Standard Evaluation System for Rice (SES)

Find out how the qualities of rice are evaluated and scored in this authoritative sourcebook.

Rice Science for a Better World
International Rice Research Institute

Rice knowledge bank

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Standard Evaluation System for Rice (SES)

Identifying promising rice germplasm with useful traits is an important activity in rice improvement. The genetic potential of breeding materials, whether developed by conventional breeding or genetic engineering, is evaluated based on phenotypic expressions in target environments with the stress of interest. Thus, an accurate and precise yet rapid and practical assessment method should be utilized.

This Standard Evaluation System for Rice (SES) has been prepared to enable rice scientists from around the world to speak a common language on evaluation of rice characters. This guide has two major functions. The first is to expedite data collection, processing and analysis of multi-environment trials (METs). Although the complexity of scale and method of scale assignment varies among rice characters, the SES remains the most popular method used in mass evaluation of breeding lines. The second is to promote an interdisciplinary approach to rice improvement. Devising improved scales and assessment methods, and interpretation of results require joint efforts of scientists in concerned disciplines.

Growth Stages of Rice Plants

When reporting results for specific characters, use this code to identify the stage of plant growth at which the observation was recorded.

Specific applications might be sequential data on disease reaction for a season's record of epidemic buildup (e.g. blast notes at growth stages 2, 3, 4, 5, 6, 7, 8).

CODE	
1	Germination
2	Seedling
3	Tillering
4	Stem elongation
5	Booting
6	Heading
7	Milk stage
8	Dough stage
9	Mature grain

Agronomic Traits

Leaf Senescence (Sen)

NOTE: It is commonly thought that rapid senescence of leaves can be detrimental to yield if the rice grains have not completely filled.

At growth stage: 9

SCALE	
1	Late and slow (leaves have natural green color)
5	Intermediate (upper leaves yellowing)
9	Early and fast (all leaves yellow or dead)

Lodging Incidence (Lg)

NOTE: Indicates % of plants that lodged.

At growth stage: 6-9

Maturity (Mat)

NOTE: Use the number of days from seeding to grain ripening (85% of grains on panicle are mature).

At growth stage: 9

Panicle Exsertion (Exs)

NOTE: The inability of panicles to exsert fully is commonly considered a genetic defect. Environmental and disease factors also attribute to such defect.

At growth stage: 7-9

SCALE	
1	Well exserted
3	Moderately well exserted
5	Just exserted
7	Partly exserted
9	Enclosed

Panicle Threshability (Thr)

NOTE: Firmly grasp and pull the hand over the panicle and estimate the percentage of shattered grains.

At growth stage: 9

SCALE	
1	Difficult (less than 1%)
3	Moderately difficult (1-5%)
5	Intermediate (6-15%)
7	Loose (26-50%)
9	Easy (51-100%)

Phenotypic Acceptability (PAcp)

NOTE: Use actual measurment (cm) from soil surface to tip of the tallest panicle (awns excluded). For height measurements at other growth stages, specify the stage. Record in whole numbers (do not use decimals).

At growth stage: 7-9

SCALE	
1	Excellent
3	Good
5	Fair
7	Poor
9	Unacceptable

Plant Height (Ht)

NOTE: Use actual measurment (cm) from soil surface to tip of the tallest panicle (awns excluded). For height measurements at other growth stages, specify the stage. Record in whole numbers (do not use decimals).

At growth stage: 7-9

SCALE	
1	Semidwarf (lowland: less than 110 cm; upland: less than 90 cm
5	Intermediate (lowland: 110-130 cm; upland (90-125 cm)
9	Tall (lowland: more than 130 cm; upland: more than 125 cm)

Seedling Vegetative Vigor (Vg)

NOTE: Several factors may interact, influencing seedling vigor (e.g. tillering ability, plant height, etc.). Use this scale for evaluating genetic material and varieties under stress and non-stress conditions.

At growth stage:
Seedling vigor: 2
Vegetative vigor: 3

SCALE	
1	Extra vigorous (very fast growing; plants at 5-6 leaf stage have 2 or more tillers in majority of population)
3	Vigorous (fast growing; plants at 4-5 stage have 1-2 tillers in majority of population)
5	Normal (plant at 4-leaf stage)
7	Weak (plants somewhat stunted; 3-4 leaves; thin population; no tiller formation
9	Very weak (stunted growth; yellowing of leaves

Spikelet Fertility (SpFert)

NOTE: Identify the fertile spikelets by pressing the spikelets with the fingers and noting those that do not have grains.

At growth stage: 9

SCALE	
1	Highly fertile (>90%)
3	Fertile (75-89%)
5	Partly sterile (50-74%)
7	Highly sterile (<50% to trace)
9	(0%)

Tillering Ability (Ti)

NOTE: Environmental factors can greatly influence the degree of tillering ability. The score should represent most plants within the plot.

At growth stage: 5

SCALE	
1	Very high (more than 25 tillers/plant)
3	Good (20/25 tillers/plant)
5	Medium (10-19 tillers/plant)
7	Low (5-9 tillers/plant)
9	Very low (less than 5 tillers/plant)

Crop Damage (diseases)

Viruses and Mycolplasma-like Organisms_(MLO)

Rice Diseases caused by Viruses and Mycoplasma-like Organisms (MLO)

The reaction of a certain genotype to rice virus infection can be assessed by a skilled worker based on visible symptoms after inoculation under natural conditions (in a field), or under controlled conditions (in a greenhouse). The factors needed for a successful test are the presence of virus sources and insect vectors, inoculation at the susceptible growth stage of the test plants and favorable environmental conditions.

SCALE (% Infection)	
0	No symptom observed
1	1-10%
3	11-30%
5	31-50%
7	51-70%
9	71-100%

Field test:
Screening of test materials, notably breeding lines, can be done in the field and their reaction to virus infection can be assessed on a scale of 09- based on the percentage of infection observed.

Greenhouse test:
However, field tests generally select vector resistance and are not appropriate for selecting virus resistance. Resistance to the virus can be assessed in the greenhouse where factors needed for infection can be manipulated. Inoculation using a high number of vectors is desired and the susceptible check would be also useful as a reference to measure pant height. Since some fertilizers might affect symptoms, it is recommended not to use any during the experiment. A disease index (DI) for the genotype, which would represent both disease incidence and symptom severity, can be used as an indicator for virus resistance in a greenhouse test. DI can be calculated as:

$$DI = \frac{n(3) + n(5) + n(7) + n(9)}{tn}$$

Where: n(3), n(5), n(7), and n(9) = number of plants showing a reaction in a scale (3), (5), (7), and (9) respectively.
tn = total number of plants scored

The resulting DI can be classified as:

DI	**REACTION**
0-3	Resistant/tolerant
4-6	Moderate
7-9	Susceptible

For further confirmation, test materials with DI rating of 0-3 may be tested by forced inoculation using different number of vectors, at different plant growth stages, and may be assayed serologically to differentiate between virus resistance and tolerance.

Rice Grassy Stunt 1 & 2 Disease

Causal agent
Rice grassy stunt virus 1 (RGSV1) and rice grassy stunt virus 2 (RGSV2)

Symptoms
RGSV1 **-** Severe stunting, excessive tillering, plae green to yellow and narrow leaves with small rusty spots.

RSGV2-Severe stunting, excessive tillering, yellow to orange and narrow leaves with small and rusty spots.

At growth stages:
2-3 (for the greenhouse)
4-6 (for the field)

Score and calculate DI at 5 weeks after inoculation in the greenhouse.

SCALE (RGSV1)	
1	No symptom observed
3	Pale green and slightly narrow leaves, no height reduction and with few small tillers.
5	Pale green and slight narrow leaves, 1-10% height reduction, and with numerous small tillers.
7	Pale green to yellow and narrow leaves with some rusty spots, 11-30% height reduction, and with numerous small tillers.
9	Pale green to yellow and narrow leaves with numerous rusty spots, more than 30% height reduction and with numerous small tillers.

SCALE (RGSV2)	
1	No symptom observed
3	Pale yellow and slightly narrow leaves, no height reduction, and with numerous small tillers
5	Distinct yellow and narrow leaves, 1-10% height reduction, and with numerous small tillers
7	Yellow to orange and narrow leaves with some rusty spots, 11-30% height reduction, and with few small tillers
9	Yellow to orange and narrow leaves with numerous rusty spots, >30% height

	reduction and with few small tillers

Rice Hoja Blanca (RHBV)

Causal agent
Rice hoja blanca virus

Symptoms
Cream colored to yellow spots, elongation and coalescing to form longitudinal yellowish green to pals green striations. Streaks may coalesce to cover the whole leaf. Brown and sterile glumes with typical "parrot beak" shape of deformation.

At growth stages:
2-4 (leaf)
7-8 (panicle)

NOTE: To determine the degree of resistance in fixed lines under field conditions, susceptible check should have at least more than 50% infection.

SCALE (RGSV1)	
0	No symptom observed
1	Less than 1%
3	1-10%
5	11-30%
7	31-60%
9	61-100%

Rice Tungro Disease

Causal agent
Rice tungro bacilliform virus (RTBV) and rice tungro spherical virus (RTSV)

Symptoms
Yellow to yellow orange leaves, stunting, and slightly reduced tillering.

At growth stages:
2 (for the greenhouse)
3-5 (for the field)

Score and calculate DI at 4 weeks after inoculation in the greenhouse.

SCALE (RGSV1)	
1	No symptom observed
3	1-10% height reduction, no distinct yellow to yellow orange leaf discoloration
5	11-30% height reduction, no distinct yellow to yellow orange leaf discoloration
7	31-50% height reduction, with distinct yellow to yellow orange leaf discoloration
9	More than 50% height reduction, with distinct yellow to yellow orange discoloration

Rice Yellow Mottle (RYM)

Causal agent
Rice yellow mottle virus

Symptoms
Stunting, reduced tillering, mottling and yellowish streaking of the leaves, delayed flowering or incomplete emergence of the panicles; in extreme cases, death of plants.

SCALE (for field test)	
1	No symptom observed
3	Leaves green but with sparse dots or streaks and less than 5% of height reduction
5	Leaves green or pale green with mottling and 6% to 25% of height reduction, flowering slightly delayed
7	Leaves pale yellow or yellow and 26-75% of height reduction, flowering delayed
9	Leaves turn yellow or orange, more than 75% of height reduction, no flowering or some plants dead

Yellow Dwarf (YD)

Causal agent
Mycoplasma

Symptoms
Pale yellow, droopy leaves, excessive tillering and stunting.

At growth stage: 4-6 (greenhouse, on secondary growth after cutting at the base)

On ratoon (fields)

Bacterial Leaf Streak (BLS)

Causal agent
Xanthomonas oryzae pv*. oryzicola*

Symptoms
Linear lesions with small bacterial exudates evident.

At growth stage: 3-6

NOTE: This scale may also be used for leaf smut caused by *Entyloma oryzae.*

SCALE (Affected leaf area)	
0	No lesions observed
1	Small brown specks of pin-point size or larger brown specks without sporulating center
3	Lesion type is the same as in scale 2, but a significant number of lesions are on the upper leaves
5	Typical blast lesions infecting 4-10% of the leaf area
7	Typical blast lesions infection 26-50% of the leaf area
9	More than 75% leaf area affected

Bakanae Diseases (Bak)

Causal agent
Giberella fujikuroi

Symptoms
The plant elongated abnormally, has few tillers, and usually dis before producing grains.

At growth stage: 3-6

Brown Spot (BS)

Causal agent
Cochliobolus miyabeanus (Bipolaris oryzae, Drechslera oryzae).

Symptoms
Typical leaf spots are small, oval or circular and dark brown. Larger lesions usually have the same color on the edges but have a pale, usually grayish center. Most spots have a light yellow halo around the outer edge.

SCALE (Affected leaf area)	
1	No incidence
2	Less than 1%
3	1-3%
4	4-5%
5	11-15%
6	16-25%
7	26-50%
8	51-75%
9	76-100%

False Smut (FSm)

Causal agent
Ustilaginoidea virens

Symptoms
Infected grains are transformed into yellow-greenish or greenish-black velvety-looking spore balls.

At growth stage: 9

SCALE (Infected florets)	
0	No incidence
1	Less than 1%
3	1-5%
5	6-25%
7	26-50%
9	51-100%

Grain Discoloration (Gd)

Causal agents
Species of *Sarocladium, Bipolaris, Alternaria, Gerlachia, Fusarium, Phoma, Curvularia, Trichoconiella,* and *Psuedomonas.*

Symptoms
Darkening of glumes of spikelets, brown color to black including rotten glumes caused by one or more pathogens. Intensity ranges from sporadic discoloration to discoloration of the whole glume.

At growth stage: 8-9

NOTE: Severity of grain discoloration can be estimated by counting grains with more than 25% of glume surface affected.

SCALE (Grains with severely discolored glumes)	
0	No incidence
1	Less than 1%
3	1-5%
5	6-25%
7	26-50%
9	51-100%

Kernel Smut (KSm)

Causal agent
Tilletia barclayana

Symptoms
Infected grains show minute black pustules or streaks bursting through the glumes. In severe infection, the rupturing glumes produce short beak-like or spur-like growths.

At growth stage: 9

Leaf Blast (Bl)

Causal agent
Magnaporthe grisea (*Pyricularia oryzae*)

Symptoms
Lesions usually start near the leaf tips or leaf margins or both, and extend down the outer edge(s). Young lesions are pale green to grayish green, later turning yellow to gray (dead) with time. In very susceptible varieties, lesions may extend to the entire leaf length into the leaf sheath. Kresek or seedling blight causes wilting and death of the plants.

At growth stage: 2-3

NOTE: Use this scale only for the nursery. Actual estimation of blast affected leaf area (%) is recommended for field assessment of blast disease together with predominant lesion type (see coding system for lesion type).

Entries with consistent rating, between 4 and 6 with overall average not higher than 5.5 may have a good level of quantitative resistance.

SCALE (for blast nursery)	
0	No lesions observed
1	Small brown specks of pin-point size or larger brown specks without sporulating center
2	Small roundish to slightly elongated, necrotic gray spots, about 1-2 mm in diameter, with a distinct brown margin
3	Lesion type is the same as in scale 2, but a significant number of lesions are on the upper leaves
4	Typical susceptible blast lesions 3 mm or longer, infecting less than 4% of the leaf area
5	Typical blast lesions infecting 4-10% of the leaf area
6	Typical blast lesions infection 11-25% of the leaf area
7	Typical blast lesions infection 26-50% of the leaf area
8	Typical blast lesions infection 51-75% of the leaf area and many leaves are dead
9	More than 75% leaf area affected

CODE (Predominant lesion type)	
0	No lesions observed
1	Small brown specks of pinpoint size or larger brown specks without sporulating center
3	Small, roundish to slightly elongated necrotic sporulating

	spots, about 1-2 mm in diameter with a distinct brown margin or yellow halo
5	Narrow or slightly elliptical lesions, 1-2 mm in breadth, more than 3 mm long with a brown margin
7	Broad spindle-shaped lesion with yellow, brown, or purple margin
9	Rapidly coalescing small, whitish, grayish, or bluish lesions without distinct margins

Leaf Scald (Ls)

Causal agent
Monographella albescens (Microdochium oryzae)

Symptoms
The lesions occurs mostly near leaf tips, but sometimes starts at the margin of the blade and develops into large ellipsoid areas encircled by dark-brown, narrow bands accompanied by a light-brown halo.

At growth stage: 5-8

SCALE (Affected leaf area)	
0	No incidence
1	Less than 1% (apical lesions)
3	1-5% (apical lesions)
5	6-25% (apical and some marginal lesions)
7	26-50% (apical and marginal lesions)
9	51-100% (apical and marginal lesions)

Narrow Brown Leaf Spot (NBLS)

Causal agent
Sphaerulina oryzina (Cercospora janseana)

Symptoms
Linear lesions with small bacterial exudates evident.

At growth stage: 3-6

NOTE: This scale may also be used for leaf smut caused by *Entyloma oryzae*.

SCALE (Affected leaf area)	
0	No lesions observed
1	Small brown specks of pin-point size or larger brown specks without sporulating center
3	Lesion type is the same as in scale 2, but a significant number of lesions are on the upper leaves
5	Typical blast lesions infecting 4-10% of the leaf area
7	Typical blast lesions infection 26-50% of the leaf area
9	Typical blast lesions infection 26-50% of the leaf area

Panicle Blast (PB)

Causal agent
Magnaporthe grisea (pyricularia oryzae)

Symptoms
Dark, necrotic lesions cover partially or completely around the panicle base (node) or the uppermost internode or the lower part of panicle axis. The panicles are greyish and have either partially filled or unfilled grains.

NOTE: Based on the number of panicles with each scale, compute panicle blast severity (PBS) as follows:

$$PBS = \frac{(10xN_1)+(20 \times N_3)+(40xN_5) + (70xN_7)+(100xN_9)}{\text{Total no. of panicles observed}}$$

where N_1-N_9 are the number of panicles with score 1-9.

At growth stage: 8 (20-25 days after heading).

NOTE: For the mass evaluation of panicle blast incidence count only the number of panicles with lesions covering completely around the node, neck

SCALE (based on symptoms)	
0	No visible lesion or observed lesions on only a few pedicels
1	Lesions on several pedicels or secondary branches
3	Lesions on a few primary branches or the middle part of panicle axis
5	Lesion partially around the base (node) or the uppermost internode or the lower part of panicle axis near the base
7	Lesion completely around panicle base or uppermost internode[3] or panicle axis near base with more than 30% of filled grains
9	Lesion completely

or lower part of the panicle axis (symptom type 7-9).

At growth stage: 8-9

	around panicle base or uppermost internode or the panicle axis near the base with less than 30% of filled grains.

SCALE (Incidence of severely infected panicles)	
0	No incidence
1	Less than 5%
3	5-10%
5	11-25%
7	26-50%
9	More than 50%

Sheath Blight (ShB)

Causal agent
Thanethoporus cucumeris (Rhizoctonia solani)

Symptoms
Grayish-green lesions may enlarge and coalesce with other lesions, mostly on lower leaf sheaths, but occasionally on the leaves.

NOTE: The relative lesion height is the average vertical height of the uppermost lesion on leaf or sheath expressed as a percentage of the average plant height.

SCALE (based on relative lesion height)	
0	No infection observed
1	Lesions limited to lower 20% of the plant height
3	20-30%
5	31-45%
7	46-65%
9	More than 65%

Sheath Rot (ShR)

Causal agent
Soracladium oryzae

Symptoms
Oblong or irregular brown to grey lesions on the leaf sheath near panicle; sometimes coalescing to prevent emergence of panicle.

At growth stage: 7-9

SCALE (Incidence of severely affected tiller)	
0	No incidence
1	Less than 1%
3	1-5%
5	6-25%
7	26-50%
9	51-100%

Udbatta Disease (UDb)

Causal agent
Balansia oryzae-sativae (Ephelis oryzae)

Symptoms
A white mycelial mat ties panicle branches together so that they emerge as single, small, cylindrical rods.

SCALE (for field test)	
0	No incidence
1	Less than1%
5	1-25%
9	26-100%

Crop Damage (Insects)

Brown Planthopper (BPH)

Causal agent
Nilaparvata lugens

Symptoms
Partial to pronounced yellowing and increasing severity of stunting. Extreme signs are wilting to death of plants. Infested areas in the field may be patchy.

At growth stage: 2 (greenhouse)
3-9 (field)

Test evaluation for resistance can be considered valid if hopper population is uniformly distributed at a high level across the screening box or field. For field screening, a minimum of the following hopper density on susceptible check is necessary:

a. 10 hoppers/hill at 10-15 days after transplanting
b. 25 hoppers/hiI at maximum tillering

100 hoppers/hill at early booting stage

SCALE (For greenhouse test)	
0	No damage
1	Very slight damage
3	First and 2nd leaves of most plants partially yellowing
5	Pronounced yellowing and stunting or about 10 to 25% of the plants wilting or dead and remaining plants severely stunted or dying
7	More than half of the plants
9	All plants dead

SCALE (For field test)	
0	No damage
1	Slight yellowing of a few plants
3	Leaves partially yellow but with no hopperburn
5	Leaves with pronounced yellowing and some stunting or wilting and 10-25% of plants with hopperburn, remaining plants severely stunted
7	More than half the plants wilting or with hopperburn, remaining plants severely stunted
9	All plants dead

Caseworm (CW)

Causal agent
Nymphula depunctalis

Symptoms
Larvae feed on leaf tissue,
leaving only the papery upper epidermis.

At growth stage: 2-7

SCALE (Scraping index)	
0	No scraping
1	Less than 1%
3	1-10%
5	11-25%
7	26-50%
8	51-100%

Gall Midge (GM)

Causal agent
Orseolia oryzae

NOTE: For the field test to be valid more than 60% of the plants should be affected with not less than 15% silver shoot in the susceptible check. Similarly, 60% of the plants In susceptible check should show
silver shoots under greenhouse tests.

If any of the test entry in field evaluation exhibits damage less than 10% on plant basis, rate it in “0” category, since such damage could be due to other reasons.

At growth stage: 2-5

SCALE (Infected tillers in field test)	
0	No damage
1	Less than 1%
3	1-5%
5	6-10%
7	11-25%
9	More than 25%

SCALE (Plants with silver shoots in greenhouse test)	
0	No damage
1	Less than 5%
3	6-10%
5	11-20%
7	21-50%
9	More than 50%

Green Leafhopper (GLH)

Causal agent
Nephotettix spp.

Symptoms: Partial to pronounced yellowing and increasing severity of stunting. Extreme signs are wilting to death of plants. Infested areas in the field may be patchy.

At growth stage:

- 2 (greenhouse)
- 3-9 (field)

SCALE	
0	No damage
1	Very slight damage
3	First and 2nd leaves yellowing
5	All leaves yellow; pronounced
7	More than half the plants dead; stunting or both remaining plants wilting; severely stunted
9	All plants dead

Leaffolder (LF)

Causal agent
Cnaphalocrosis medinalis, Marasmia patnalis

Symptoms: Larvae consume the leaf tissue except the epidermis, causing typical white streaks. They create a leaf tube during later stages of feeding. Note: Plant a susceptible and resistant check (if available) after every 10 test entries. Replicate, test entries three times if seed is available. Determine the percentage of damaged and folded leaves. Damaged leaves of the susceptible check should average at least 40% for the test to be considered valid. Use the following scale on the basis of the converted figures to place percentage of damaged leaves on a 0-9 scale.

At growth stage:

- 2-3 (greenhouse)
- 3-9 (field)

SCALE (Damaged plants)	
0	No damage
1	1-10%
3	11-20%
5	21-35%
7	36-50%
9	51-100%

Greenhouse screening
For greenhouse screening, consider both the % of leaves with damage and the extent of damage on each leaf. For each entry, first examine all of the leaves and rate each one from 0-3 as based on the extent of damage.

Based on the number of leaves with each damage grade, compute as follows:

$$\% \text{ Rating (R)} = \frac{(\text{No. of leaves with damage grade of } 1 \times 100)\,1}{\text{Total no. of leaves observed}} + \frac{(\text{No. of leaves with damage grade of } 2 \times 100)\,2}{\text{Total no. of leaves observed}} + \frac{(\text{No. of leaves with damage grade of } 3 \times 100)\,3}{\text{Total no. of leaves observed}} \div 6$$

Calculate as above for each test entry and the susceptible check. Then adjust for extent of damage in the susceptible check by:

$$\text{Adjusted \% damage (D) rating} = \frac{\text{R of test entry}}{\text{R of susc. check}} \times 100$$

Grade	**Damage**
0	No damage
1	Up to 1/3 of leaf area scraped
2	1/3 to 1/2 of leaf area scraped
3	More than 1/2 of leaf area scraped

The overall damage rating (D) is converted to a 0-9 scale.

Scale %	**Damage Rating (D)**
0	No damage
1	1-10
3	11-30
5	31-50
7	51-75
9	more than 75

Rice Bug (RB)

Causal agent
Leptocorisa oratorius

At growth stage: 7-9

Scale	Damaged grains per panicle (%)
0	No damage
1	Less than 3
3	4-7
5	8-15
7	12-25
9	26-100

Rice Delphacid (RDel)

Causal agent
Tagosodes orizicolus

Symptoms
Similar to WBPH

NOTE: The scale is based on symptoms. Incidence of dead plants could be considered for final evaluation.

At growth stage:
- 2 (greenhouse)

2-6 (field)

SCALE (for field test)	
0	No damage
1	Very slight damage/leaf discoloration
3	Yellowing of 1st and 2nd leaves
5	Pronounced yellowing of leaves and some stunting, less than 50% of plants dead
7	Strong yellowing of leaves and pronounced stunting, greater than 50% of plants dead
9	All plants dead

Rice Whorl Maggot (RWM)

Causal agent
Hydrellia philippina

Symptoms
Leaf margin feeding causes conspicuous damage and sometimes stunting of plants.

At growth stage: 3

SCALE (for field test)	
0	No damage
1	Less than 2 leaves/hill damaged
3	2 or more leaves/hill but less than 1/3 of leaves damaged
5	1/3 to 1/2 of leaves damaged
7	More than 1/2 of the leaves damaged with no broken leaves
9	More than 1/2 of the leaves damaged with some broken leaves

Stem Borers (SB)

Causal agent
Chilo suppressalis, (striped); C. polychrysus (dark headed); *Rupela albinella* (South American white); *Scirpophaga incertulas* (yellow); *S. Innotata* (white); *Sesamia inferens* (pink); *Maliarpha separatella* (African whiteheads); *Diopsis macrophthalma* (Stalked-eyed fly); and several other species.

At growth stage:
- 3-5 (deadhearts)
- 8-9 (whiteheads)

Deadhearts and whiteheads in the susceptible check should average more than 20 and 10%, respectively, of infested tillers for the test to be considered valid. Percentage of susceptible check should be recorded. Percentage of deadhearts and 5 11-15% whiteheads is based on tiller count and productive tillers (panicles), respectively.

For *Diopsis spp*., it is not necessary to estimate whiteheads since infestation occurs usually at growth stages 2-4.

NOTE: Stem dissections from 10 hills of susceptible checks are necessary at maximum tillering, panicle initiation and late ripening, in order to identify SB species and to assess more accurately the actual incidence of stem damage.

For Maliarpha separatella, however, stem dissection is the only way to accurately estimate both the damage and incidence. Ten to 50 hills are dissected and percentage infested tillers are rated in accordance with the scale for deadhearts. Unlike whiteheads, infested tillers do produce some panicles and so the relationships between whiteheads/infested tillers and yield are not quite the same.

For deepwater rice, make dissections of 20 or more tillers per plot or row at growth stages 6-8 and count the numbers of infested (or damaged) tillers. Apply the above index using the numbers of infested tillers in place of the numbers of deadhearts. Scoring for whiteheads is of little value in deepwater rice.

SCALE (Deadhearts)	
0	No damage
1	1-10%
3	11-20%
5	21-30%
7	31-60%
9	61% and above

SCALE (Whiteheads)	
0	No damage
1	1-5%
3	6-10%
5	11-15%
7	16-25%
9	26% and above

Thrips

Causal agent
Stenchaetothrips biformis

SCALE	
1	Rolling of terminal 1/3 area of 1st leaf
3	Rolling of terminal 1/3-1/2 area of 1st and 2nd leaves
5	Rolling of terminal 1/2 area of 1st, 2nd, and 3rd leaves; yellowing of leaf tips
7	Rolling of entire length of all leaves; pronounced yellowing
9	Complete plant wilting, followed by severe yellowing and scorching

Whitebacked Planthopper (WBPH)

Causal agent
Sogatella furcifera

Symptoms
Partial to pronounced yellowing and increasing severity of stunting. Extreme signs are wilting and death of plants. Infested areas in the field may be patchy.

At growth stage:
- 2 (greenhouse)

3-9 (field)

SCALE	
0	No damage
1	Very slight damage
3	First and 2nd leaves with orange tips; slight stunting
5	More than half the leaves with yellow-orange tips; pronounced stunting
7	More than half of plants dead; remaining plants severely stunted and wilted
9	All plants dead

Crop Damage (Rodents and Birds)

Bird Damage (BD)

NOTE: Since there is no genetic resistance to birds, the damage can be quantified as it does not represent resistance.

SCALE (Damaged panicles)	
0	No damage observed
1	Less than 5%
5	6-25%
9	26-100%

Rat Damage (RD)

NOTE: Since there is no genetic resistance to rats, the damage can be quantified as it does not represent resistance.

SCALE (Damaged panicles)	
0	No damage observed
1	Less than 5%
5	6-25%
9	26-100%

Deepwater

Elongation (Elon)

NOTE: Some rice can elongate and grow in areas annually flooded to varying depths. The scale is based on the performance of check varieties. Specify water depth under which the data was recorded.

At growth stage: 5-6

Elongation in deepwater		
Scale	**Description**	**Biological check**
1	Best elongation response	Best local floating variety (i.e. Leb Mue Nahng 111)
3	Response better than that of elongating semidwarf, but not as good as that of the best local floating variety	Elongating semidwarf (i.e. IR11141-6-1-4)
5	Response similar to that of Elongating semidwarf	
7	Response better than that of the nonelongating semidwarf, but not as good as that of elongating semidwarf	
9	Poorest elongation, or none	Non-elongating semidwarf (i.e. IR42)

Kneeing Ability (KnA)

SCALE	
1	Tiller angle greater than 45" for 50% of tillers
3	Tiller angle greater than 45" for 25% of tillers
5	Maximum tiller angle is less than 45" for 50% of tillers (Tiller angle greater than 45" for 1 or 2 tillers)
7	Maximum tiller angle less than 30"
9	No kneeing

Submergence Tolerance (Sub)

Greenhouse screening
For greenhouse screening count or % survival (S) of test entries and resistant control entry such as FR13A. Compute for % comparative survival value as follows:
% S of entry / % S of control x 100.

At growth stage: 2

Field evaluation
The period of submergence varies and often is not under full experimental control. Record actual % of plants that survived.

SCALE (% comparative survival)	
1	100
3	95-99
5	75-94
7	50-74
9	0-49

Drought

Drought Sensitivity (DRS)

NOTE: Drought sensitivity is highly interactive with crop phenology, plant growth prior to stress, and timing, duration, and intensity of drought stress.

For many soils, it takes at least 2 rainless weeks to cause marked differences in drought sensitivity during the vegetative stage and at least 7 rainless days during the reproductive stage to cause severe drought injury.

Leaf rolling precedes leaf drying during drought. Repeated ratings are recommended through progress of the drought. Record the stage of plant growth when the stress occurred and the number of stress days.

SCALE (leaf rolling at vegetative stage)	
0	Leaves healthy
1	Leaves start to fold (shallow)
3	Leaves folding (deep V-shape)
5	Leaves fully cupped (U-shape)
7	Leaf margins touching (0-shape)
9	Leaves tightly rolled V-shape)

SCALE (leaf drying at vegetative stage)	
0	No symptoms
1	Slight tip drying
3	Tip drying extended up to 1/4
5	One-fourth to 1/2 of all leaves dried
7	More than 2/3 of all leaves fully dried
9	All plants apparently dead. Length in most leaves fully dried

SCALE (spikelet fertility)	
1	More than 80%
3	61-80%
5	41-60%
7	11-40%
9	Less than 11%

Recovery (DRR)

NOTE: Scores are taken after 10 days following soaking rain or watering. Indicate the degree of stress before recovery.

SCALE (plants recovered)	
1	90-100%
3	70-89%
5	40-69%
7	20-39%
9	0-19%

Grain Quality

100-grain Weight (GW)

NOTE: Enter measurements in grams of 100 well-developed whole grains, dried to 13% moisture content, weighed on a precision balance.

At growth stage: 9

Alkali Digestion (AlkD)

NOTE: Place six milled-rice kernels in 10 ml 1.7% KOH in a shallow container and arrange them so that they do not touch. Let it stand for 23 hours at 30°C and score for spreading.

At growth stage: 9 (after milling)

Alkali digestion (AlkD) (as an indication of gelatinization temperature)		
Code	**Alkali Digestion**	**Gelatinization Temperature**
1-Not affected but chalky	Low	High
2-Swollen		
3-Swollen with collar incomplete or narrow	Low or intermediate	High or intermediate
4-Swollen with collar complete and wide	Intermediate	Intermediate
5-Split or segmented with collar complete and wide		
6-Dispersed merging with collar	High	High
7-Completely dispersed and cleared		

Amylose Content of the Grain (Amy)

NOTE: Use standard laboratory procedure to determine amylose content. Give amylose content in actual percentage.

Brown Rice Length (Len)

At growth stage: 9 (after dehulling, before milling)

SCALE (Length)	
1	Extra long (more than 7.5 mm)
3	Long (6.6 to 7.5 mm)
5	Medium (5.51 to 6.6 mm)
7	Short (5.5mm or less)

Brown Rice Protein (Prt)

Percent of total brown rice weight (at 14% moisture) to one decimal place.

At growth stage: 9 (after dehulling)

Brown Rice Shape (BrS) (length-width ratio)

NOTE: Kernel shape can be easily estimated by this method (avoid broken samples).

At growth stage: 9 (after harvesting, cleaning and dehulling)

Scale	Shape	Ratio
1	Slender	Over 3.0
3	Medium	2.1 to 3.0
5	Bold	1.1 to 2.0
9	Round	Less than 1.1

Chalkiness of Endosperm (Clk)

NOTE: Evaluate a representative milled sample for the degree (extent) of chalkiness that will best describe the sample with respect to (a) white belly, (b) white center, (c) white back.

At growth stage: 9

SCALE (% of kernel area)	
0	None
1	Small (less than 10%)
5	Medium (11% to 20%)
9	Large (more than 20%)

Chalkiness of Endosperm (Clk)

NOTE: Evaluate a representative milled sample for the degree (extent) of chalkiness that will best describe the sample with respect to (a) white belly, (b) white center, (c) white back.

At growth stage: 9

SCALE (% of kernel area)	
0	None
1	Small (less than 10%)
5	Medium (11% to 20%)
9	Large (more than 20%)

Scent (Sct)

At growth stage: 6-9

Code (At flowering stage or at maturity - by cooking test)	
0	Unscented
1	Lightly scented
2	Scented

Seed Coat (bran) Color (SCC)

At growth stage: 9

Code	
1	White
2	Light brown
3	Speckled brown
4	Brown
5	Red
6	Variable purple
7	Purple

Morphological Characteristics

Variety Group

Code	
1	Indica
2	Japonica (Sinica)
3	Javanica
4	Intermediate (hybrids)

Auricle Color (AC)

At growth stage: 4-5

Code	
1	Light green
2	Purple

Awn Color (AnC)

At growth stage: 6

Code	
0	Awnless
1	Straw
2	Gold
3	Brown (tawny)
4	Red
5	Purple
6	Black

Awning (An)

At growth stage: 7-9

Code	
0	Absent
1	Short and partly awned
5	Short and fully awned
7	Long and partly awned
9	Long and fully awned

Basal Leaf Sheath Color (BLSC)

At growth stage: 3-5 early to late vegetative stage.

Code	
1	Green
2	Purple lines
3	Light purple
4	Purple

Collar Color (CC)

At growth stage: 4-5

Code	
1	Light Green
2	Green
3	Purple

Culm Angle (CmA)

At growth stage: 7-9

Code	
1	Erect (<30°)
3	Intermediate (~45°)
5	Open (~60°)
7	Spreading (>60°)
9	Procumbent (the culm or its lower part rests on ground surface)

Culm Internode Color (CmIC)

NOTE: The outer surface of the internodes on the culm is recorded.

At growth stage: 7-9

Code	
1	Green
2	Light gold
3	Purple lines
4	Purple

Culm Length (CL)

NOTE: Measure from soil surface to panicle base in centimeters.

Sample size = 5

At growth stage: 7-9

Culm Number (CN)

NOTE: Enter actual count of the total number of tillers and full heading. Specify if per plant, hill or area.

At growth stage: 6-9

Diameter of Basal Internode (DBI)

NOTE: Enter actual measurements in millimeters from the outer diameter of the culms at the basal portion of the main culm.

Sample size = 3

At growth stage: 7-9

Flag Leaf Angle (FLA)

NOTE: Leaf angle is measured near the collar as the angle of attachment between the flag leaf blade and the main panicle axis.

Sample size = 5

At growth stage: 4-5

Code	
1	Erect
3	Intermediate
5	Horizontal
7	Descending

Grain Width (GrW)

NOTE: Enter the actual measurement of width in millimeters as the distance across the fertile lemma and the palea at the widest point.

Sample size = 10

At growth stage: 9

Leaf Angle (LA)

NOTE: The angle of openness of the blade tip is measured against the culm of the leaf below the flag leaf.

At growth stage: 4-5

Code	
1	Erect
5	Horizontal
9	Droopy

Leaf Blade Color (LBC)

At growth stage: 4-6

Code	
1	Light green
2	Green
3	Dark Green
4	Purple tips
5	Purple margins
6	Purple blotch (purple mixed with green)
7	Purple

Leaf Blade Pubescence (LBP)

Methodology: Aside from ocular inspection, rub fingers from the tip down on the leaf surface. Presence of hairs on the blade surface are classified.

Code	
1	Glabrous
2	Intermediate
3	Pubescent

At growth stage: 5-6

Leaf Length (LL)

NOTE: Enter actual measurements, in centimeters of the leaf just below the flag leaf.

At growth stage: 6

Leaf Width (LW)

NOTE: Enter actual measurements, in centimeters of the widest portion of the leaf blade just below the flag leaf.

At growth stage: 6

Lemma and Palea Color (LmPC)

At growth stage: 9

Code	
0	Straw
1	Gold and gold furrows on straw background
2	Brown spots on straw
3	Brown furrows on straw
4	Brown (tawny)
5	Reddish to light purple
6	Purple spots on straw
7	Purple furrows on straw
8	Purple

9	Black
10	White

Lemma and Palea Pubescence (LmPb)

At growth stage: 7-9

Code	
1	Glabrous
2	Hairs on lemma keel
3	Hairs on upper portion
4	Short hairs
5	Long hairs (velvety)

Ligule Color (LgC)

At growth stage: 4-5

Code	
1	White
2	Purple lines
3	Purple

Ligule Length (LgL)

NOTE: Enter actual measurement of ligules measured in millimeters from the base of the collar to the tip.

Sample size = 5

At growth stage: 4-5

Ligule Shape (LS)

At growth stage: 3-4

Code	
1	Acute to acuminate
2	Cleft
3	Truncate

Panicle Axis (PnA)

At growth stage: 7-9

Code	
1	Straight
2	Droopy

Panicle Length (PnL)

NOTE: Enter actual measurements in centimeters from panicle base to tip.

At growth stage: 8

Panicle Type (PnT)

NOTE: Panicles are classified according to their mode of branching, angle of primary branches, and spikelet density.

At growth stage: 8

Code	
1	Compact
2	Intermediate
3	Open

Secondary Branching of Panicles (PnBr)

At growth stage: 8

Code	
0	Absent
1	Light
2	Heavy
3	Clustered

Seedling Height (SH)

NOTE: Enter actual measurements of 10 seedlings in centimeters, from the base of the shoot to the tip of the tallest leaf blade.

At growth stage: 2-3 (5-leaf stage)

Sterile Lemma Color (SLmc)

At growth stage: 9

Code	
1	Straw (yellow)
2	Gold
3	Red
4	Purple

Sterile Lemma Length (SLmL)

NOTE: Measurement is made on each of the two sterile lemmas. The classification is based on 5-grain sample.

At growth stage: 9

Code	
0	Absent
1	Short (not longer than 1.5mm)
3	Medium (1.6-2.5 mm)
5	Long (longer than 2.5 mm but shorter than the lemma)
7	Extra long (equal to or longer than the lemma)
9	Asymmetrical

Stigma Color (SgC)

NOTE: Stigma color is determined from blooming spikelets (between 9 a.m. to 2 p.m.) with the aid of a hand lens.

At growth stage: 6

Code	
1	White
2	Light green
3	Yellow
4	Light purple
5	Purple

Physiochemical Stress

Alkali Injury (Alk) and Salt Injury (Sal)

Problem soils

NOTE: Observe general growth conditions in relation to standard resistant and susceptible checks. Since some soil problems are very heterogeneous in the field, several replications may be needed to obtains precise reading.

At growth stage: 3-4

SCALE (Alkali and salt injury)	
1	Growth and tillering nearly normal
3	Growth nearly normal but there is some reduction in tillering and some leaves discolored (alkali)/whitish and rolled (salt)
5	Growth and tillering reduced; most leaves discolored (alkali)/whitish and rolled (salt); only a few elongating
7	Growth completely ceases; most leaves dry; some plants dying
9	Almost all plants dead or dying

Iron Toxicity (FeTox)

At growth stage: 2-5

SCALE (Damaged panicles)	
0	Growth and tillering nearly normal
1	Growth and tillering nearly normal; reddish-brown spots or orange discoloration on tips of older leaves
3	Growth and tillering nearly normal; older leaves reddish-brown, purple, or orange yellow
5	Growth and tillering retarded; many leaves discolored
7	Growth and tillering ceases; most leaves discolored or dead
9	Almost all plants dead or dying

Phosphoric Deficiency (PDef)

At growth stage: 2-5

Greenhouse (use the following equation):

$$\frac{\text{No. of tillers in 0.5 ppm P culture solution}}{\text{No of tillers in 10 ppm P culture solution}} \times 100$$

Field (use the following equation):

$$\frac{\text{No. of tillers with no P culture solution}}{\text{No of tillers with 25 kgP/ha}} \times 100$$

SCALE (Relative tillers)	
1	80-100%
3	60-79%
5	40-59%
7	20-39%
9	0-19%

Zinc Deficiency (ZDef)

At growth stage: 2-4

SCALE	
1	Growth and tillering nearly normal; healthy
2	Growth and tillering nearly normal; basal

	leaves slightly discolored
3	Stunting slight, tillering decreased, some basal leaves brown or yellow
5	Growth and tillering severely retarded, about half of all leaves brown or yellow
7	Growth and tillering ceases, most leaves brown or yellow
9	Almost all plants dead or dying

Temperature

Cold Tolerance (Ctol)

NOTE: Observe differences in vigor along with subtle changes in leaf color. The optimum time to make observations would be the seedling, tillering, flowering, and mature stages.

At growth stage: 1;4-9

SCALE (for seedlings)	
1	Seedlings dark green
3	Seedlings light green
5	Seedlings yellow
7	Seedlings brown
9	Seedlings dead

SCALE (from tillering to maturity)	
1	Plants have a normal color; rate of growth and flowering normal
3	Plants slightly stunted; growth slightly retarded
5	Plants moderately stunted, leaves yellowish and development delayed
7	Plants severely stunted, leaves yellow and development delayed, and panicles poorly exserted
9	Plants severely stunted, with leaves brown, development much delayed and panicles not exserted

SCALE (spikelet fertility)	
1	More than 80%
3	61-80%
5	41-60%
7	11-40%
9	Less than 11%

Heat Tolerance (Htol)

At growth stage: 7-9

SCALE	
1	More than 80%
3	61-80%
5	41-60%
7	11-40%
9	Less than 11%

Traits for evaluation of rice hybrids and parental lines

Abortion Pattern of Male Sterile Lines

It can be monitored at growth stage 5-6. Florets are collected and fixed in 3:1 Acetic alcohol. Pollen grains are squeezed out from some anthers in Acetocarmine stain and observations are made on their staining behavior and number of nuclei visible in most of the pollen grains.

Scale	Description	Pollen Sterility (%)
1	Pollen free	TGMS line Norin PL12
3	Abortion at uni-nucleate stage of pollen	"CMS-WA" type
5	Abortion at binucleate stage of pollen	"CMS-HL" type
7	Abortion at trinucleate stage of pollen	"CMS-boro" type
9	Abortion at later stge and pollen looks like a fertile pollen	518A (*O. nivara* cytoplasm)

Degree of Male Sterility of Male Sterile Lines

A. Pollen sterility

It is observed under the microscope under magnification 10 x 10 after staining pollen grains with 1% Iodine Potassium Iodide (IKI) solution. Samples for pollen are collected from at least ten florets from individual plants at growth stage 6 and fixed in 70% alcohol. Two to three anthers are extracted from five of the florets on a glass slide and pollen are squeezed out with a spear-shaped needle in a drop of IKI solution. At least three microscopic fileds are used to count sterile pollen grains (viz., unstained withered, unstained spherical, and partially stained round) and fertile pollen grains (stained round); percentage pollen strerility is computed as follows:

$$\frac{\text{Number of (unstained withered + unstained spherical) + partially stained round)}}{\text{Total number of pollen grains (including fertile)}} \times 100$$

Scale	Description	Pollen Sterility (%)
1	Completely sterile	100
3	Highly sterile	99.0-99.9
5	Sterile	95.0-98.9
7	Partially sterile	70.0-94.9
9	Partially fertile to fertile	<70

B. Spikelet sterility

This trait of a male sterile line is monitored at growth stages 8 and 9. Two primary panicles of at least 50 plants of a male sterile line are bagged with glassine bags at growth stage 5-6 before their anthesis begins. Filled and unfilled spikelets of the bagged panicles are counted.

Scale	Description	Pollen Sterility (%)
1	Completely sterile	100
3	Highly sterile	99.0-99.9
5	Sterile	95.0-98.9
7	Partially sterile	70.0-94.9
9	Partially fertile to fertile	<70

A male sterile line is considered sterile if its pollen and/or spikelet sterility ranges from scale 1 to 3. Otherwise, it is considered unstable.

Extent of Outcrossing on Male Sterile Lines

This trait is monitored at growth stages 8-9 of a male sterile line grown in the field where pollen supply at its flowering time is abundant. Seed set on the out-pollinated primary panicles is observed.

Scale	Seed set (%) on out-pollinated primary panicles
1	Above 30
3	20-29.9
5	10-19.9
7	5-9.9
9	0-4.9

Fertility Restoration of F_1 Hybrids

This trait is monitored at growth stage 6 for pollen fertility and growth stage 8-9 for spikelet fertility.

Pollen fertility is measured using 1% IKI solution and following the technique described for evaluating male sterile lines. However, in this case, emphasis is one extent of fertile pollen percentage. Spikelet fertility is monitored by counting the number of filled grains and total spikelets per panicle and converted into percentage.

Scale	Pollen Sterility (%)	Spikelet Fertility (%)
1	90 and above	90 and above
2	80-89	90 and above
3	90 and above	75-89
4	80-89	75-89
5	70-79	75-89
6	70-79	60-74
7	60-69	60-74
9	<60	<60

Male Sterility Group

Male sterility group

SCALE	
1	Cytoplasmic-nuclear interaction type
2	Thermosensitive-genic type (TGMS)
3	Photoperiod-sensitive genic type (PGMS)
4	Thermo-photoperiod genic type (TPGMS)
5	Genetically engineered (transgenic type)
6	Nuclear type

Opening of Glume of Male Sterile Linerids

This trait is monitored at growth stage 6 during the time (9:00AM - 12:00Noon) when rice florets are blooming. Between 5-10 blooming florets of a male sterile line are collected from different plants and angle of opening of glumes (viz., lemma and palea) is measured on each floret. Following scale is used to classify male sterile lines on the basis of mean angle of glume opening:

Scale	Angle of glume opening (°)
1	50 above
3	40-49
5	30-39
7	20-29
9	Below 20

Panicle Exsertion of Male Sterile Lines

This trait is monitored at growth stage 6 by observing the extent of coverage of panicles by the flagleaf sheath.

Scale	Extent of coverage (%) of panicle by flagleaf sheath
1	0
3	1-10
5	11-25
7	26-40
9	Above 40

Stigma Exsertion of Male Sterile Lines

This trait is monitored at growth stage 6-7 by counting number of florets which have completed anthesis on a given day and the number of florets showing exserted stigma on one or both sides of the florets and expressed as percent stigma exsertion.

Scale	Stigma exsertion
1	Above 70
3	41-70
5	21-40
7	11-20
9	0-10

Culm Strength (Cs)

NOTE: Culm strength is first rated after heading by gently pushing the tillers back and forth a few times. This test gives some indication of culm stiffness and resilience. Final observation at maturity is made to record standing position of plants.

At growth stage: 8-9

SCALE	
1	Strong (no bending)
3	Moderately strong (most plants bending)
5	Intermediate (most plants moderately bending)
7	Weak (most plants nearly flat)
9	Very weak (all plants flat)

Grain Yield (Yld)

NOTE: Area harvested should not be less than 5 m2/plot (border rows should be discarded). Report yield in kilogram per hectare at 14% moisture.

At growth stage: 9

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