Seed Production Strategies and Progeny Selection in Greater Yam Breeding

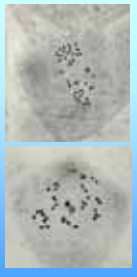
K. Abraham, M. T. Sreekumari and M. N. Sheela
Central Tuber Crops Research Institute
Trivandrum, India

Greater yam – a food crop of great potential

- Its yields are high
- Tuber storability is very long
- Tremendous variation in tuber shapes & chemotypes
- Value addition remains unexplored
- Breeding potential remains untapped

Basic information for breeding

- Dioecy imposes synchronous flowering of males and females for breeding
- Cultivars are polyploid races: 2n= 40, 60, 80
- 2n = 40 types are more frequent, fertile and mostly males



Bottleneck & Solution

- **Bottle neck**
- Fertile female cultivars rare
- Erratic in flowering
- **Alternative**
- Female clones developed from true seeds
- They are floriferous and more regular flowering
- **It is an outcome of seed production & progeny selection**

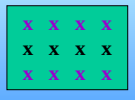
Seed production

- Hand pollination
  - Pencil method
- Natural pollination
  - Mediated by thrips
- Directed natural pollination
  - Using selected males and females
- Non- directed natural pollination
  - Open pollination of non-selected parents

Hand pollination

Directed natural pollination

- Directed between particular male and female parents
- One male- one female combinations grown in plots
- 3 rows of 4 plants each
- Middle row male; outer rows female
- Vines trailed on common stake



Directed natural pollination

- Requirements
  - Males and females flowering together
  - Large number of males and females
  - Fertility of parents
  - Thrips to mediate pollination
- Advantages
  - Less laborious
  - Large number of seeds produced
  - Large number of recombinants

Necessity of outbreeding

- Results of extensive pollination studies of related and unrelated parents showed:
- Inbreeding depression for seed germination
- But fruit set and seed set not affected
- Seeds non-germinable in majority of the crosses of related parents
  - Germinability: 0.5 – 10.4 %
- Seed germination in all crosses of unrelated parents
  - Germinability: 22.4 – 60.8 %

Seedling tubers

- Seedlings – low vigour & low yields
- Seedling tuber shapes highly variable: cylindrical, round to oval and irregular

Progeny selection –tuber shape

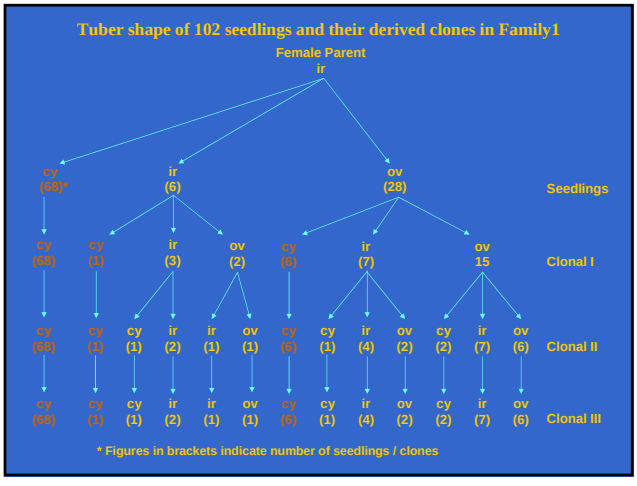
- At seedling harvest: selection by tuber shape
- Cylindrical tubers are rejected from seedlings
- Oval and irregular tubers are carried over to clonal- I generation wherein cylindrical tubers are again rejected
- It is repeated in clonal II generation

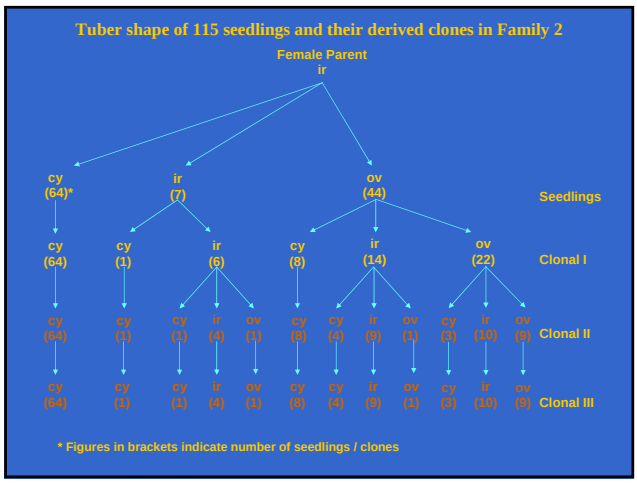
Progeny selection – tuber flesh traits

- Clonal I harvest - Graininess & browning of cut tuber examined
- Clonal II harvest – mean plant yields and cooking quality
- Clonal III onwards – quality testing and comparative yield assessment in trials

In the sexual progeny…..

- Cylindrical tuber shape remains stable from seedling generation
- Oval and irregular tubers of seedlings change shape in initial clonal generations





In the study of two families

- About 75 % of oval tubered seedlings changed tuber shape
- About 47 % of irregular tubered seedlings changed tuber shape
- End result in stabilized clonal generation:
  - Oval tubers reduced by 1/3 to ¼
  - Cylindrical and irregular tubers increased by 2 -3 times
- After clonal II harvest, number of clones reduced to about 25 % by rejection of cylindrical tubers

In the sexual progeny….

- Tuber yield of seedlings have no strong correlation with clonal tuber yields
- Tuber yield & tuber shape stabilize in clonal II generation

  And hence…
- Management of sexual progeny up to clonal II generation is laborious
- And we need to speed up breeding by using markers for early selection of seedlings – great savings of time, effort, land, money etc.

Conclusions

- Seed production is possible in greater yam by natural pollination which can be directed between specific clones
- There is inbreeding depression for seed germination
- Oval and irregular tubers in many cases, recorded change of shape through seedling to clonal generations, with the result that:
  - Oval tubers reduced
  - Cylindrical & irregular tubers increased by clonal II
- Methods for early selection of seedlings are to be developed
- Tremendous scope exists for breeding and improvement of greater yam

Yams in yesterday's presentations..

- Africa – need for increasing yield
- Japan – production is slightly increasing
- Caribbean- limited research
  - Domestication of *D. cordata*
- Sub-Saharan Africa – lack of locally adapted varieties due to lack of breeding

Per cent increase of production of tuber crops during the last 10 years

	Cassava	Sweet potato	Yams	Taro
Area	8.5	-2.8	35.9	49.5
Production	20.6	-6.5	24.1	53.8
yield	11.2	-3.9	-3.9	3.0

Source: FAO

Perspectives for future

- Early selection of seedlings – markers
- Utilizing the genetic wealth in Pacific, Caribbean and SE Asia
- New morphotypes to avoid staking
- Polyploidy breeding
- Interspecific hybridization
- Greater collaboration & international networking