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Methods of Breeding in Self Pollinated Crops

Plant Introduction

Plant Introduction: According to Allard (1960) plant introduction is the acquisition of superior varieties by importing them from other areas. Or plant introduction is the process of taking / introducing plants/ genotype or group of genotype into new environment where they were not being grown before. Introduction may involve new varieties of a crop already grown in the area wild relatives of the crop species or totally new crop species for that area. Plant introduction may within the country between the countries or confirmed between the states or within the state. The plant may be introduced from the country of another continent. Ex. Introduction of Ridley wheat varieties from Australia. Introduction may be classified into two categories:

a) Primary

b) Secondary

a) Primary Introduction: When the introduced variety is well suited to the new environment and is directly released for commercial cultivation without any change the original genotype, known as primary introduction.

Ex. Introduction of semi dwarf wheat varieties Sonora, Lerma Rojo and semi dwarf Rice Var. TN-1, IR-8, IR-28, and IR-36. 2) Secondary Introduction: The introduced variety is subjected to selection, to isolate superior variety or may be hybridized with local variety to transfer one or few desirable characters to the local variety, known as secondary introduction. Secondary introduction is much more common than primary introduction particularly in countries having well- organised crop improvement programme.

Ex. Kalyan sona and sonalika varieties selected from the material introduced from CIMMYT. Mexico (Centro International de Mejoramieno de maize ‘Y’ Trigo) commonly known as Internation centre for maize and wheat Research.

Procedure of Plant Introduction:

Plant introduction is one of the very old and effective methods of plant breeding. It consists of following steps:

i) Procurement of Germplasm: Any individual or scientist or institute can introduce germplasm, but the entire introduction must be routed through NBPGR, from the known source of the country or neighbouring countries. While introducing germplasm scientist has to allow two routes. In case of the first route individual make a direct request to individual or institution abroad and in the second route individual submit his requirement to the NBPGR, by giving much detail information about the requirement. Generally, the required materials are obtained through correspondence as gift, an exchange, purchased etc. The plant part to be introduced depend upon the crop species, it may be seed, tubers, runners, suckers, stolons, bulbs, Rhizome, cutting, bud or seedling. The part of the plant used for the propagation of a species is known as propagule. The nature of propagules varies from species to species. Seeds general have more viability than propagules and are packed and transported more easily, while propagules require special packing techniques.

ii) Quarantine: Quarantine means to keep the materials in isolation to prevent the spread of disease, weeds etc. all the introduced material is thoroughly inspected for contamination with weed, disease and insect pests. The material is fumigated or treated to avoid the contamination.

If necessary, the materials are grown in isolation for observation of disease, insect, pest and weeds, this entire process is known as quarantine and the rules prescribed them are known as quarantine rules.

All the materials being introduced must be covered by an authentic phytosanitary certificate from the source of country i.e the must be declared free from disease, weed and pests. If any country or material does not fulfil the quarantine rules, that materials are likely to be destroyed by NBPGR or would return to the source country.

The quarantine controls is exercised by NBPGR at prescribed part of entry. E.g Mumbai, Calcatta and Madras and this process is required at least three weeks.

III) Catloguing: The introduced material is entered in assession register and is given on entry number. The information regarding the name of the species, crop variety, and place of origin, adoption and morphological character are reduced.

The plant materials are classified into three groups viz.

a) Exotic Collection (EC)

b) Indigenous Collection (IC)

c) Indigenous Wild Collection (IW)

IV) Evaluation:

The introduced material is evaluated to assess the potential of new introduction and their performance. These materials are evaluated at different substation. The material resistance to disease and pest is evaluated under favourable environment conditions, and the promising one is either released as such as a variety or subjected to selection or hybridization.

V) Multiplication and Distribution

After evaluation promising material from production may be increased by multiplication and released for general cultivation as varieties after necessary trials. Most of there are identified for desirable character and maintain for future use.

Acclimatisation: The process that leads to the adoption of a variety to a new environment is known as acclimatisation.

Generally the introduced varieties perform poorly because they are often not adapted to the new environment. Sometimes the performances of that variety improve in the new environment by growing it for number of generations. Acclimatisation is brought about by a faster growing it for number of generations.

Acclimatisation is brought about by a faster multiplication of those genotype that are better adopted to new environment. The population having more variability is easily acclimatized i.e cross pollinated crops are easily acclimatized than self pollinated crop.

Plant Introduction Agencies in India

In India centralized plant introduction agency was initiated at IARI (Indian Agricultural Research Institute) in 1946 at New Delhi.

In 1956 it was expanded as the "Plant Introduction and Exploration Organization" and in 1961, it was made an independent division in IARI as the "Division of Plant Introduction".

In 1976 division was reorganized as NBPGR (National Bureau of Plant Genetic Resources). This bureau is responsible for the introduction and maintenance of germplasm of Agricultural and horticultural crops.

In addition to bureau there are some other agencies, which are concerned with plant introduction *viz.*

i) FRI (Forest Research Institute): Dehradun established for the Introduction and Maintenance of forest species

ii) Botanical Survey of India: It was established in 1890 and responsible for introduction testing and maintenance of medicinal and botanical plants. But at present introduction and improvement of medicinal plan looked after by NBPGR.

iii) The Central Research Institute: For various crops e.g. Tea, Coffee. Sugarcane, Potato, Tobacco, etc introduce, test and maintain plant material of their interest, but their activities are coordinated by NBPGR.

iv) NBPGR: NBPGR has its head quarter at IARI, Delhi. It has four substations for testing of the introduced materials viz. Simla, Jodhpur, Kanyakumari and Akola. They represent the temperate zone, arid zone, tropical zone and mixed climatic zone respectively.

The Activities Functions of NBPGR:

1) It introduces the required germplasm from its counter plants.
2) It arranges explorations inside and outside the country to collect valuable germplasm.
3) It is responsible for inspection and quarantine of all the introduced plant materials.

4) It is responsible for testing, multiplication and maintenance of germplasm obtained through various sources.

5) Maintenance of record of introduced plants.

6) To supply on request germplasm of various scientists or institution.

7) Improvement of medicinal and aromatic plants.

8) To set up natural gene sanctuaries of plants, where genetic resources are available.

9) To supply germplasm to its counterparts or other agencies in other countries.

Purpose and Achievement of Plant Introduction Method of Breeding Purpose / Object of Plant Introduction:

i) To obtain an entirely new crop plants E.g. Maize, potato, tobacco, soybean, gobhi, Sarson (Brassica napus).

ii) To serve as new varieties. E.g. Sonara-64, Lerma Rojo, TN-1, IR-8 , IR-26.

iii) To be used in crop improvement is introduced material is subjected to hybridization. E.g Pusa Ruby.

iv) To save the crop from disease and pests. E.g. Coffee was introduced to South America from Africa to prevent from leaf rust.

v) For scientific studies. The introduced material is used for studies or biosystematics evolution and origin of plant species.

vi) For arsthetic value: Ornamental shrubs and lawns grasses are introduced to satisfy the tired human being and are used for decoration. Achievement of Plant Introduction: In India introduced materials have been used directly as varieties, released as a varieties as a varieties after selection or used in hybridization programme.

Some of the achievements of introduction are:

I) New Crop Species: The crop introduced in India includes Potato, Maize, Chilli, coffee. Hevea rubber, guava, grape, papaya, soybean, Jojoba.

II) Directly Released as Varieties: Semi dwarf wheat varieties, sonara-64 and lerma Rajo introduced from Mexico. TN-1 rice variety introduced from Tawan and other varieties IR-8, IR-28 and IR-36 introduced from IRRI Philippines, Bonnevilla- pea, Rice, Wheat from Australia.

III) Varieties Selected and Developed from Introduction Varieties Selected from Introduction: Kalayan sona and sonalika selected from the material introduced from Mexico, Bajara- Jamnnagar and Sweet Potato –Pusa lal and Pusa Sunehari.

IV)Varieties Developed through Hybridization: All dwarf varieties of wheat derived from crosses with Mexican varieties. All but few semi dwarf rice varieties posses the dwarfing gene from Dee-geo-woo gene from TN-1 or IR-8. Pusa ruby tomato – meeruti X Sioux and pusa early dwarf – meeruti X red cloud ,etc.

Merits and Demerits for Plant Introduction Method of Breeding

Merits of Introduction: It provides entirely new crops.

i) It provides superior variety directly after selection.
ii) It protects the variability from genetic erosion by collecting germplasm.
iii) It is a very quick and economical method of crop improvement.
iv) It provides protection to the crop by introducing into new disease free areas. Eg. Coffee and rubber.

Demerits of Introduction:

i) Introduction of noxious weeds Eg. Argemone Mexicana, Parthenium argantatum, water hyacinth, etc.
ii) Introduction of disease Eg Late blight of potato from Europe in 1883, flag smut of wheat from Australia and Bunchy top of Banana from Ceylon.
iii) Introduction of pests Eg. Potato tuber moth from Italy.
iv) Ornamentals turned weeds E. g Water hyacinth and lantana camera.
v) Threat to Ecological balance, Eucalyptus sp. Introduced from Australia.