A Local Germplasm Bank Information Management System

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The purpose of this paper is to discuss the advantages of using a computerized information management system to assist in the operations of a germplasm bank. Storage of both seed and relevant information is a vital task of germplasm banks, and it is equally important that bank managers provide seed samples and the corresponding documentation to users. The information system developed for CIMMYT's maize germplasm bank is a local system for handling passport information, records on seed regeneration, agronomic data obtained from evaluation and characterization, and records on storage and utilization of the accessions.

The Information System Environment

The maize germplasm bank involves relationships among the various elements shown in Figure 1. The circle in the middle of the figure represents the information system, and the boxes represent related elements, which are as follows:

- Seed donors--Institutions or individuals that send materials to the bank
- Field book system--Computer system that provides field books needed by bank management
- Bank management--Persons responsible for the performance of the germplasm bank
- Bank users--Insitutions or individuals that are interested in receiving materials from the bank

The information system helps maintain the relationships among these elements and is designed to meet the requirements of management and users efficiently.

Data Management

The functions of the germplasm bank information management system are as follows:

- Passport data--Allows new material to be accessioned. Bank management decides about the final disposition of the new material, that is, whether to accept or reject it.
- Storage--Assigns a storage location in the active and base collections to new material that has been accepted by bank management.
- Regeneration--Handles information generated through characterization and preliminary evaluation of accessions and monitors seed viability in the storage chambers to identify possible candidates for regeneration.
- Evaluation--Allows bank management to retrieve information obtained through further evaluation of accessions, so that they can be compared according to traits of interest.

- Seed shipment--Provides information on the shipment of accessions to users requesting bank material.

- Field books--Produces field books needed for collecting data on bank material. Data collected in the field can be added to that already stored in the information system.

These data management activities are designed to fit the current requirements of bank management. Some features of the system, however, such as the number of storage chambers and the conditions that warrant seed regeneration, can be altered to meet future needs. The system is thus flexible and can readily be adjusted according to future developments in the germplasm bank.

Passport data--The steps by which new material is incorporated into the bank's holdings are shown in Figure 2. Bank management first adds information on new material to the passport data stored in the information system. If information about the incoming material is missing, the seed donor is notified. Upon creating its passport, the system assigns a unique number to the new material, which is employed in any further management operations. This number is independent of the accession number, which is not assigned until the material is finally accepted as a bank accession. Bank management next decide about the final disposition of the material, that is, whether it should undergo preliminary observation and regeneration or not be accessioned.

In the observation phase, the material undergoes a preliminary check to determine whether the bank will accept or reject it. If the material is to be maintained, it is scheduled for regeneration, the main purposes of which are to obtain the amount of seed and characterization data required in order for the material to be accessioned. As discussed below, field books are provided for data collection during observation and regeneration.

At the end of each maize growing cycle, the system updates previous information on the material according to data collected in the field. Depending on field results, the information system indicates that the new introductions are ready for the next phase or will remain at the current one. The system will also check materials for which observation or regeneration has been completed and indicate that they are ready to be accessioned.

Seed storage--New material completing the passport phase has to be stored and preserved. For that purpose each material accessioned is placed in the base and active collections. The storage process is closely related to the regeneration and seed shipment processes, as indicated in Figure 3. The information system identifies each material that has completed the passport phase and, using its identification number, assigns the material to storage locations, records the amount of seed stored in each, and indicates that the material is an accession available for shipment to users. The seed viability of the accession is monitored to anticipate the need for regeneration and seed increase. The information system also allows bank management to specify the amount of seed transferred from the base to the active collection, a procedure that is useful for updating inventories of seed in the two collections, and to determine the number of new accessions that have entered the bank over time. All of these capabilities contribute to more efficient use of scarce storage space.

Regeneration--To ensure that bank holdings remain in good condition, it is important to periodically check certain characteristics of the seed in storage. The information system will perform these checks and produce an audit report showing the accessions for which seed

amounts or viability are low enough to warrant seed increase or regeneration. The system will not schedule the material automatically for regeneration but will let bank management take the final decision as to which materials should enter the regeneration phase. When an accession is regenerated, data are collected and entered in a field book for storage in the information system (these steps are covered below). After the maize growing cycle, the information system updates the amounts of seed in storage, and accessions that have been increased or regenerated are once again designated as being available for shipment to users.

Seed distribution--Helping users decide which accessions to use and shipping these materials to users, along with the corresponding documentation, are key activities of bank management. The Maize Germplasm Bank Inquiry System, which is available on CD-ROM (compact disk, read-only memory), was developed to help users choose accessions. With this system they can actively search for potentially useful accessions on the basis of multiple criteria derived from the passport and regeneration data.

The information system helps bank management make various decisions about seed shipment. The system displays incoming requests, along with any stored data on seed availability, thus preventing shipment of any accession for which the quantity of seed is low. If a request can be met, passport and regeneration data are produced and included in the seed shipment. The system also produces a packing list that specifies the accession being sent, its location in the storage chambers, and the amount of seed of each accession being sent. One can also generate reports on the amounts of seed provided to particular institutions and countries.

Further evaluation--The main objective of this task is to provide bank management and users with information on the agronomic performance of accessions. A computer system is being developed that will facilitate management of information pertaining to field trials of bank materials. Future releases of the information system will be able to extract information from this trial system. Bank management will then have a better means of comparing materials, and the data will also be added to the documentation that is sent with seed shipments to users.

Field books--The information system provides field books for recording data on materials (during observation, regeneration, or evaluation in the field) as well as a means of entering the data in the system. The information system first inquires what kind of field book is needed. The current options are:

- Observation of introduction field book
- Regeneration of introduction field book
- Regeneration of accession field book
- Evaluation of accession field book

The information system allows bank management to enter the accessions to be included in the field book. It then checks the materials to determine whether they can be included in the field book that has been specified. For example, an introduction that is ready for observation cannot be included in a regeneration of accessions field book. The information system also allows for modifications in the list of accessions.

The field book contains certain items of passport data that help bank management identify accessions, and it includes various columns where data collected in the field can be entered. The field books requested can be reprinted later. Thus, the bank manager can prepare a set of field books, modify the list of entries as necessary, and then reprint the field book for the upcoming crop cycle.

Upon entry of data in the information system, it inquires what type of field book is to be entered. In adding the observation, regeneration, or evaluation data to information already stored, the system will check whether the accessions on which data are being entered are actually scheduled for that type of operation. The system also allows for correction of typing errors that occur during data entry.

For further information on documentation in germplasm bank management, see: Konopka, J., and J. Hanson, eds. 1985. *Documentation of Genetic Resources: Information Handling for Gene Bank Management.* Rome: IBPGR and Nordic Gene Bank.

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Figure 1. The Maize Germplasm Bank.

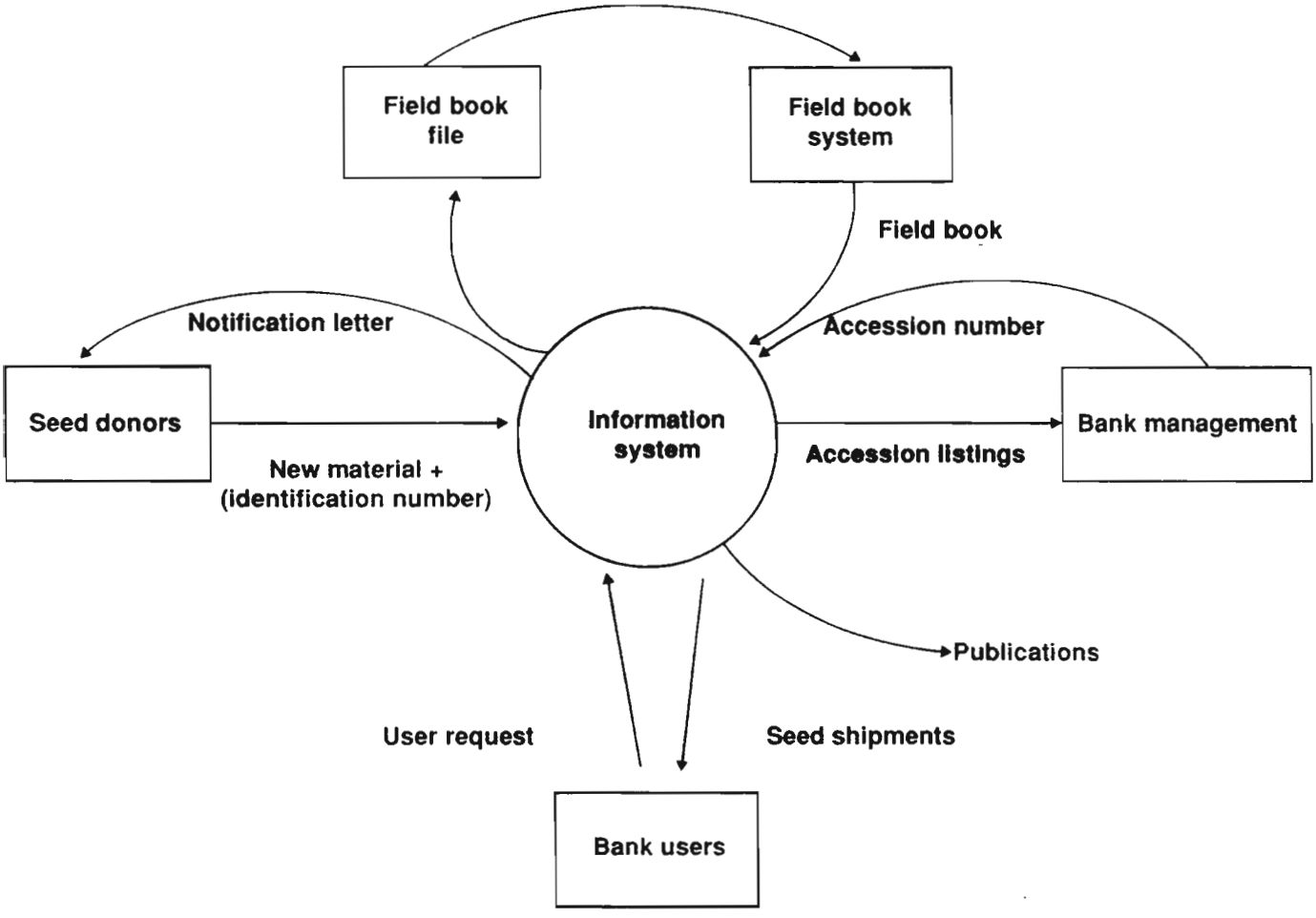

Figure 2. Introduction of new material in the maize germplasm bank (passport phase).

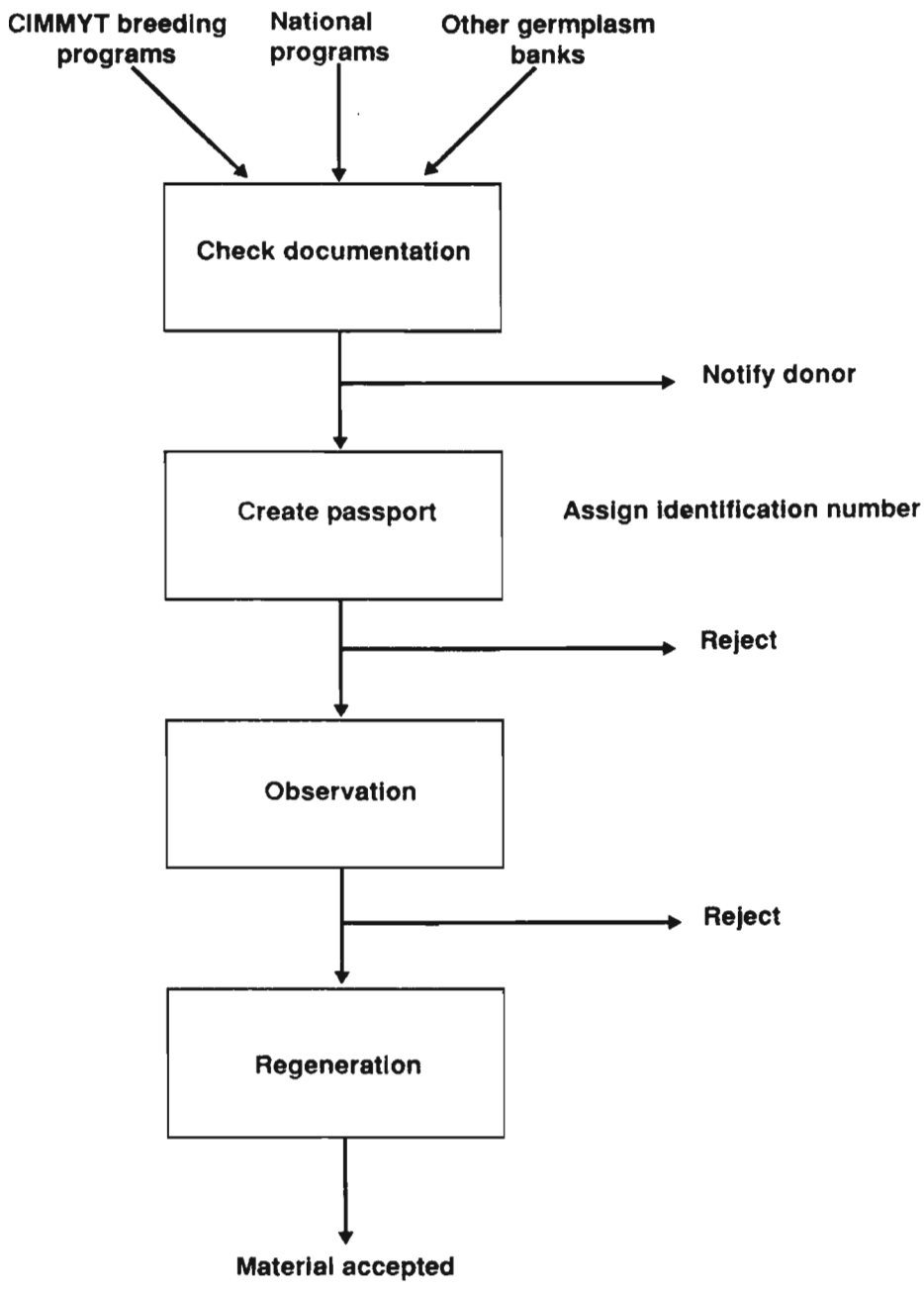

Figure 3. Interrelation of bank activities.