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9. ABSTRACT

This manual is for field workers who collect and conserve native cultivars, primitive forms, and wild species of rice; it can be used as a guide for planning and conducting collection activities. Wild species of rice need to be saved from extinction because they contribute to the genetic wealth of rice germ plasm and rare genes have made important contributions to rice breeding. The manual begins with planning the field collection. Subsections concern what to put in the project proposal, why it is important to review past collection activities, when to conduct the collection, what personnel and equipment are needed, how to conduct the sampling, what field records should be made, and how to protect them against water damage. The section on field collection operations includes communication with local officials, steps in collecting seed, handling collected samples, their registration and storage, and storage of duplicate samples at international centers. A section on preliminary screening and seed increase discusses the number of strains to be grown and cultural methods, plot size, records, and amount of seed stock to be saved. A final section on seed storage gives the proper moisture content and temperature and the proper containers for short-term and long-term storage.

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manual for field collectors of rice

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This manual is designed to help field workers in rice collect and conserve indigenous cultivars, primitive forms, and wild species of the genus *Oryza*.

It was originally suggested at the first meeting of the International Rice Collection and Evaluation Project held at Hyderabad, India, in October 1970. The operations of the project are conducted by a technical committee committee composed of C. Roy Adair (U.S. Department of Agriculture, U.S.A.), B. R. Jackson (Rockefeller Foundation, Thailand), R. D. Lane (U.S. Department of Agriculture, India), S. V. S. Shastry (All-India Coordinated Rice Improvement Project, India), and T. T. Chang (International Rice Research Institute, Philippines), chairman.

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Introduction

Genetic diversity is the foundation of all plant breeding programs. New genetic inputs are constantly needed to meet the ever increasing demand for food, to improve crop quality, and to stabilize crop production. In the cultivated rices (*Oryza sativa L.* and *O. glaberrima* Steud.), there is enough genetic variability to serve most of the needs of rice breeders. The wild taxa in the genus *Oryza* offer another source of potentially useful genes for rice researchers.

The genetic wealth of rice germ plasm is threatened by the rapid spread of newly improved varieties. Old and obscure varieties are being rapidly replaced by new ones in many areas. Primitive and wild forms are being wiped out by land clearing associated with irrigation and drainage projects, housing, and industrial development. Even in remote areas indigenous types are disappearing at an alarming rate. If man is going to save the minor, obscure, primitive, and wild types from extinction, the [illegible] act is now.

Many instances can be cited to show the important contribution genes identified in varietal collections have made to rice breeding. The single recessive gene for semidwarfism found in Dee-geo-woo-gen (from Taiwan) led to an enormous increase in world rice production. It was incorporated into the genetic background of tall, lodging-susceptible indicas, resulting in the de-

velopment of Taichung Native 1, IR8, and many other improved varieties. Rexoro, originating in the Philippines, has made machine-harvesting by U.S. rice farmers easier because of its gene for smooth (glabrous) leaves and glumes. Tadukan and Tetep collected by Japanese workers in Southeast Asia during the 1940's are two of the best sources of resistance to the blast fungus. Pankhari 203 and Mudgo from India have high levels of pest resistance, although they represent extremely poor agronomic types and are minor varieties in their home habitat. The field resistance of Tainan Yu 487 (PI 215936) to the hoja blanca virus was identified after extensive testing in South America and it was later incorporated into resistant varieties such as ICA-10. The wild relative of cultivated rice, *O. nivara* (Sharma and Shastry), is the only known source of resistance to the grassy stunt virus. IRRI pathologists screened more than 6,000 cultivars and breeding lines and hundreds of wild strains to find it.

These examples show the value of collecting and conserving rice varieties of an obscure nature and of unknown genetic potential. They also underscore the need to systematically screen large varietal collections for desired features.

Most national collections were assembled by plant breeders as working collections. The collections consist mostly of commercially important varieties plus a small number of minor or obscure varieties, types reported to have special features, foreign introductions, and breeding lines. The collec-

tions are usually deficient in primitive types from remote areas. Few collections include wild species.

In the tropics, rice researchers often have difficulty in maintaining a large collection because genetic stocks must be replanted every year when no air-conditioned seed storage facilities are available or when land and labor are inadequate to manage a large number of accessions. Other problems associated with frequent seed increases are errors in harvesting and in labelling, loss of unadapted or highly susceptible strains, and changes in genetic composition of the population. As a result, many national collections are dwindling in both size and genetic coverage.

Planning the field collection

The field collection should be carefully organized after reviewing past activities and thoroughly planning all details. To get funds for the collection activity you usually will have to specify many of the details in a project proposal.

Review of past activities. Make a critical review of past collection activities including how the collected specimens were evaluated, used, and conserved. It is important to know where genetic diversity exists or where rice varieties have performed well in spite of such problems as endemic diseases or insects, problem soils, cool temperatures, salinity, or deep water.

Examine the records of different stations and communicate with rice workers to find:

— The number of accessions being

maintained in national and regional collections that are reasonably distinct in name, place of origin, or morpho-agronomic description.

— Areas where past collection efforts were extensive and provided useful germ plasm.

— Remote areas where little collection effort has been made in relation to the known rice varietal diversity.

— Problem areas where a small number of varieties tolerate an adverse factor (soil, water, pest, or climate).

— Less developed areas where primitive or wild forms can be found in special environments to which they are adapted.

Careful assessment of these points will reveal areas where further collection will be worthwhile. The information gained in this appraisal can be used to develop a general review of national efforts on rice collection for use in a project proposal.

When to conduct the collection. The appropriate time for field collection is the grain ripening period. This period is rather short and, in the humid tropics, rainy, making collection work difficult. When the collection involves a large area, several teams should be organized or the sampling job should be extended over two or more seasons. It is often difficult to schedule a collection period that will cover all the varietal types grown in the area which differ appreciably in maturity. Therefore, make contingency plans to cover the different maturity groups. Another consideration is that in some areas local farmers may not be willing to

supply the seeds until a festival associated with rice harvest is over. Or, villages may not become accessible until after the rainy season when the roads become passable. The collection team should be ready to modify the travel plan if necessary.

Personnel. Teams for field collection activities should be organized according to the extent of the collection program, the magnitude of personnel, funds, and facilities available, and the length of time needed to canvass the areas concerned. Plans should be prepared to complete the collection activities within the shortest possible period.

A team should consist of at least one rice worker who knows varietal types, soil types, diseases and insects, and the general environment (climate, soil, topography, diseases, and insect pests) in the area. The leader could be a botanist, a breeder, an agronomist, or an extension specialist trained for the assignment. He should be assisted by a field aide and a driver, one of whom is familiar with the dialect, local administration, and general conditions of the area, and therefore can serve as a guide.

Keep the team small for efficiency. Organize several small teams if the project warrants.

Sampling. How many samples to collect primarily depends on the varietal diversity existing in the area and on the extent of previous collections, if any. It will be difficult to estimate the number until the team has arrived in the area, talked to local workers and

farmers, and traveled extensively within the area. The number of samples can also be affected by the length of time available for collecting seed samples from the field or from farmers' storage bins. Pest incidence or climatic problems may limit the number of samples that can be collected during the time available.

Vigorous efforts should be made to collect obscure or primitive varieties grown in less travelled or previously uncollected areas. Avoid those routes which are so readily accessible that they are likely to have been covered in previous collection operations. Areas where serious soil or endemic pest problems exist may be rich in useful germ plasm.

For each named variety in an area, more than one seed sample should be collected when the team leader feels that there are recognizable differences between farmer's plantings of the same variety. These samples should be handled as different accessions.

It is useful to assemble a list of varieties in the national collection along with their source and a few essential features (crop season, maturity group, height, grain features) in an alphabetically indexed notebook. The information will help in judging whether a variety to be collected is a duplicate of an existing accession or not.

For each variety, the seed sample taken from plants in a field should not be less than 100 grams, so that sufficient seed is available for preliminary evaluation and storage and for maintaining a portion as seed file or reserve.

A larger sample (about 400 grams) is needed when seed is taken from a farmer's storage bin or from the local market. But quantities larger than 500 grams are cumbersome. The size of the container for collected seeds or

Morpho-agronomic features for identifying and distinguishing among rice varieties.

Pigmentation of plant parts (basal leaf sheath, leaf blade, internodes): green or shades of purple.

Pubescence of leaves and glumes: hairy vs. glabrous (smooth).
Leaf characteristics: dimensions and shape; angle of attachment; angle of openness (erect or drooping); degree of greenness; rate of senescence.

Culm characteristics: angle (erect vs. spreading); outer diameter; length; wrapping of internodes by sheath; number of tillers per plant.

Flagleaf features: dimensions and shape; angle.

Panicle features: degree of exsertion; number per plant; length; pattern of branching; clustering on secondary branches; number of spikelets on the panicle; threshability.

Grain (spikelet) features: length, width, shape, thickness; color of glumes; presence, or absence of brown furrows; presence or absence of awns; length of the sterile lemmas ("outer glumes"); grain weight.

Caryopsis (brown rice): presence or absence of red pigments in the seedcoats; dimensions and shape; translucency of starchy endosperm; chalkiness in the endosperm; hardness.

panicles should be designed to hold 200 to 400 grams of seed.

For wild species or primitive forms, an adequate number of plants must be sampled in order to represent the heterogeneous population. Maintain seeds from each plant as a sub-population without selection or purification.

Collect seeds from plants that are apparently free from disease or pest damage. However, when a variety has an outstanding feature such as grain quality or tolerance to an adverse factor, sample seeds from relatively healthy plants even though the variety is obviously susceptible to a disease or an insect.

As a rule of thumb, 30 to 40 well-filled panicles produce 100 grams of seed. The collector should look over the field and randomly sample panicles from many plants in different parts of a field rather than harvesting all of the panicles from a few plants. One panicle per plant from many plants will insure a better coverage of inherent or non-recognizable genetic variability within a variety.

In this aspect, genetic conservation through field collection differs from conventional selection and purification processes used by plant breeders. The objective of conservation is to include most of the genetic variability present in the variety because most farmer's varieties are not pure lines but conglomerates of morphologically similar lines which may differ in less obvious but essential features such as resistance to diseases or insects and grain characteristics. The separation of pure

lines based on subtle differences should be made later in the evaluation process.

Field records. Field records should include essential items such as district code, sample (or collection) number, date, variety name or the nearest local description, farmer's name, location of the field (site), and type of variety (maturity group, grain class, etc.). To these, when applicable, add information on soil type, cultural type (lowland, rainfed, upland, deep water, waterlogged), disease or insect reactions,

Rice Collection No. _____-_____
(*District*) (*Sample*)

Variety name(s) _____

_____
(*give species name, if needed*)

Maturity: _____ days, _____ season

Type: ___ lowland, ___ rainfed ___ upland

___ deep water, ___ water logged

Altitude: _____ meters

Locality: _____ village

_____ town/city

Grower's name: _____

Team or collector: _____ Date: _____

NOTES: (*on soils, topography, diseases and insects, special plant characteristics, etc., if warranted*).

_____

_____

_____

Accession no.: _____
(*given by national center*)

A sample of the field record form.

topographical features of the site, seed source (if other than the farmer's field). Record only those items which have significance or future value.

For obscure varieties or primitive forms without a name, enter the collection number as the name.

The information may be entered on pre-numbered sheets printed in duplicate copies or on a pre-stamped form of the seed envelope (or bag). If a separate recording sheet is used, make sure that the same number is entered on the sheet and on the seed envelope. A copy of the record sheet may be stapled to the seed envelope or enclosed in the envelope (if seed is dry). If information is written on the envelope, it should later be transferred to a record book when the seed samples are processed at the laboratory. Use consecutive sample numbers for seeds collected from the same district in different crop seasons.

Equipment. Prepare a check list of equipment and supplies during the planning stage. Check off each item before setting out on the field trip. You will need:

1. A motor vehicle with four-wheel drive. The team needs a rugged and versatile vehicle to reach remote areas. The vehicle should carry the necessary accessories such as spare tires, tools, additional gasoline tanks, and flashlights.

2. Record forms, seed envelopes, cloth bags, tags, writing pens, stapling machine and stapling wires, and other supplies. All paper materials should be durable and usable even when ex-

posed to moisture. All printing and writing ink should be indelible.

3. Chemicals. Insecticide and drying agent are vital for protecting seeds against the two principal enemies of seed viability: insects and moisture. Diazinon, DDT, and BHC are commonly used to treat the seed samples. Use dehydrated silica gel or calcium chloride or calcium sulfate to help dry the seed.

4. Official papers. Official letters, printed stationery, identification cards, maps, and charts come in handy.

5. Medicines, drinking water, food supplies, and camping equipment. The usual items needed in camping can also be used by a collection team.

The project proposal. A good project proposal shows the need for the field collection, explains where it will be done and what type of varieties will be collected, and gives the details of how it will be carried out.

1. Begin the project proposal with a review of past rice collection activities in the country.

2. Describe the areas to be covered along with a statement about the magnitude of genetic diversity and the travel plan to such areas. If possible, supplement the statement with maps showing the areas and the route of travel. Assign coded numbers to the different areas. You should consult with local authorities about geographic distribution and varietal diversity before planning a collection program.

3. Describe the varietal types to be collected as fully as possible. The principal types to be collected in an area

will be determined by what is believed to be available and useful to a local or national breeding program. Provide an estimate of the number of samples to be collected.

4. Specify when the collection will be conducted. Usually the period will be related to the crop season in the area.

5. Give the number of teams and the composition of each team. How many to organize depends on the extent of the collection program, the amount of personnel, funds and facilities available, and the length of time needed to canvass the areas concerned.

6. List the equipment and supplies needed: Vehicles and accessories, record forms, seed envelopes, stapling machines, chemicals, etc.

7. Itemize the budgetary requirements: Estimated transportation costs, traveling allowances of the collection team, equipment and supplies, mailing cost of seed samples, and miscellaneous expenses.

Operations related to field collection

Communication with local officials. Well before field operations begin, the project leader should officially communicate with the local officials and ask them to supply information on communication facilities, the approximate harvesting period, climatic conditions, extent of varietal diversity, local customs, and local assistance available. Information on local preference for grain quality and prevalent pests or

soil problems also is helpful. A questionnaire may be sent containing all pertinent items about which information is needed. The local officials should also be requested to provide a working map for the area concerned. Enclosing a self-addressed and stamped envelope along with the questionnaire will be helpful in obtaining information.

The local contact could be a district agricultural officer, extension worker, town magistrate, or a village chief. An experiment station operating in the area can serve as an effective link with the appropriate local official. The local official should be informed about the approximate date of arrival of the collection team so that one or more persons may be present to give the necessary assistance. Adequate time should be allowed to complete the communication process which may require more than one exchange of letters.

Steps in collecting seed. Seed samples can come from farmer's field, farmer's storage bin, or the local market. The ideal source is the farmer's field, but sometimes circumstances such as limited time for sampling or a miscalculation of the maturity period may compel the team to gather seed samples from the other sources. Occasionally, the team leader may ask the local extension worker or village leader to gather seed samples from the grower and mail the samples to the station. Samples other than from the farmer's field should be large enough to guard against a reduction in seed viability during the post-harvest period due to humidity or insect infestation.

The collector should sample at random covering an adequate number of plants in a field or several seed bags (or layers in a bin) to include, as much as possible, the inherent genetic base of the variety. In collecting seed from a field, the collector should walk across a field while taking panicle samples. While doing so he can identify important features such as levels of disease or insect resistance (or individual plants resistant to a pest) or leaf discolorations associated with problem soils or low temperatures.

While sampling, it is impractical to attempt to completely avoid gathering duplicate samples of the same variety. Therefore, it is helpful to enter the name and district number of each accession in the indexed record book when a sample is collected. Thus you can readily check the variety to be collected against the list of those already collected during the preceding days or those already in the national collection. As a guiding principle, if a variety has the same name and essential features as another variety from the same district or village, you need not collect a second sample. But, for varieties with the same name and features grown in ecologically distinct sites, you should sample in both locations, because they may be different eco-strains of a variety.

Obvious duplicate accessions can be sorted out more effectively at the national or regional center during the preliminary evaluation process. Field collectors therefore, need not spend too

much time checking minute details during the limited period available for field sampling.

Handling collected samples. If panicles are collected, it is not necessary to thresh and clean them during the collection period. But the team workers should attempt to dry the panicles or seeds as much as possible in the sun or with a drying agent such as silica gel or by allowing ample aeration within a sample. Seed envelopes should not be tightly sealed when the seeds are moist. When the seeds are dried to about 15 percent moisture or less, apply a light dose of insecticide to the seeds to guard against insect infestation.

After collecting in a district is completed thresh the panicles of each sample. Pack the samples in small lots and place them in a cloth bag, plastic bag, or strong paper bag to facilitate sorting later on. When collecting in one or two districts is completed, send the samples to the national or regional center promptly for further drying to a safe level to preserve seed viability.

Registration and storage of collected samples. At the regional experiment station or the national center, the collection and evaluation staff should assemble the collected materials, arrange the samples according to district number and alphabetical order of variety names (or assigned numbers for nameless samples), and check both previous and current records so that duplicate samples can be identified by comparing the grain characteristics and so that

the obvious duplicate samples can be eliminated from the register for new accessions.

Discard the duplicate sample when two collected samples have 1) an identical name or very similar names, 2) identical grain features, maturity, and other morpho-agronomic features described in the field record book, and 3) the same or neighboring places of origin. After duplicate samples are identified and discarded in the first round of comparisons, the remaining samples should be entered in an overall register and assigned an accession number. The accession number should be given consecutively from year to year and not repeated.

In registering the accessions, the district number and collection (sample) number should also be entered. The record sheets should be filed according to the district and collection numbers.

A small seed sample should be set aside, treated with an insecticide and filed as the representative for the accession concerned.

Before storage, the seed sample should be cleaned, sun-dried or heat-dried (40 C, with a dehydrating agent in the container or in an airconditioned room) to 8 to 12 percent moisture content, dusted with an appropriate insecticide (DDT, diazinon, or BHC), and stored in an airtight container. Placing an ample amount of dehydrating agent such as silica gel, along with the seed will help maintain seed viability. Extra seed samples of several accessions obtained in sizeable quantity and treated in the same manner should

be stored and tested periodically to provide information on seed viability. Two essential conditions in extending the viability of seeds are low humidity and constant temperature (from subfreezing to 25 C).

Storage of duplicate samples at international centers. The collected seed samples have unknown but great potential value. Therefore, after drying and treatment with insecticide the samples should be divided and at least one duplicate should be airshipped to one or more international gene banks such as the International Rice Research Institute and the U.S. Department of Agriculture for safekeeping. Include the variety name in both English and native characters (alphabets), site of collection, and other pertinent information with the seed. The international gene bank should provide assurance that the originating country may retrieve a portion of the original seed sample, if needed, and that the center will observe the conventional rules for the protection of plant breeder's rights.

Preliminary screening and seed increase

The preliminary screening and seed increase of collected samples is a primary responsibility of the national or district center. The objectives of such operations are to eliminate obviously duplicate samples; to multiply enough seed for systematic screening, for distribution to other centers, and for medium- to long-term storage; and to provide information for selecting en-

tries for further screening or testing. The extent of preliminary evaluation will depend on the technical and financial resources available, the need for identifying certain traits, and the range of genetic diversity included in the collected materials. The operations should be performed within 1 year (if the environment is hot and humid and no airconditioned seed storage facility is available) or within 2 years from the date of collection, so that the seed samples retain more than 50 percent viability. When an adequate seed storage facility is available, the operations may be extended over several years to spread the work load.

Number of strains to be grown and cultural practices. Before any planting, the collection and evaluation staff of the national center should eliminate duplicate samples and register the new accessions (see Registration and storage of collected samples, p. 19). Any accessions that are suspected to be duplicates can be grown side by side to facilitate comparison.

The number of plants of each accession to grow depends on the need for increased seed and the available experimental facilities. Since repeated cycles of seed increase are not practical and the process may lead to genetic changes in the composition of the population, it is better to carry out one efficient cycle of seed increase and preliminary evaluation by planting enough plants for further evaluation, seed distribution, and storage. Since some of the collected samples may not be well adapted to the environment in which

the seed is increased, the amount of planting material should be based on an expected yield no greater than 2,000 kg/ha, using one seedling per hill in a transplanted culture or more widely spaced drill-planting in a direct-seeded culture. Complete fertilizers should be applied to insure adequate plant growth but at a rate that will not induce serious lodging. A relatively wide spacing will be helpful in separating lodged plants. Other cultural and plant protection practices should be designed so that sufficient healthy seeds can be obtained.

Plot size. Forty single-plant hills in a transplanted culture or two 5-meter drilled rows is the minimum number necessary for each accession. Fifty to eighty plants is about optimum. Before seeding, it may be useful to test the germination of accessions that were collected prematurely or over-ripe, or that came from storage bins or market places. When only a few viable grains of an accession are available, grow them in pots or special plots so that the preliminary seed increase and evaluation can be carried out on an adequate scale. Rows or plots of one or two standard varieties should be planted at regular intervals to serve as controls.

Accessions belonging to the same crop season or maturity group should be planted together at one date of seeding. Watch out for signs of seed-borne diseases and insects and take the appropriate control measures.

Observation and records. It is more efficient to measure and count a small

number of characters thoroughly and accurately than to have grand designs and incomplete recording over the whole collection. Distribute your workload evenly and adopt efficient recording devices to facilitate complete and uniform rating. Field books should be set up so that coded numbers or letters can be used to minimize recording time. Use an increasing scale of numbers to indicate the relative ranking of a trait from little to much or from desirable to undesirable.

The important morpho-agronomic characters and incidence of disease or pests should be recorded at various stages:

Young seedlings — rate of seedling emergence; leaf color.

Juvenile plants — rate of tillering; leaf length; leaf angle and color; color of basal leafsheaths.

Plants around maximum tillering — tiller number; angle (inclination) of tillers; leaf length, width, angle, hairiness, and color.

Plants at and shortly after heading — date of full heading and uniformity of heading among plants; plant height after full heading.

Plants during the grain-ripening stage — flagleaf length and angle; panicle exsertion; panicle features.

Grain features after harvest — length and shape; pigmentation of hull; awning; color of seedcoats; chalkiness of milled kernels; shape and symmetry of milled kernels.

Natural incidence of diseases and insects at all stages — kind; severity; stage of growth.

Typical coding scale

Coded scale	*Leaf blade color*		*Disease reaction*
No data*	Blank		Blank
0	None		Absent
1	Pale green	R	Very resistant
2	Chlorotic stripes	R	Resistant
3	Yellowish green	R	Mod. resistant
4	Green	M	Low intermediate
5	Dark green	M	Intermediate
6	Purple margins	M	High intermediate
7	Purple trace	S	Mod. susceptible
8	Purple	S	Susceptible
9	Dark purple	S	Very susceptible
+	Present		
×	Mixed		Mixed

* Or missing plot

Amount of seedstock to be saved. After the obvious duplicate samples are removed from the harvesting list, each plot (or accession) should be rogued for off-types. If more than one major morphological group exists within one accession, the two major groups may be separated and treated as sub-populations and given identifying numbers in the form of a suffix, for example, 2120-A and 2120-B.

For each accession, save 500 grams or more of viable seeds, if possible. This stock may be divided into several lots for storage at two or more centers, for systematic evaluation, and for

general distribution. If any accession shows promise of being high yielding, save a larger quantity of seed (1 to 2 kg) to facilitate its entry in yield trials. Such accessions should be distributed to other centers for further evaluation.

Seed storage

For safekeeping, be sure healthy seeds have a moisture content of between 5 and 11 percent, protect the seeds against insects and moisture, and store the seeds at a relatively constant and preferably low temperature. To reduce seed moisture to 9 percent or less, gently heating the seed at moderate temperatures (about 40 C, not over 50 C) with a drying agent (such as silica gel or calcium chloride) in an airconditioned room for 2 to 3 days is the safest and most efficient method. Fumigate seeds for insect control only when the moisture content of seed is below 12 percent. Other useful insecticides are diazinon and DDT or its analogs with short residual effect.

For short-term storage (2 to 3 years), seal the dried and treated seed in an airtight container. A glass jar with airtight cap, a plastic bottle with a stopper, or envelopes of bonded aluminum foil and polyethylene are suitable containers. The humidity and the temperature in the storage room can be maintained at a relatively low level (40% R.H. or below, 25 C or below) by insulating the walls and door of the room and by the use of an airconditioner or an electric dehumidifier.

For medium-term storage (5 to 10 years), use an airtight container containing a dehydrating agent and maintain the storage room at 30 percent relative humidity and a relatively constant temperature between 2 to 15 C.

For long-term storage, use vacuum cans and low temperature (sub-freezing to 10 C). For storage under freezing temperatures, the moisture content of the seed should first be reduced to 5 and 6 percent.

Glossary

accession. An addition (of a variety or a strain or a bulk population) to the national register of varieties obtained by field collection or exchange.

bulk. The growing and maintenance of genetically different plants in a population without separating them into pure lines.

collection. A collected sample.

cultivar. A variety.

eco-strains. Strains within a variety that have developed physiological differences in response to long-time growth and selection in distinct environments.

deep water field. A field that usually has at least 1 meter of standing water from tillering to flowering.

duplicate samples. Collected samples from different sources which belong to the same variety as indicated by name, site of collection or origin, and morpho-agronomic characters.

gene. The genetic unit controlling the inheritance of a character. A character may be governed by one or several genes.

gene bank. An institution that serves as a center of exchange and preservation for a large number of varieties.

genetic composition. The constitution and proportion of genetically different individuals in a population.

genetic variability. Differences among individuals within a species, or a smaller subdivision due to differences in genetic constitution (genotype).

germ plasm. The sum total of genetic material in a species.

line. A strain; a family derived from one plant.

lowland field. An irrigated field surrounded by levees.

off-types. Plants that differ in morpho-agronomic characters from the majority or representative plants of a variety.

population. A group of individuals (plants) within a species or a variety that are found at one site or field. Plants in the population may or may not be genetically alike.

primitive forms. Plants that show primitive features such as pigmented plant parts, long awns, lax panicles, extreme shattering, and perennial growth habit.

pure line. A line that has been made almost completely homozygous by repeated self-pollination and removal of off-types.

rainfed field. An unirrigated field surrounded by levees and depending on rainfall for moisture supply.

sample. Individuals taken from a population to represent it.

strain. A group of plants within a variety that share common, recognizable features in morpho-agronomic characters, physiological differences, or reactions to specific disease pathogens or insect pests. A strain may include several lines with similar features.

upland field. An unirrigated field without levees. Planting is made by direct seeding on granular soil.

variety. A group of cultivated plants within a species which is distinguished from another variety (group) by any characters (morphologic, physiological, chemical, or other) of significance to agriculture and which, when reproduced, retains its distinguishing characters. A variety may be derived from several pure lines which have many common features and are reasonably uniform in appearance (but not necessarily genetically pure).

water-logged field. A field which continuously has standing water and cannot be drained. The water level may not be deep.

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