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Breeding methods in asexually propagated crops: clonal selection

Dr. Prabhat Kr. Singh

**Assistant Professor,
Department of Genetics and Plant Breeding
MSSSoA, CUTM, Paralakhemundi, Odisha, India**

Clone:

A clone is a group of plants produced from a single plant through asexual reproduction.

- ❖ A procedure of selecting superior clones from mixed population of asexually propagated crop is referred as **clonal selection**.
- ❖ The crop plants can either be propagated by seeds or by vegetative parts. The vegetative propagation is resorted due to :
 1. **Lack of seed** : Eg. Ginger, termiric
 2. **There is short viability of seed** : Eg. Sugarcane
 3. **The seed production is very rare** : Eg. Banana
 4. **Seeds are produced under special conditions only** : Eg. Sugarcane, potato

Main Features of clones

- 1. Homogeneous Constitutions:** All the individual belonging to a single clone are identical in genotype. Hence phenotypic variation within a clone is due to environment only.
- 2. Heterozygosity:** Asexually propagated crops highly heterozygous & stable and hence clones. Exhibit high inbreeding depression.
- 3. Vigorous growth:** Due to fixation of heterosis clones have hybrid vigour.
- 4. Wider Adaptation:** More adaptable to environmental variation and infestation of diseases due to high level of heterozygosity than pureline.
- 5. Source of Variation:** 3 SOV (i) Bud mutation (ii) Mechanical mixture and (iii) Occasional sexual reproduction. Theoretically clones are immortal. They deteriorate due to viral/ bacterial infection
- 6. Segregation in F1:** Selection can be practised in F1.
- 7.** The phenotype of a clone is due to the effects of genotype(g), the environment(e) and the $G \times E$ interaction, over the population mean.

Clonal selection :

First year: From a mixed variable population, few hundred to few thousand desirable plants are selected on the basis of yield, maturity, disease resistant etc. and rigid. Plants with obvious weakness are eliminated.



Second year: Clones from the selected plants are grown separately, generally **without replication**. Based on the observations the inferior clones are eliminated. The selection is based on visual observations and on judgement of the breeder on the value of clones. Fifty to one hundred clones are selected on the basis of clonal characteristics.



Third year: Replicated preliminary yield trial is conducted with a suitable check. The clones superior to the check are selected for multilocation trials.

Fourth to eighth years: Replicated yield trials are conducted at several locations along with suitable check.

- The yielding ability, quality and disease resistance etc. of the clones are rigidly evaluated.
- The best clones that are superior to the check in one or more characteristics are identified for release as varieties.



Ninth year: The superior clones are multiplied and released as varieties

Sources of clonal selection :

1. Local varieties
2. Introduced material
3. Hybrids and
4. Segregating populations

Advantages:

1. Varieties are stable and easy to maintain
2. Avoids inbreeding depression
3. Clonal selection, combined with hybridization generates necessary variability for several selections.
4. Only method to improve clonal crops
5. Hybrid vigour is easily utilized selection may be used in maintaining the purity of clones.

Disadvantages

1. Selection utilizes the natural variability already present in the population.
2. Sexual reproduction is necessary for creation of variability through hybridization.
3. Applicable only to the vegetatively propagated crops.

Comparison among clones, purelines and inbreds

No.	Particular	Clone	Pureline	Inbre
1	Mode of pollination in crop species where they occur	Cross-pollination	Self-pollination	Cross-pollination
2	Natural mode of reproduction in such species	Asexual (in most of the cases)	Sexual	Sexual
3	Genetic make-up of the plants in natural population of such species	Heterozygous	Homozygous	Heterozygous
4	Obtained through	Asexual reproduction from a single plant	Natural self-pollination from a single homozygous plant	Artificial self-pollination or other form of inbreeding selection for several generations
5	Maintained through	Asexual reproduction	Natural self-pollination	Artificial self-pollination or close inbreeding
6	All the plants in a single entity are genotypically	Identical	Identical	Almost identical
7	Used directly as a variety	Yes	Yes	No (Used in developing hybrid or synthetic varieties)
8	The genetic make-up of plants within a variety	Heterozygous	Homozygous	Almost homozygous
9	Organism where found	Plants	Plants	Plants and animals

Achievements

I. Through clonal selection

Potato :

1. Kufri Red from Darjeeling Red Round
2. Kufri Safed from phulwa
3. Bombay Green banana is a bud selection from dwarf Cavendish, pidi monthan from Monthan

II. Through hybridization

Potato: Kufri Alankar, Kufri Kuber, Kufri Sindhuri, Kufri Kundan, Kufri Chamatkar, Kufri Jyothi (late blight resistant), Kufri Sheetman (frost resistant)

Sugarcane: Co 1148, Co 1158, CoS 510, Co 975, Cos 109, Co 541

Mango: Pedda Neelam, Chinna Suwarnarekha

Banana: High gate from Gross Michel

Citrus: Robertson Navel Orange

Sweet oranges: Yuvaraj blood Red

Turmeric: Kesari, Kasturi