

Instructions for the management and reporting of results for wheat program international yield and screening nurseries

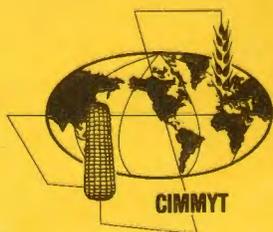
bread wheat ISWYN, ESWYT, IBWSN

durum IDYN, EDYT, IDSN

triticale ITYN, ITSN

barley IBYT, INBYT, IBON

septoria ISEPTON



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**PLEASE RETURN THE RESULTS
OF YOUR YIELD NURSERY AND
SCREENING NURSERY AS SOON
AS POSSIBLE AFTER HARVEST**

**LATE RETURNS LEAD TO SERIOUS DELAYS IN
PUBLICATION OF THE RESULTS AND REDUCE
THEIR VALUE TO WHEAT WORKERS THROUGHOUT
THE WORLD**

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PART I. YIELD NURSERIES

INTRODUCTION

The objectives of CIMMYT yield nurseries are: (1) to provide research workers who are developing new varieties with an opportunity to assess the performance of their advanced breeding lines over a wide range of climatic, cultural, and disease conditions, (2) to serve as a source of information on adaptation, (3) to allow local research and extension workers to compare the performance of new varieties from other countries, and (4) to provide a source of new and valuable genetic variability which cooperators may use directly or in crosses within their breeding programs.

The results of the international yield nurseries are statistically analyzed and published for general distribution. The value of these nurseries depends to a large extent on the quality of the data returned for analysis. Therefore, is important for cooperators to study carefully the following pages which contain directions for the conduct of various nurseries and note-taking techniques.

Any country collaborating in these tests is free to use any of the material included in the nurseries, either as parental material or as commercial varieties. *If material from the nurseries is released directly as a commercial variety, the originating institution must be recognized, as well as the country of origin.* Varieties originated from these nurseries and released for commercial production cannot be protected under patents or plant breeders' rights legislation.

These tests are a collective endeavor, and CIMMYT sincerely requests the cooperation of all interested persons or institutions. Success depends upon the information collectively contributed. It is recognized that there may be faults and limitations in the nursery system as currently established and any suggestions for improvement would be appreciated.

INTERNATIONAL SPRING WHEAT YIELD NURSERY (ISWYN)

The international Spring Wheat Yield Nursery is designed to test the adaptation of advanced spring wheat lines and varieties under a wide range of latitudes, climates, daylengths, fertility conditions, water management, and exposure to disease complexes. While it has been known for years that certain lines and varieties are much more broadly adapted than others, little systematic information has been collected regarding this important aspect of plant breeding. These experiments are designed to study the performance of some of the most important varieties and experimental material from the major wheat growing areas of the world, and under the environmental conditions of many countries. Results of previous nurseries have shown that it is possible to produce lines and varieties of nearly universal adaptation, as well as those adapted to only a narrow geographic range.

ELITE SELECTION WHEAT YIELD TRIAL (ESWYT)

The Elite Selection Wheat Yield Trial is designed to test the adaptation of high-yielding, disease resistant advanced lines bred by CIMMYT. The test is conducted in limited locations around the world. The most promising materials identified in ESWYT are then further tested in ISWYN.

INTERNATIONAL DURUM YIELD NURSERY (IDYN)

The International Durum Yield Nursery is designed to measure the performance and adaptation of current and new durum varieties and lines in a wide range of latitudes, climates, fertility conditions, water management, and disease complexes. Experience gained from the ISWYN and ESWYT has been useful as a basis for designing the present durum nurseries.

ELITE DURUM YIELD TRIAL (EDYT)

The Elite Durum Yield Trial (EDYT) is designed to measure the yield potential and adaptation of superior durum lines that have evolved from tests conducted under irrigation and excellent cropping conditions in northwest Mexico. The durum lines included constitute the final results of a continuous selection of segregating materials, from the initial F₁ crosses to advanced generations (F₅-F₈). These materials have been subjected to numerous diseases and varied growth environments, including both summer and winter seasons in Mexico.

The primary aim of the EDYT is to develop durum materials having greater yield potential for areas and conditions appropriate for maximum expression. Several new durum varieties that have evolved from the EDYT have been released by national crop improvement programs.

INTERNATIONAL TRITICALE YIELD NURSERY (ITYN)

Worldwide interest has been shown in the man-made crop plant called triticale, a plant produced by crossing wheat and rye. Initially a biological oddity, triticale has now reached the stage of having valuable commercial capabilities in several countries.

Due primarily to the work of members of the Plant Science Department of the University of Manitoba, Winnipeg, Canada, and more recently to CIMMYT working in collaboration with the Canadian group, many of the germplasm deficiencies of triticale have been overcome. By improving the growth habit, plant type, disease resistance, and fertility, the productivity of triticale has risen spectacularly and now outyields wheat in several environments.

The first triticale yield nurseries were designed to assess the performance of advanced breeding lines over a wide range of production conditions and to compare them with other cereals. The performance of triticale lines in these nurseries provides the information necessary to further improve its adaptation as a crop in national and CIMMYT breeding programs.

INTERNATIONAL BARLEY YIELD TRIAL (IBYT)

The International Barley Yield Trial is designed to test the adaptation of superior barley lines and varieties produced world-wide by national programs. Although the aim of the CIMMYT barley program is to improve barley for direct human consumption, barley varietal improvement has been more widely applied to the production of malting and feed barleys. Hence, all three types are included in this test.

Since barley is a diploid, it has some disadvantage in breadth of adaptation of individual lines and varieties as compared with other cereal crops. It is hoped that this nursery will assist in establishing wider adaptation in barley, thereby leading to an increase in adaptive capacity. This nursery contains both hulled and hull-less grained types, and also early and late types. Yields should therefore be judged on the basis of comparisons within the different classes. When comparing among classes, equal production inputs should be applied to avoid biased results.

INTERNATIONAL NAKED BARLEY YIELD TRIAL (INBYT)

The International Naked Barley Yield Trial has been assembled with varieties and lines carrying the hull-less grain character, and is designed only for distribution in places where these types of barleys have a potential for being used as human food.

In the past these materials were included in the International Barley Yield Trial, but yield comparisons were often biased and misleading. It is hoped that enough information will result from this nursery so that future breeding objectives can be clearly established.

THE PLAN OF THE EXPERIMENT

The nurseries consist of a set number of lines and/or varieties which are replicated 3 times. Six-row plots are used and the seed is packaged individually for each row of the six-row plot. The variety or line number and the plot number are identical in the first replication, but the varieties or lines have been assigned at random. The varieties/lines are then randomized in replications 2 and 3, and are arranged according to a randomized complete block design. In the seed shipment, the seed packets have been prearranged according to the above design to facilitate planting.

The seed contained in each envelope should be sown in a 3 meter row (9.4 feet) with the distance between rows left to the discretion of the cooperator. However, plot dimensions must be recorded on the general information sheet so that CIMMYT can compute variables in terms of unit area. The quantity of seed in each envelope varies with the nursery, variety or line, and from year to year. This adjustment is made by CIMMYT to allow for a uniform and optimum seeding rate. The precise information on seeding rates for any nursery is available from the coordinator. Should any other type or size of plot be used, please notify the coordinator when returning pertinent data.

Durum wheat seed used in these nurseries is nearly 30 percent lower in the number of grains per gram of seed than bread wheat seed and seeding rates for durumms have been adjusted accordingly.

If it is necessary to store seed before seeding, care must be taken to protect it from insect pests.

Selection of varieties and lines

An effort has been made to include in each nursery a balance of representative commercial varieties from the important wheat regions of the world, as well as new lines. Some of these entries may be too early or late, too tall or dwarfed, too light sensitive, or susceptible to disease. This will mean that the nursery will be difficult to handle in certain locations, but the data thus obtained will be extremely valuable to the success of the effort.

Local check variety

Empty envelopes for packaging a local variety are provided for each replication. Each year the amount of seed required in each local check packet will vary. The required amount of seed for the local check can be determined from the amount contained in the envelope of the previous entry.

The name of the local check should be entered in both the collaborator's field book and the copy to be returned to the coordinator. Please do not substitute other varieties in the experiment, as this considerably complicates the statistical analysis. If you wish to compare additional local varieties, simply place them at the end of each replication. They will be part of the experiment, but will not hinder the statistical analysis.

Planting date

There is considerable variation in the maturity of the entries included in some CIMMYT nurseries. It is therefore difficult to suggest a specific date of planting for each location. As a guide, however, it can be said that many of the entries included are of the same general maturity as the variety Siete Cerros, a variety known to many collaborators. A few entries will be from 7 to 14 days later than Siete Cerros, particularly in locations with short daylengths, whereas some others may be 14 to 21 days or so earlier at each location.

Nursery management

It is strongly urged that CIMMYT nurseries received the inputs necessary (fertilizer, water, weed control, etc.) for maximum expression of their yield potential. New advances in germplasm

development are more quickly made by selecting and crossing material that responds well to high inputs. The reason: this material also tends to do better than traditional varieties under low input production conditions. To facilitate the identification and selection of material with high yield potential, however, requires the growing of the material under high input conditions.

Protection from birds and other animals

Damage by birds and other animals will nullify the value of any experiment. Therefore, co-operators are urged to make certain that their experiments are protected from such pests. The methods employed to minimize the effects of these factors is left entirely to the discretion of collaborators. Early varieties are usually most adversely affected.

SUBMITTING VARIETIES OR LINES FOR TESTING

A number of the entries in CIMMYT nurseries will not change over a period of years. Those that are changed will be either replaced by materials from CIMMYT or entries submitted from collaborating national programs. Any scientist wishing to submit lines or varieties for inclusion in the forthcoming years' tests should ship approximately 300 grams of seed of each potential entry to:

INTERNATIONAL WHEAT NURSERIES
Centro Internacional de Mejoramiento de Maíz y Trigo
Apartado Postal 6-641
Delegación Cuauhtémoc
06600 México, D.F., MEXICO

The package or envelope must be labelled "*Experimental Wheat Seed - No Commercial Value*". In all cases the shipment of seed should be made via air express or airmail, and *should reach Mexico City no later than the 15th of September* to be increased during the winter in Sonora, Mexico. It is not always possible to include all varieties submitted for trial. The final composition of a yield nursery will be determined by CIMMYT.

RECORDING THE EXPERIMENTAL DATA

General instructions

The seed box that is shipped to each cooperator includes duplicate sets of forms for recording the characteristics described in the following pages. These forms should be completed as soon as the experiment is harvested. Cooperators may keep one set for their personal use and the other should be returned by airmail to the coordinator, i.e. International Wheat Nurseries at CIMMYT, Mexico (see address given above). The cooperator's copy and the copy to be returned are clearly marked

Attached to the front of the first data sheet is a form requesting general information about the experiment (a copy of this form is located at the end of this publication). This form provides space for reporting latitude, longitude, elevation, planting date, rainfall, irrigation applied, fertilizer used, etc. Please provide as much of the requested information as possible, for it is extremely useful in interpreting the results of the trial.

Notes should be taken for each replication of each variety, if possible, because this will allow a more adequate statistical treatment of the data. Unlabelled columns are left in the data sheets for any additional data that may prove helpful. Collaborators are urged to include all additional data in which differential reactions are observed.

CIMMYT asks that data be reported using the metric system, except in the case of rust data. The latter should be taken in the usual manner (described on pages 6-9). Clearly indicate the units in which data are taken.

Grain yield

Grain yield is to be determined on the 4 central rows of each 6-row plot in all replicates (see Figure 1). To reduce error from bird damage and shattering, each variety should be cut no later than a week after its physiologic maturity (when the peduncles have turned yellow). The grain may be either dried to a uniform moisture content in bundles before threshing, or if samples are threshed with high moisture content, all grain samples should be dried to a uniform constant moisture content before grain weights are taken and recorded. If moist grain samples are weighed, the moisture content should be determined for each sample using a reputable electric conductivity moisture meter, and sample weights corrected to a uniform 12 percent moisture basis.

Regardless of methods used, an outline of the method employed should be returned with the report to the coordinator. Grain weights in all cases should be determined using samples that have been previously cleaned of chaff. Grain weights from the 4 center rows of each 6-row plot, after being cleaned and corrected for moisture as described above, are to be recorded in grams. Please clearly indicate on the data sheets if any modifications are made in plot size or shape, area harvested, etc.

Test weight

The grain density (of the cleaned grain samples used to determine yields) is commonly measured as the weight in kilograms per hectoliter. Either pounds per bushel or kilograms per hectoliter can be employed, depending on the equipment available for making the determinations. *Please clearly indicate the units used.*

1000 grain weight

Because some cooperators may not possess equipment to determine test weights, or if there is insufficient seed to do so, the weight of a 1000 grain sample can be used. 1000 grain weight is usually expressed in grams. Should any other units be used, please indicate clearly in the record sheets.

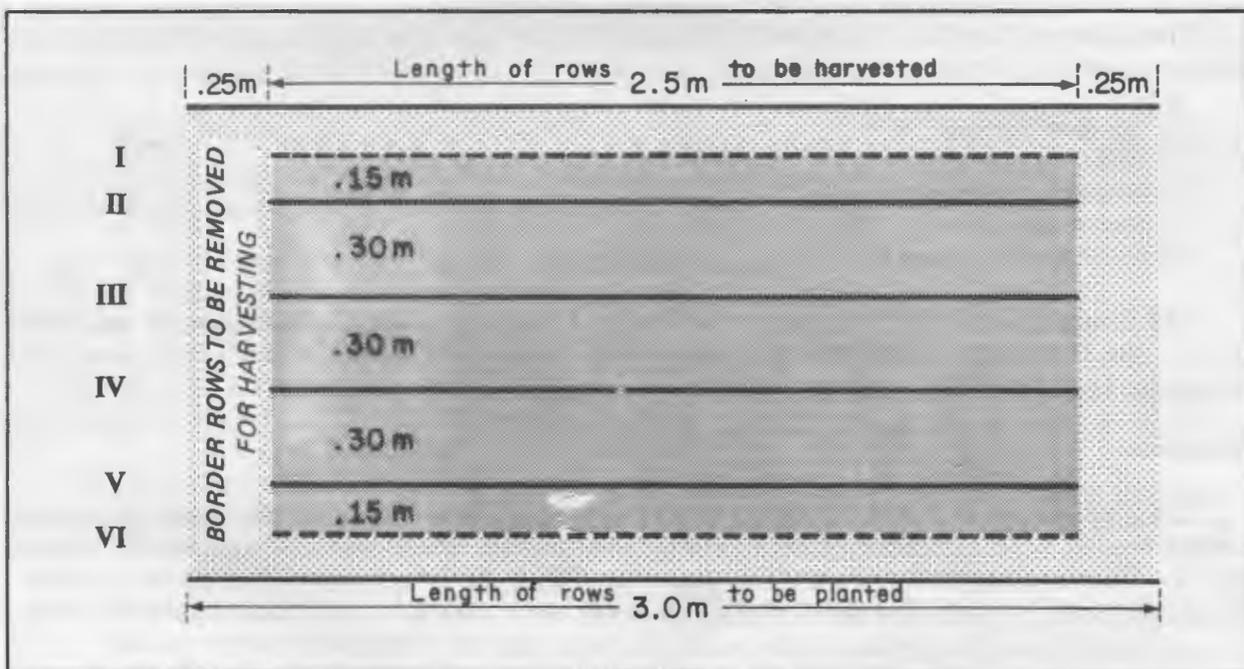


Figure 1. Layout of International Yield Nurseries

Maturity

Two measurements of maturity are requested. These are (1) the number of days from germination to flowering and (2) the number of days from germination to physiological maturity.

A variety shall be considered to be flowering as soon as 50 percent of the culms are fully headed (spikes fully exerted). The physiological maturity is considered to be the date when 50 percent of the peduncles are ripe (yellow).

Straw

Two notes on straw characteristics should be recorded. They are:

- (1) **Height.** The average height of the plants in a row (in centimeters or inches) should be determined when the grain is beginning to form. The distance from ground line to the tip of the terminal spikelets of the spike is considered plant height. Indicate clearly the units used.
- (2) **Lodging.** Lodging can be recorded on a 0-9 scale when the plants are physiologically mature. The 0 value equals fully upright and 9 equals fully lodged.

Shattering

Shattering can be recorded on a 0-9 scale (where 0 equals no shattering and 9 equals fully shattered).

Neck break

In some varieties there may be a weakness of the rachis at the "neck" or near the base of the spikelet. In such cases, the entire spike or entire spikelet (base of spike) is frequently broken and falls to the ground. Notes should be taken on the percentage of plants showing this flaw.

Frost damage

The differential damage to the seedlings caused by frost should be noted in one of the unlabelled columns using the following suggested scale:

- (1) No frost damage.
- (3) Slight damage.
- (5) Moderate damage.
- (7) Severe damage.
- (9) Very severe damage.

The damage caused by frost during the time of flowering (or after) should also be indicated to show the percentage of sterility of grain severely frozen. The dates on which frosts occurred should also be recorded.

Cereal rusts

The method outlined here for taking notes on stem, leaf, and stripe rust infections was recommended by Dr. W.Q. Loegering (USDA International Spring Wheat Rust Nursery, 1959) for use with the International Rust Nursery. This recommendation has been adopted for the sake of uniformity in compiled data. If another method is used, an explanation should accompany the data.

Field notes on cereal rusts describe severity (percentage of rust infection in the plants) and response (kind of infection).

Severity

Severity is recorded as percent of infection according to the modified Cobb scale. Since severity is determined by observation, readings cannot be absolutely accurate. Therefore, below 5 percent severity the intervals used are trace (tr) to 2. Usually, 5 percent intervals are used from 5 to 20 percent severity and 10 percent intervals for higher readings.

The Rust Severity Scale diagram on the next page shows six degrees of infection and may be useful in estimating the percentage of rust infection on a leaf or stem. The shaded spots represent rust, and the figures represent the approximate rust percentage computed on the basis of the maximum amount of surface covered, as shown in the 100 percent figure. This figure represents 37 percent of actual surface and is arbitrarily selected as 100 percent infection.

Response

The response of a variety or line refers to the type of infection and should be recorded by using only the following capital letters:

- O No visible infection of plants.
- R Resistant. Necrotic areas with or without minute uredia present.
- MR Moderately Resistant. Small uredia present surrounded by necrotic areas.
- MS Moderately Susceptible. Medium uredia with no necrosis; possibly some distinct chlorosis.
- S Susceptible. Large uredia with no necrosis and little or no chlorosis present.
- X Intermediate. Variable sized uredia, some with necrosis and/or chlorosis. Under special circumstances it may be desirable to use VR (Very Resistant) or VS (Very Susceptible). Usually, distinctions between VR and R, or VS and S are difficult to make and therefore of little value.

Combining severity and response readings

Readings of severity and response are recorded together, with severity first. For example:

- TR trace severity of a resistant type infection.
- 5MR 5 percent severity of a moderately resistant type infection.
- 60S 60 percent severity of a susceptible type infection.

Variability in reaction.

Usually, a single severity and response reading gives an adequate picture of the reaction of a line or variety; occasionally there is obvious variability in reaction within a line. This variability may appear in several forms:

- (1) Clear-cut separation of plants into 2 or even 3 classes.
- (2) A range of reaction from plants without clear-cut separation into classes.
- (3) A range of reaction on each plant.

The first and second forms of variability may result from either segregation or seed mixture, while the third may result from either race mixtures in the field or an X-response of the variety.

It is usually impractical to try to determine what causes the variability, but it is quite simple to record whether the variability is represented by a clear-cut separation of plants into classes or by a range in the reaction as follows:

- “ , ” Segregation of seed mixture. A comma separating two severity and response readings indicates that the plants fall into clear-cut classes with readings as given. For example, 5R, 40S means that there were two classes of plants in the row with respect to reaction to rust; one group 5R and the other 40S.

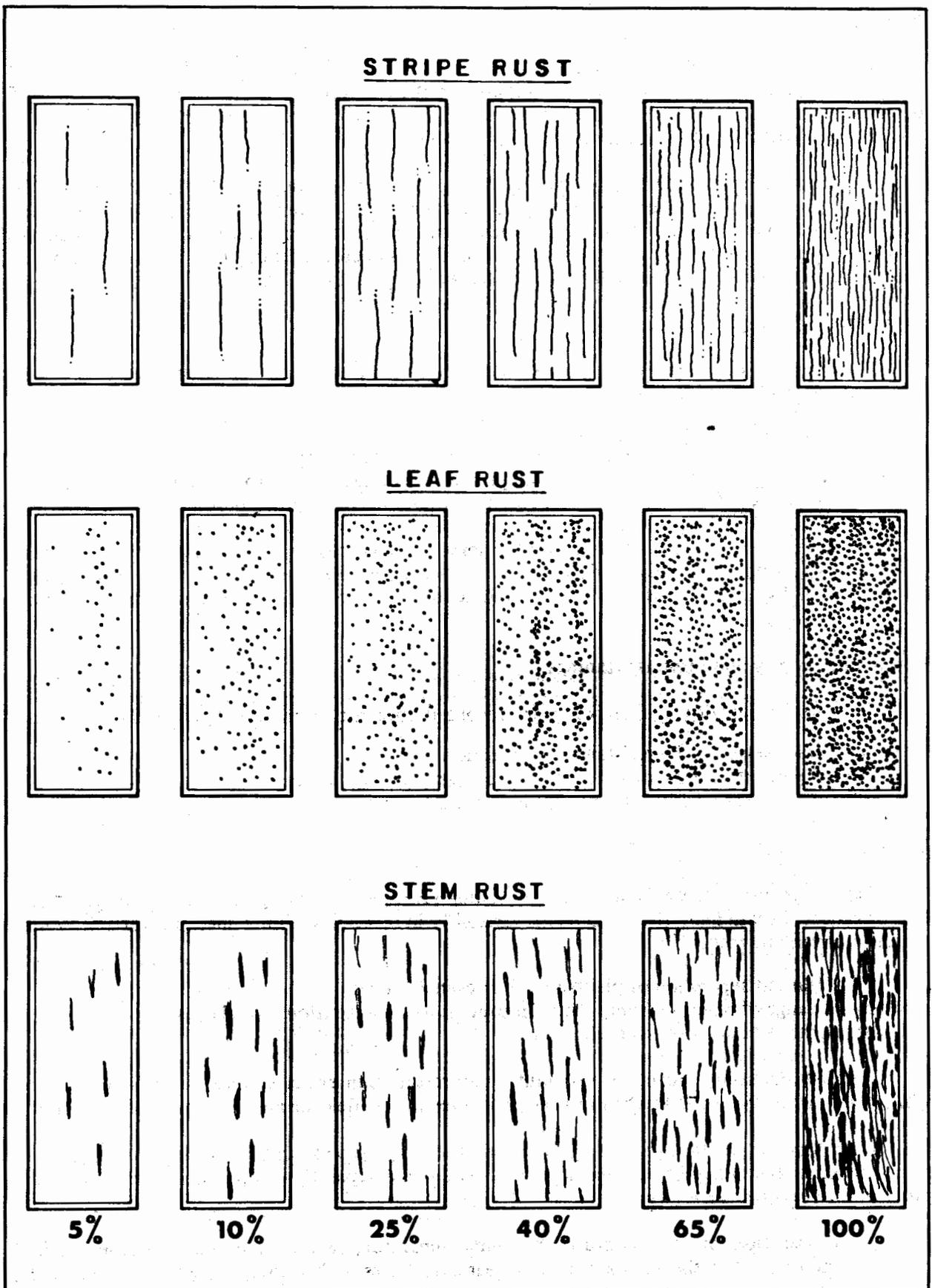


Figure 2. Rust Severity Scale

“ – ” Range in reaction. A dash separating two readings indicates a range in severity and response of the plants in the row. For example, 15R-5S means that there was a range of severity and response to rust from 15R to 5S.

When using these combinations, the first reading is understood to represent the predominating class. If it seems desirable to give information on the number in each group, it may be done in the following manner: 30p5R, 4p50S meaning that 30 plants had a severity and response reading of 5R and 4 plants were 50S.

Readings difficult to make

“ e ” Escape. Often a variety or line will have little or no rust, but there is a doubt that it is truly resistant either because it matured early or for other reasons. Thus “Oe” indicates that there was no rust in the variety, but there is a doubt that the variety was as resistant as “0” would indicate.

“ n ” Very often one disease, such as stripe rust or a leaf spot, is so severe that the taking of notes on other diseases is impossible. When this is the case, it can be indicated by using the letter “n”. For example, if stripe rust kills the leaves before leaf rust can develop, then the note for leaf rust will be “n”.

“ – ” When data cannot be recorded on an entry for any other reasons, the space for the note should be marked with a dash.

Recording disease data other than rust reaction

Sometimes diseases other than rusts develop in the nursery and it is possible to obtain good data. If such data are recorded, a key to the symbols used in the recordings should accompany the records returned to the coordinator.

Foliar diseases (other than the rusts)

Unlike the standardized rust scale, data scales for *Septoria*, *Helminthosporium*, powdery mildew, scald, and other diseases have never before been internationally standardized. However, E.E. Saari and J.M. Prescott (CIMMYT regional pathologists) have developed an easy, simple, and reliable method of evaluating foliar reactions. The basic focus of their scale is the mid-point of the plant.

To apply the scale, grasp the plant half-way up. Lesions at this point, but not above it, indicate an intensity of 5. Disease distributed above this point is given values from 6 to 9 (most intense). Disease distributed below this point is given a value from 1 to 4. A value of 0 (zero) is reserved for no infection. A precise description of this scale is given in Table 1 (page 10). See also the diagram on page 11 which shows the 0-9 scale for appraising the foliar intensity of wheat, triticale, and barley diseases.

In cases where it is desirable to record the degree of infection in the ear, a slash mark can be drawn and the percentage of ear infection given (e.g. 6/50 would mean a leaf infection just above the mid point with 50 percent of the ear infected).

Other diseases and pests

Infections of the head, spike, root, and crown, as well as insect damage should be recorded as percentage of infection or damage, or a key to the symbols used in recording such data should accompany the record.

TABLE 1. FOLIAR DISEASE SCORING SCALE (0-9)

- 0 Free from infection.
- 0e Free from infection but probably represents an escape.
- 1 Resistant: Few isolated lesions on lowest leaves only.
- 2 Resistant: Scattered lesions on the second set of leaves with the first leaves infected at light intensity.
- 3 Resistant: Light infection of lower third of plant; lowest leaves infected at moderate to severe levels.
- 4 Moderately Resistant: Moderate infection of lower leaves; scattered to light infection extending to the leaf immediately below the mid-point of the plant.
- 5 Moderately Susceptible: Severe infection of lower leaves; moderate to light infections extending to the mid-point of the plant; infection does not extend beyond mid-point of plant.
- 6 Moderately Susceptible: Severe infection of lower third of plant; moderate degree on middle leaves; scattered lesions beyond the mid-point of the plant.
- 7 Susceptible: Severe infection on lower and middle leaves; infections extending to the leaf below the flag leaf, or trace infections on the flag leaf.
- 8 Susceptible: Severe infection on lower and middle leaves; moderate to severe infection of upper third of plant; flag leaf infected in amounts more than a trace.
- 9 Very Susceptible: Severe infection on all leaves and the spike infected to some degree. Spike infections are scored on a scale as the percentage of the total area covered. The percentage ear infection figure follows the numerical leaf infection score and is separated from it by a slash, e.g. 6/50.
- n Used to indicate no scoring possible due to necrosis as a result of other diseases or factors.

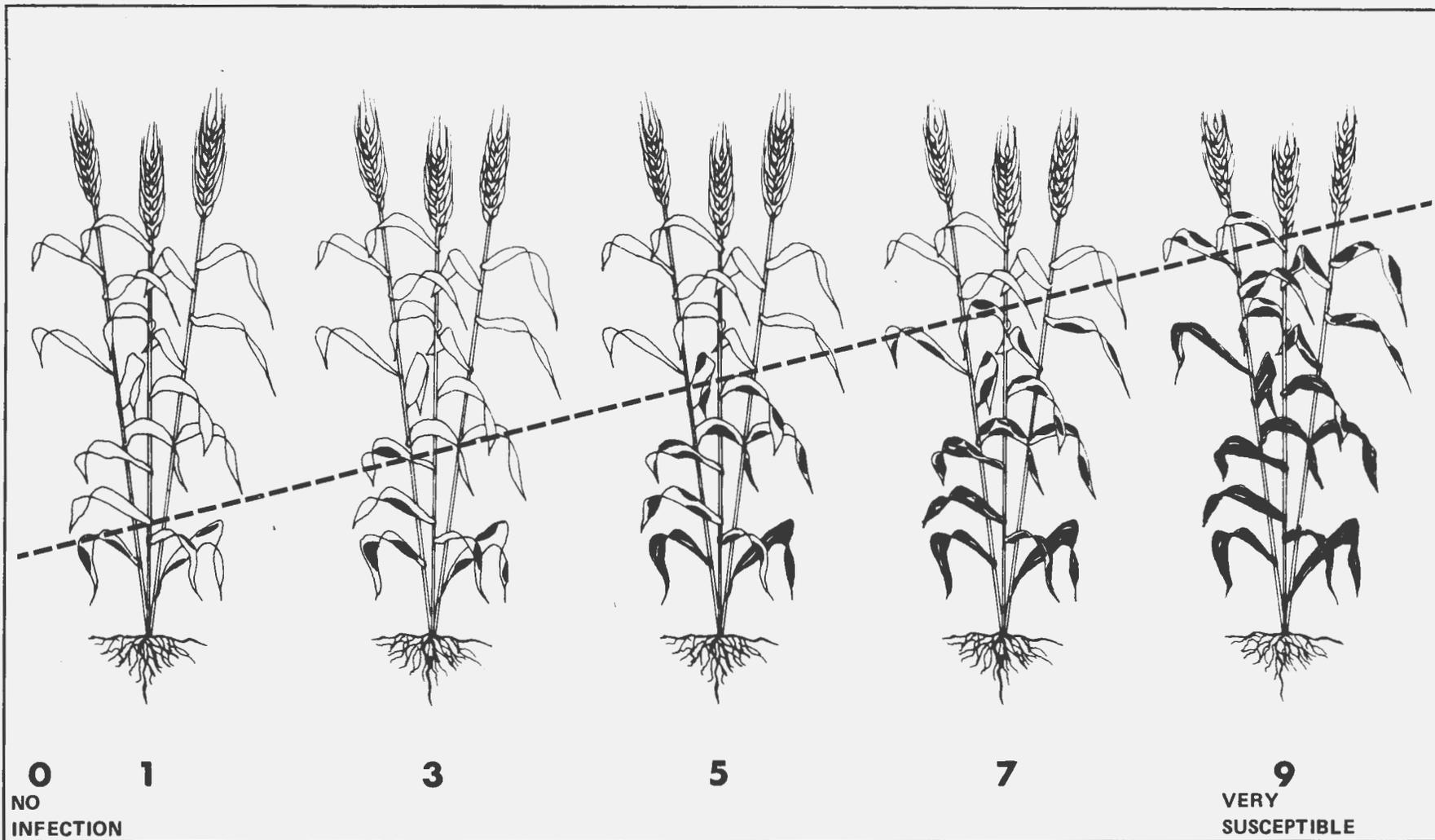


Figure 3. Scale for Appraising Foliar Intensity of Wheat, Triticale, and Barley Diseases



PART II. SCREENING NURSERIES

INTRODUCTION

The objectives of CIMMYT screening nurseries are: (1) to provide cooperating scientists with an opportunity to assess the performance of new advanced lines originating from wheat, triticale, and barley breeding projects, (2) to supply cooperators and CIMMYT with valuable information on the performance of new materials under a wide range of climatic and disease conditions, and (3) to provide a source of new genetic variability which cooperators may use directly or in crosses within their breeding programs.

Any country collaborating in these tests is free to use any of the material included in any nursery. When directly released as a commercial variety, the country of origin should be recognized. Varieties originating from these nurseries and released for commercial production cannot be protected under patents or plant breeders' rights legislation.

The results of the screening nurseries are statistically analyzed and published for general distribution. The value of these nurseries depends to a large extent on the quality of the returned reports. Therefore, it is important for cooperators to study carefully the following pages which contain directions for the conduct of various nurseries, note-taking techniques, and the return of summarized data.

These tests are a collective endeavor, and CIMMYT requests the cooperation of all interested persons or institutions.

INTERNATIONAL BREAD WHEAT SCREENING NURSERY (IBWSN)

The International Bread Wheat Screening Nursery (IBWSN) is designed to rapidly assess a large number of advanced generation (F3-F7) lines of spring wheat under a wide range of latitudes, climates, daylengths, fertility conditions, water management, and (most importantly) disease conditions. The distribution of these nurseries is deliberately biased toward the major spring wheat regions of the world where the diseases of wheat are of high incidence. Each year the nursery is prepared and shipped to cooperators from Ciudad Obregon, Sonora, Mexico. Shipments are usually made during July-August.

INTERNATIONAL DURUM SCREENING NURSERY (IDSN)

The objectives of the IDSN are similar to those of the IBWSN, that is, to evaluate rapidly a large number of advanced generation lines under a variety of disease and climatic conditions.

The nursery is prepared yearly from the Cd. Obregon, Sonora harvest and shipped to interested cooperators in the major durum wheat areas of the world.

INTERNATIONAL TRITICALE SCREENING NURSERY (ITSN)

CIMMYT offers a screening nursery for advanced generation triticale materials. Initially, the International Triticale Yield Nursery was used to evaluate new material, but in recent years (with more rapid triticale germplasm advancement) a screening nursery has been distributed to evaluate advanced lines under an array of conditions. This information is vital to development of commercially acceptable triticale varieties with broad adaptability and good disease resistance.

INTERNATIONAL BARLEY OBSERVATION NURSERY (IBON)

The objective of the International Barley Observation Nursery is to circulate a large number of newly derived lines of barley for assessment of their adaptation, resistance to various diseases, and general performance in difficult environments. Nurseries are distributed to areas in which barley is cultivated, particularly to those countries where the crop is used as human food, and to locations where diseases are known to be prevalent.

Lines may be used directly, either as varieties for increase, for further selection, or as breeding material. Since CIMMYT material is primarily bred for high nutrition for human food or animal feeds, most of the materials will not be suitable for malting purposes. The nursery is prepared after the Cd. Obregon harvest and is shipped during July-August.

INTERNATIONAL DISEASE NURSERIES FOR SEPTORIA, MILDEW, ALTERNARIA, ETC.

Disease nurseries are designed to identify and evaluate potential sources of disease resistance with a minimum of complication. Selection of participating locations is based primarily on the likely occurrence of a particular disease. Much lesser emphasis is placed on agronomic evaluations and performance.

PLANTING THE SCREENING NURSERY

A single packet of seed of each breeding line to be tested is provided and every 20th packet contains seed of a control variety selected from the International Spring Wheat Yield Nursery.

There is sufficient seed in each packet to allow any one of the following three unreplicated planting plans to be made:

- (a) One 5 meter row.
- (b) Two 2 meter rows.
- (c) One 2.5 meter row at each of 2 locations.

It is important to sow in accurate rows, since yield measurements might be taken (see Yield section, under Data Collection, on page 15). The spacing between rows and the shape and dimensions of the field layout are left to the discretion of the cooperator. In any case, indicate which planting arrangement was used when returning information.

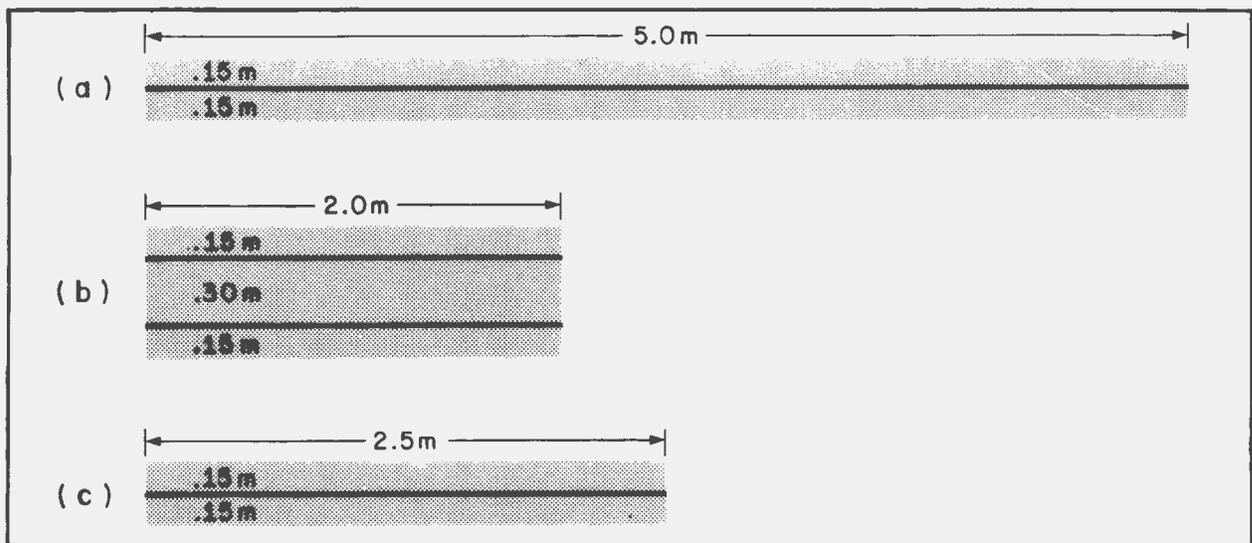


Figure 4. Layout of International Screening Nurseries

The IBON is composed of lines with a wide range of maturity, and of hulled and hull-less varieties. Comparisons of yield can be valid only when these factors are considered.

Planting date

Because screening nurseries are prepared and airfreighted from Mexico only once each year, some cooperators may receive their set out of season. Therefore, it is important that the seed be stored in a safe place until the normal growing season. The nursery should not be grown out of season unless there is a very good reason for doing so (e.g. disease development). If it is grown out of season, please indicate this on the data sheets to be returned.

Nursery management

Consult the information provided on page 4.

DATA COLLECTION

The kind of data collected will depend in part upon the nursery and the degree of differentiation among the entries. This decision is left to the discretion of the cooperator. For uniformity of reporting, the following types of data and units of reporting have been selected as convenient for cooperators and for purposes of summary reports:

1. **Yield** (in kg/ha). Although these nurseries consist of unreplicated rows, the range of genotypes and trial environments is so great that very valuable information can be obtained from comparative grain yield data. In the case of the IBON, this information is not required.
2. **Days to flowering and/or maturity.**
3. **Stripe rust.** Where possible, both leaf and head reactions should be reported using the modified Cobb scale. (See pages 6-9).
4. **Leaf rust.** The modified Cobb scale should be used.
5. **Stem rust.** The modified Cobb scale should be used.
6. **Septoria, Rhynchosporium** and other leaf diseases should be measured on the 0-9 scale. (See pages 9-11).
7. **Any other disease factor** for which differential data can be taken. The 0-9 scale should be used.
8. **Height.** Record the height in centimeters (cm).
9. **Lodging.** The 0-9 scale should be used.
10. **Shattering.** The 0-9 scale should be used.
11. **Any other agronomic factor** for which differential data can be taken, e.g. cold resistance, sterility, etc. The 0-9 scale should be used.
12. **Quality data.**

IMPORTANT. It is expected that all data will be recorded in the units of measure indicated above, e.g., yield in kg/ha. If other units of measure must be used, they should be specified clearly.

RETURN OF DATA

As indicated in Part I (page 4), data should be recorded on the forms supplied and one copy should be sent to CIMMYT where the results will be computer analyzed and then sent back to cooperators. The other copy of the data should be kept for the station records.

The completed data form should be airmailed to CIMMYT as soon as possible after harvest. It is important that data be returned as quickly as possible so that preliminary reports can be prepared and made available to other cooperators. If planting plan (c) is adopted (that is, a 2.5 meter row at each of 2 locations), data from both locations should be provided.

When all cooperators have reported a final summary will be published for general distribution.

METHODS OF REPORTING RESULTS

Location description:

CIMMYT requests only essential information on the location at which the experiment was conducted.

Fertilizer applied:

Total amounts of fertilizer should be converted to N, P, and K in kg/ha.

Note taking dates:

The dates when notes were recorded should be stated.

Check varieties:

For each nursery there are a number of check varieties included which serve to indicate the levels of disease at the test location. Cooperators should provide disease data on these checks.

General:

Space is provided for any additional comment which the cooperator may wish to make.

SUBMITTING LINES FOR TESTING

Cooperators are invited to send approximately 300 grams of advanced generation lines for increase and inclusion in a screening nursery. The package must be labelled "*Experimental Wheat Seed—No Commercial Value,*" and reference should be made to the nursery for which the submission is intended. The package or envelope should be addressed to:

**International Wheat Nurseries
Centro Internacional de Mejoramiento de Maiz y Trigo,
Apartado Postal 6-641,
Delegación Cuauhtémoc
06600, Mexico D.F., MEXICO**

The shipment should be sent via air express or airmail and it *should reach Mexico no later than September 15th* to be increased during the winter in Sonora, Mexico. It is not always possible to include all varieties submitted for trial.

CEREAL RUSTS; FOLIAR AND OTHER DISEASES; PESTS.

The cooperator should consult the data provided in Part I on pages 6-11.

INTERNATIONAL WHEAT NURSERIES

GENERAL NOTES TO BE TAKEN

Nursery Name: _____
 Year: _____
 Location: _____
 Identification: _____

COUNTRY: _____ State or Province: _____

STATION NAME: _____

Nurs. Year Perm. Loc.

COOPERATOR(S): _____

ELEVATION

LATITUDE Degrees Minutes N or S

LONGITUDE Degrees Minutes E or W

Meters or Feet

PLEASE CHECK () EACH APPROPRIATE BOX

DATE PLANTED: Month Day Year

DATE HARVESTED: Month Day Year

FERTILIZER APPLIED NOT APP.
 N
 P
 K

SOWING DATE ¹¹
 1 EARLY
 2 NORMAL
 3 LATE

SOIL CONDITION ¹³ AT SOWING
 4 MOIST
 5 DRY

GERMINATION ¹⁴
 6 POOR
 7 GOOD

SCALES USED AND DATES ON WHICH THE AGRONOMIC AND DISEASE NOTES WERE TAKEN

VARIABLE	SCALE USED	DATE
		Month Day Year

LOCAL CHECK ²⁹

34 Chemical Control of Insects.
 35 Chemical Control of Weeds.
 36 Chemical Control of Insects and Weeds.
 37 Mechanical Control of Weeds.
 38 Hand Weeding.

DISEASE DEVELOPMENT ¹⁹

17 NEGLIGIBLE
 18 SLIGHT
 41 MODERATE
 42 HEAVY

INSECT DAMAGE ²⁷

20 NEGLIGIBLE
 44 SLIGHT
 45 MODERATE
 46 HEAVY

WEED PROBLEM ²²

28 NEGLIGIBLE
 49 SLIGHT
 50 MODERATE
 51 HEAVY

BIRD DAMAGE ³³

29 NEGLIGIBLE
 52 SLIGHT
 53 MODERATE
 54 HEAVY

OTHER OBSERVATIONS: _____

COPIA PARA EL COOPERADOR
 COPY FOR THE COOPERATOR
 COPIE POUR LE COOPÉRATEUR

No. OF RAINS DURING THE CYCLE: _____

TOTAL PRECIPITATION: _____ mm

NUMBER OF IRRIGATIONS: _____

TOTAL WATER APPLIED: _____ mm

COPIA PARA DEVOLVERSE
 COPY TO RETURN
 COPIE POUR RETOURNER

YIELD GIVEN IN: kg/ha _____ bu/acre _____ grams/plot _____ kg/plot _____

PLANT HEIGHT: cm _____ inches _____ m _____ OTHER MEASURE: _____

TEST WEIGHT: kg/bd _____ lbs/bu _____ OTHER MEASURE: _____

WEATHER: _____ IF ABNORMAL, PLEASE SPECIFY: _____

15 NORMAL

PLOT SIZE

A No. OF ROWS HARVESTED PER ENTRY: _____
 B LENGTH OF EACH ROW: _____ m
 C DISTANCE BETWEEN ROWS: _____ cm

★ A x B x C = _____ m²

