

Mating design: An introduction

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Mating populations are specifically designed for genetic studies

DIALLEL CROSSES.

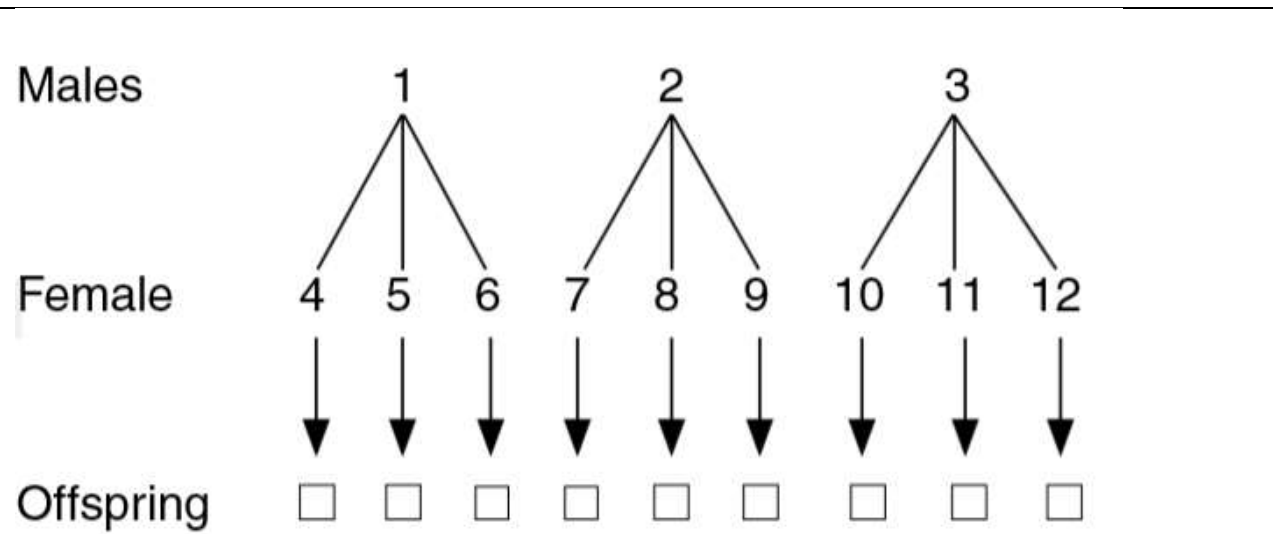
- All possible combination of number of lines used as a males and females. The F1s or F2s derived from these crosses are then genetically analysed.
- A full diallel analysis : all one-way hybrids and parents
- A Partial or incomplete diallel analysis may contain just half the diallel without reciprocals or parents.
- Diallel crosses are usually used to estimate general combining ability for the parents and special combining ability for specific crosses, providing information for producing hybrids.

| Parent | P_1 | P_2 | P_3 | ... | P_n |
|--------|-------|-------|-------|-----|-------|
| P_1 | × | × | × | ... | × |
| P_2 | × | × | × | ... | × |
| P_3 | × | × | × | ... | × |
| ... | | | | | |
| P_n | × | × | × | ... | × |

NORTH CAROLINA DESIGNS.

There are three North Carolina designs, denoted by NCI, NCII, and NCIII. These designs are most often used in cross-pollinated crops and to study broadbased populations.

NCI: two inbred lines are crossed to produce F2, and then some individuals are randomly selected from the F2 population as males to intermate with other randomly selected females.



The offspring derived from this intermating will be used in genetic analysis. The design can be described as below:

NCII: n parental lines are divided into two groups, one as males and the other as females, to produce crosses of all possible combinations.

| Cultivar | 1 | 2 | 3 | ... | n_1 |
|-----------|---|---|---|-----|-------|
| n_1+1 | × | × | × | ... | × |
| n_1+2 | × | × | × | ... | × |
| n_1+3 | × | × | × | ... | × |
| ... | | | | | |
| n_1+n_2 | × | × | × | ... | × |

NCIII: n individuals are selected from an F₂ population to backcross with two parents, P₁ and P₂

| F_2 individual | 1 | 2 | 3 | ... | n |
|------------------|---|---|---|-----|-----|
| P_1 | × | × | × | ... | × |
| P_2 | × | × | × | ... | × |

TRIPLE TESTCROSS (TTC) AND SIMPLIFIED TTC (STTC)

TTC is an extension of NCIII, where n individuals ($n > 20$) are selected from an F_2 population to backcross with both parental lines, P_1 and P_2 , and the F_1 ($P_1 \times P_2$):

| F_2 individual | 1 | 2 | 3 | ... | n |
|------------------|---|---|---|-----|-----|
| P_1 | × | × | × | ... | × |
| P_2 | × | × | × | ... | × |
| F_1 | × | × | × | ... | × |

In SIMPLIFIED TTC (STTC)

n cultivars or strains ($n > 20$) are selected from the germplasm pool to cross with two cultivars or strains, P_H and P_L , which show extreme phenotypes (with the highest and lowest phenotypic values), respectively.

| Strain | 1 | 2 | 3 | ... | n |
|--------|---|---|---|-----|-----|
| P_H | × | × | × | ... | × |
| P_L | × | × | × | ... | × |

The populations derived from

- To study and subsequently exploit modes of gene action determining

the inheritance and expression of the target traits.

References (if any)

Molecular Plant Breeding By Yunbi Xu

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