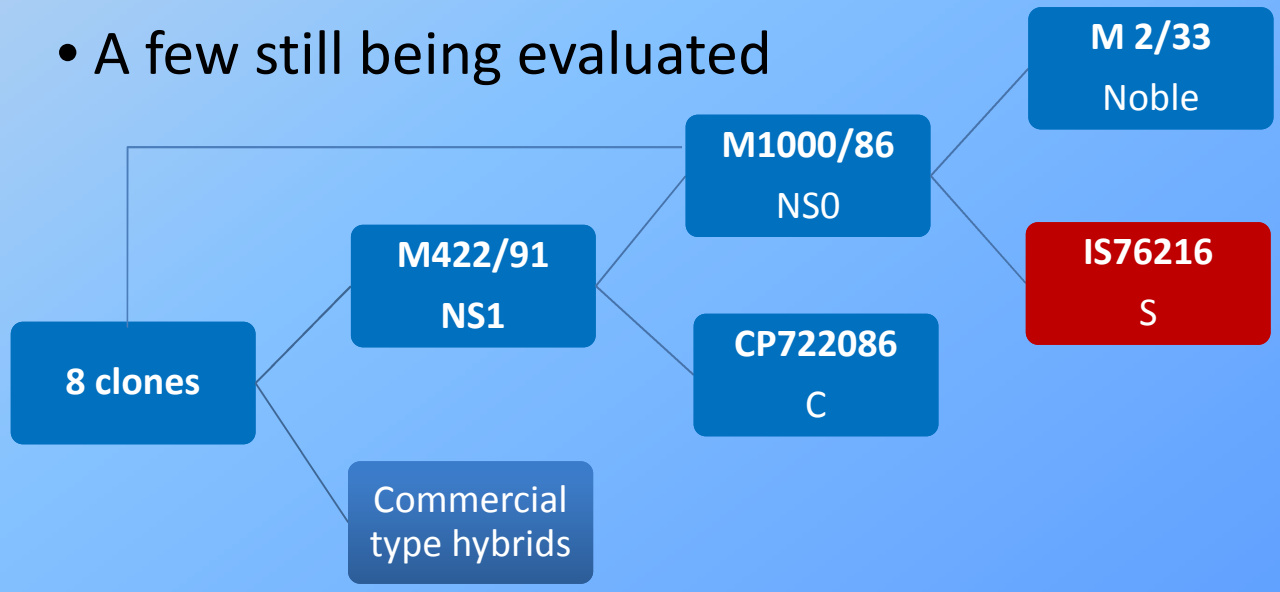
# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones



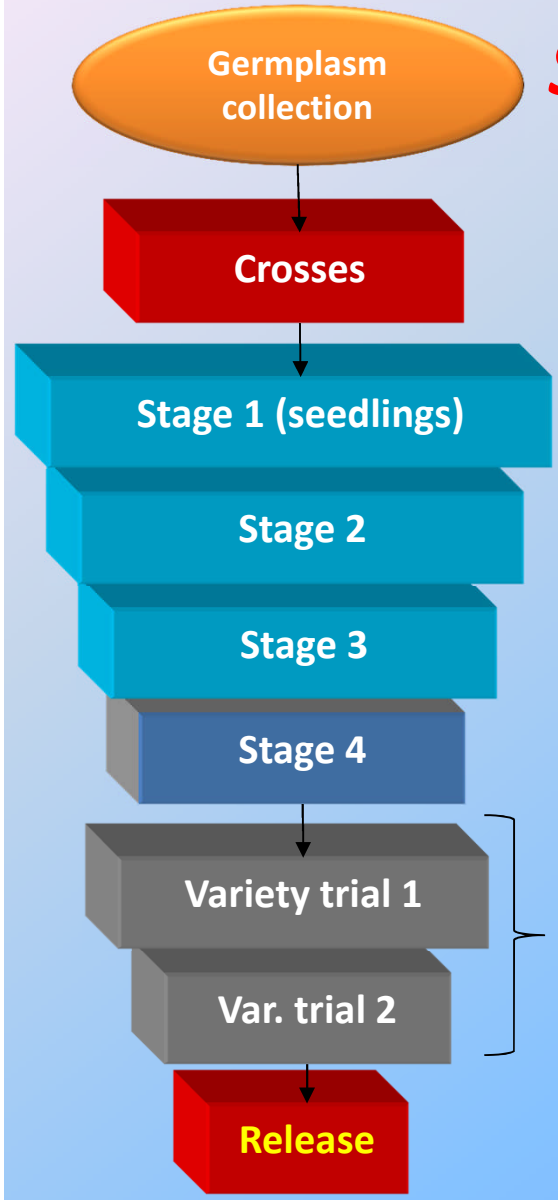

***Saccharum spontaneum:*** **IS 76216**

- Progenitor of M 1000/86 (F1) and M 422/91 (BC1)
- 8 clones that reached variety trial stages in the last decade
- A few still being evaluated



# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones

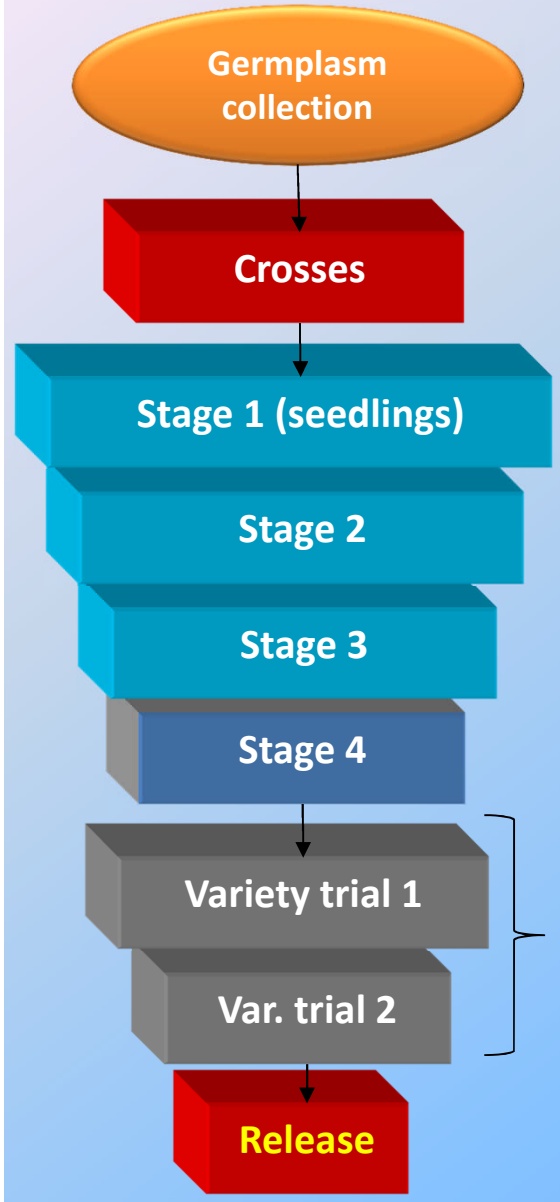



***Saccharum spontaneum:*** **Mandalay and IK 7610**

- Their contributions very recent
- **Mandalay** produced two BC2 clones that entered the final phase trials in 2008 and 2011.
- **IK 7610** produced 3 BC1 clones that entered the variety trials in 2014.
- Still being evaluated

# Of 2080 progenies reaching final phase trials (1970 – 2014)

## Contribution of specific wild clones




***Erianthus sp:*** **IK 7647**

- Several crosses attempted with different *Erianthus sp.* in late 1990s
- Progenies obtained with **IK 7647**
- Progeny M 1156/00 being evaluated for biomass yield
- **Molecular analyses confirmed that the offsprings were selfings of the wild parent**

# Conclusions

- Study highly informative on the breeding values of certain parents
- In the recent past, ~10% of progenies evaluated at variety trial stage were early generation hybrids
- Few of them (13% since 1970) released in the past for industrial exploitation

| CULTIVAR | CATEGORY | Year released |
|---|---|---|
| M 351/57 | BC2 | 1970 |
| M 438/59 | BC3 | 1971 |
| M 555/60 | BC3 | 1976 |
| M 376/64 | BC3 | 1977 |
| M 126/63 | BC3 | 1983 |
| M 96/82 | BC2 | 1998 |
| M 1954/91 | BC2 | 2013* |

# Conclusion

- High prevalence of wonder canes: POJ 2878, POJ 2725, CO 421, CO 312, CO 281 among the ancestors in Mauritius
- Wild canes:
  - *S. spontaneum* – MAUR 1937, Kletak, IS 76216, IK 7610, Mandalay
  - *S. robustum* – NG 57208, Molokai 5843
  - *Erianthus sp.* – IK 7647
- Their achievements closely related to creation of specific early generation hybrids, like M 2077/78, *UBA Marot*, M 376/84, M 422/91.
- The early generation progenies attaining final selection stages represent potential candidates for high biomass subject to their fibre content. Evaluation using LMM contemplated.
- **MSIRI interspecific programme is producing elite early generation hybrids derived from wild canes**

# Acknowledgement


- Personnel of MSIRI involved in crop improvement programme
- Dr. S. Saumtally, Director of MSIRI
- Mauritius Cane Industry Authority


**Thank you**