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# Breeding methods in self-pollinating crops

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# Introduction

- ❖ **Method of Plant Breeding in Self Pollinated Plants Selection** One of the oldest method of breeding and is the basis for all crop improvement, practiced by farmer in ancient times.
- ❖ Selection is essentially based on the **phenotype** of plants. Consequently the effectiveness of selection primarily depends upon the degree to which the phenotypes of plants reflect their genotype.
- ❖ Two methods of selection are commonly practiced in breeding of self pollinated crops
  - i) **Pure Line Selection** ii) **Mass Selection.**

# **Mass Selection**

# Main features

## 1. Genetic constitution :-

- **Self pollinated crops:-** A mass selected variety is **homozygous but heterogeneous** because it is mixture of several **pure line**.
- **Cross pollinated crops:-** variety is mixture of **homozygous and heterozygous** and variety is **heterogeneous**.

## 2. Adaptation:-

- Mass selected varieties have wide adaptation.
- Varieties are **more stable** against environmental changes.
- Heterogeneity provides better buffering capacity.
- Mass selected varieties have **broader genetic base**.
- Adaptability is more in cross pollinated crops than in self pollinated crops.

### 3. Variation:-

- They are composed of several pure line in self pollinated crops and of several homo and heterozygous genotypes in cross pollinated crops.
- There is heritable variation in the mass selected varieties.
- The heritable variation provides them good buffering capacity.

### 4. Selection:-

- Selection is effective due to presence of heritable variation.

### 5. Quality:-

- A variety developed by mass selection is less uniform in the quality of seed than pure lines due to presence of heritable variation.

# MERIT

- **Good method for old and land races varieties.**
- **Good for purification of improved variety.**
- **More stable than pure lines due to heterogeneity.**
- **Good protection against disease and pest.**
- **Simple and quick method for improvement.**
- **Applicable in self and cross pollinated species.**

# DEMERIT

- The developed through mass selection so variation and are not uniform as pure line variety.
- The improvement through mass selection is generally less than that could be achieved through pure line selection.
- In the absence of progeny test, it is not possible to determine if the selected plant are homozygous.
- Due to the popularity of pure line variety, mass selection is not commonly use for improvement of self pollinated crop.

# Selection

“ Identification and isolation of plants having the desirable combination of characters, and growing their progeny only”

## History:

- 1843: **Le Couteur** published his results on selection in wheat
- About the same time **Patrick Shireff** practiced individual plant selection in wheat and oats
- 1857: **Hallet** practised single plant selection in wheat, oats and barley
- **Vilmorin** proposed Individual plant selection based on progeny testing
- 1903: **Johannsen** proposed pureline theory



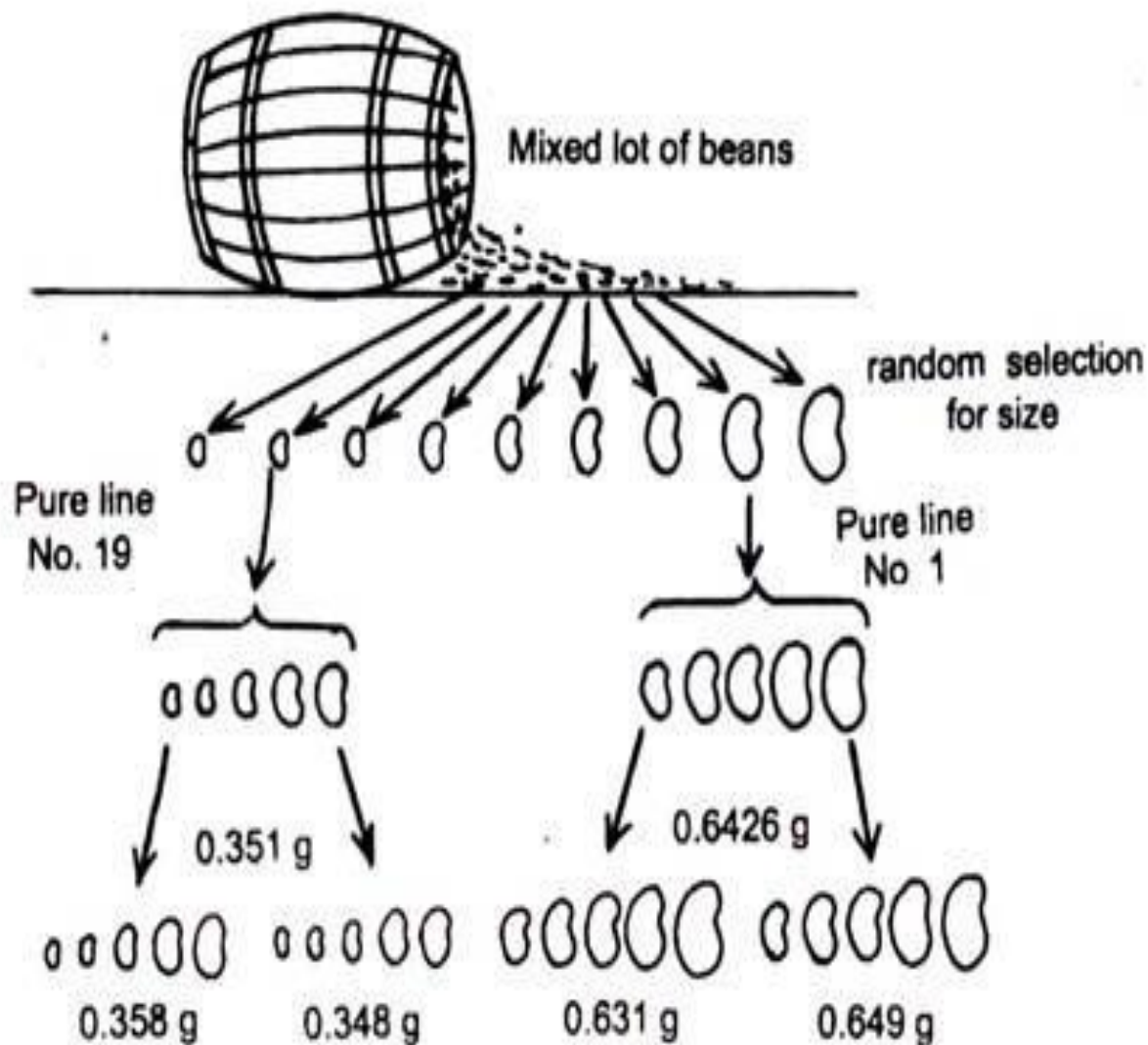
# PURE LINE

**WILHELM JOHANSSEN**  
(A DANISH BOTANIST)



**DISCOVERED THE PURE LINE THEORY IN**  
French Bean (*Phaseolus vulgaris*) 1903

**Princes variety**



**Fig. 3. Pure line selection in beans. The experiment demonstrated that a mixed population of a self pollinated crop may be separated into pure lines inherently different, but that further selection with a pure line is ineffective in changing the genotype of the line.**

# Pureline selection

- In **Pureline selection** a large number of plants are selected from a self pollinated crop and harvested individually; individual plant progenies from them are evaluated, and the best progeny is released as a pureline variety

## APPLICATIONS

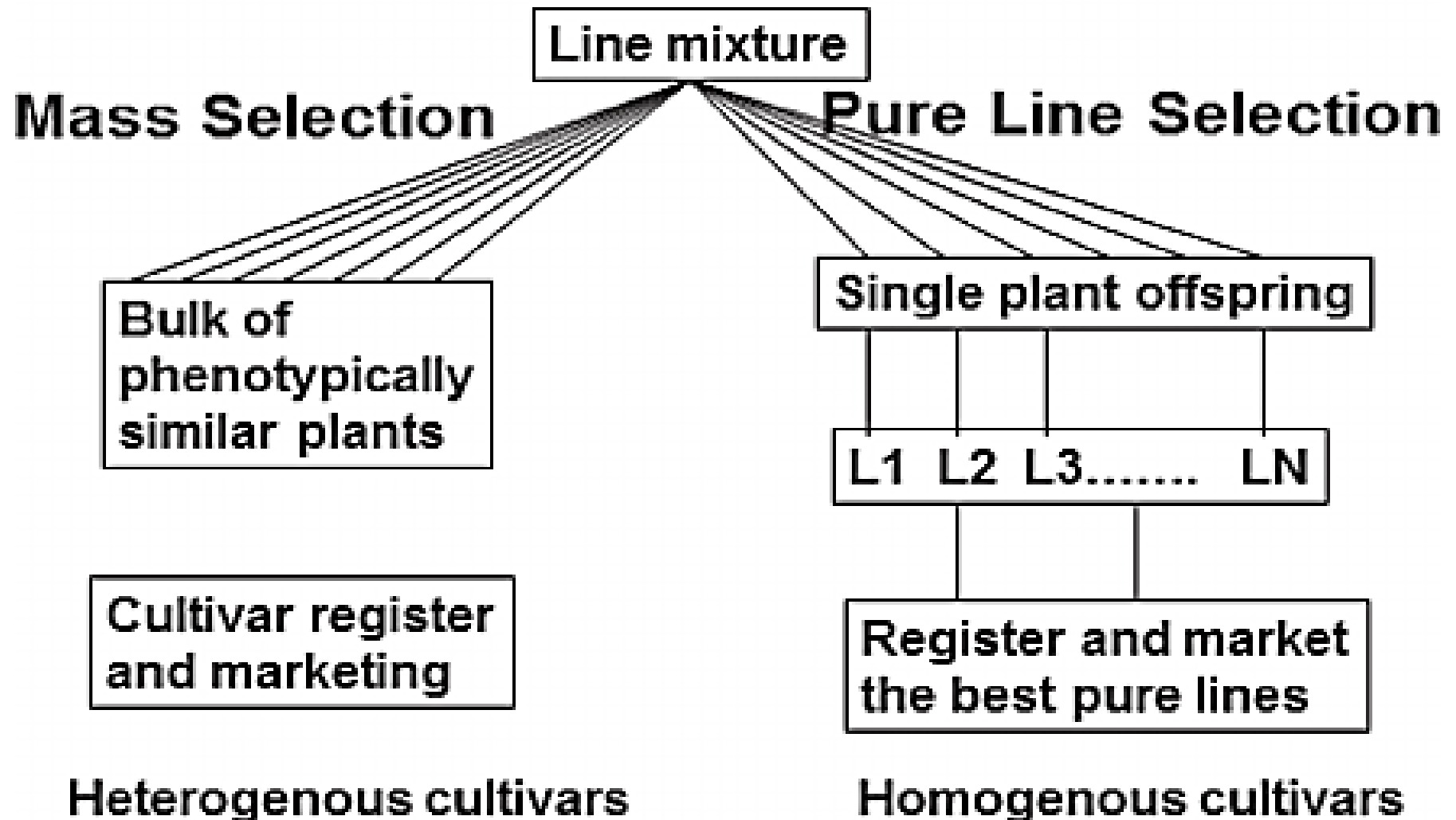
Improvement of local varieties

Selection in introduced varieties

Improvement of old pureline varieties

Selection for a new characteristic in a pureline

# Mass Selection vs. Pure Line Selection



## Merits of Pure Line Selection Method:

1. Pure line selection achieves maximum possible improvement over the original variety.
2. Being **extremely uniform**, more liked by farmers and consumers than those developed by other methods like mass selection.
3. It is **easier** than hybridization required less skill.
4. Used for developing inbred lines and pure lines.
5. Due to extreme uniformity, it is easily identified in seed certification.

# Demerits of Pure Line Selection Method:

1. It is not practiced in cross pollinated crops because it is expensive, laborious.
2. The variety developed can't be easily maintained by the farmers.
3. The varieties developed by pure line selection don't have wide adaptability and stability in production.
4. The upper limit on the improvement is created by the genetic variation present in the original population.
5. It requires more time and laborious than mass selection.
6. The breeder's has to devote more time to pure line selection than mass selection.

# Applications of Pure Line Selection:

- 1. Improvement of local varieties**, have a considerable genetic variability, e.g. Wheat var. NP-4 and NP-52.
- 2. Introduced material to develop suitable varieties** e.g. shining mung -1 selected from Kulu type-1, Kalyan sona from CIMMYT.
- 3. Improvement of old pure line varieties**, e.g. Chafa, from No.816 (gram), Jalgaon 781 from China Mung 781.
- 4. It provides an opportunity for selection of new characteristics**, such as disease resistance, grain type, plant type, etc.
- 5. It provides an opportunity for selection in the segregating generation from crosses.**

# Achievements of pure line selection:

A large number of improved varieties have been developed in self pollinated crop like wheat, barley, rice, pulses, and oilseeds, cotton and many vegetables etc. Many wheat varieties developed include NP-4, NP-6, NP-12, NP-28, Mung Var. (T-1, B-1), rai var. (L18), cotton var. (Combodia Caoimbatore2, Gadag1), tobacco (Harrison special 9, chatham), rice (Pant6, Waner)