Perspective

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Method for Controlling Agricultural Biotechnology

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Description

Germplasm are living genetic resources such as seeds or tissues that are maintained for the purpose of animal and plant breeding, preservation, and other research uses. These resources may take the form of seed collections stored in seed banks, trees growing in nurseries, animal breeding lines maintained in animal breeding programs or gene banks, etc. Germplasm collections can range from collections of wild species to elite, domesticated breeding lines that have undergone extensive human selection.

Several thousands of sheep and goat embryos, as well as significant numbers from deer, are transferred annually within countries and internationally. The technologies used for superovulation, collection and transfer of such embryos are now well developed, and pregnancy rates of over 60% can be achieved. Such transfers offer a unique opportunity to safeguard the health status of the flocks and herds even when the embryos originate from countries with a radically different health status. Viral diseases which have been investigated with regard to their risks of transfer by derived small ruminant embryos include bluetongue, border disease, pulmonary adenomatosis, maedi/visna and caprine arthritis–encephalitis. Bacterial diseases investigated include brucellosis, campylobacteriosis, mycoplasmosis and chlamydial abortion. Scrapie, a prion disease, has also been studied and will be discussed in another paper. Provided that the sanitary procedures recommended in the IETS manual as outlined here, are strictly followed, the risks of transmitting diseases are minimal.

Advances in Agricultural Biotechnology

Advances in agricultural biotechnology have led to interest by agribusiness to license elite germplasm from national programs in developing countries, now in need of funds. Uncertainties about the value of the material have delayed negotiations. This article proposes a method of setting upper and lower negotiating bounds on values. The model accounts for annual productivity enhancements, effects on world prices, and obsolescence effects of greater R&D. A demonstration application for soybeans in Brazil, which has completed the preconditions (IPR, biosafety, internal policy), suggests limited private value for public germplasm. The optimal solution is cooperation

Germplasm that is amenable to the transformation and tissue culture regeneration process is typically not the high-performing germplasm used in today's intensive production agriculture. It is necessary to introduce a GE event into elite germplasm via process of breeding and selection. The use of molecular markers can dramatically enhance the speed and effectiveness of this introduction by minimizing the transfer of alleles from the GE donor line and maximizing the recovery of alleles from the elite germplasm. Throughout the process of introgression, a Bt event is evaluated in increasingly diverse germplasm and environments for performance of the IR trait and the germplasm.

Germplasm is a reservoir for many abiotic stress tolerance genes, which will be used to breed climate-resilient crops for the future. The introduction of germplasm and the identification of new germplasm available in the gene bank would be the option for abiotic stress tolerance introgression into the main breeding programs. Identification of abiotic stress-tolerant varieties through traditional breeding is quite complicated due to the limited availability of genetic variability of many cultivated species/crops. Germplasms, crop wild relatives, and landraces serve as reservoirs for heat tolerance genes and associated traits that could be utilized to accelerate the breeding programs.

Germplasm

Germplasm is the genetic material of an individual that may be transmitted, sexually or somatically, from one generation to another. In a general sense, germplasm may represent a species, population, landrace, hybrid, or cultivar. Conservation of germplasm may take many forms but is generally classed as ‘in situ,’ in natural or managed areas or farms, or ‘ex situ, in seedbanks, tissue repositories, or botanic gardens. It should be collected, stored, and managed so that it maintains its usefulness that is, viability, quantity, and diversity – for its intended use.

Huge germplasm resources with wide variation and adaptability serve as a buffer in the diverse agro-ecosystems and changing climatic conditions. Consultative Group on International Agricultural Research (CGIAR) gene banks have largest collection of coarse millets and small millets, followed by

National bureau of Plant Genetic Resources (NBPGR) New Delhi with 21,226 accessions of six small millets. CGIAR gene banks are not involved in conservation of pseudo-cereals germplasm. However, considerable efforts have been made by various national gene banks across the globe for ex situ conservation of indigenous and exotic germplasm of pseudo-cereals. Most of the accessions have been evaluated for descriptors of the respective crops and donors for yield component traits, disease resistance and various another agro-morphological traits have been identified and used in breeding programmer for the development of new varieties. Many varieties in millets and almost all varieties of Amaranth and buckwheat are pure-line selections from local germplasm collections.

Germplasm of ginger conserved in field gene banks is often infected by soil-borne pathogens and the exchange of germplasm as rhizomes is problematic. Synseed technology is an important asset for micro propagation, possessing the ability of regrowth and development into plantlets (conversion) for in vitro and in vivo use and for exchange of germplasm with potential storability, ease of handling, limited quarantine restrictions, and low cost of production. Furthermore, they can be used for cryopreservation through encapsulation dehydration and encapsulation verification methods. Fabre and Dereuddre reported encapsulation dehydration, a new approach in cryopreservation of Solanum shoot tips. Thus, the synthetic seed technology is designed to combine the advantages of clonal propagation with those of seed propagation and storage. Reports on synthetic seeds are available in ginger. Sharma et al. successfully encapsulated ginger shoot buds in 4% sodium alginate gel for production of disease-free encapsulated buds, which were germinated in vitro to form roots and shoots.