THE 1ST MULTI-ENVIRONMENT TESTING FOR IRRIGATED LOWLAND RICE – STAGE 0 DRY SEASON (MET0-IR, 2013DS)

INTRODUCTION

IRRI breeding programs generate fixed and stable lines each season that are identified from pedigree nurseries as well as observational and replicated yield trials. Eventually, elite lines are advanced to multi-environment testing (MET) conducted via breeding networks. These networks, however, presently have limited geographical coverage and face challenges in terms of germplasm movement. Moreover, the materials tested through these networks are generally in the advanced stage of varietal development. An exhaustive MET system for early generation breeding products is so far lacking at IRRI and in the global rice breeding community. For this reason, a new MET system is being established at IRRI beginning in 2011 under the Global Rice Science Partnership (GRiSP), to be piloted for irrigated lowland rice.

Goal

- To establish a systematic, sequential, multistage, and multi-environment testing (MET) system for elite breeding lines, managed through one entity, in order to improve overall breeding efficiency.

Objectives

- To identify elite breeding lines with high and stable yields and wide adaptation across a target population of environments that can be the future mega-varieties;
- To be able to select superior breeding materials adapted to one or more specific environment(s) and agro-ecologies;
- To develop and deploy varieties and breeding products to specific market segments;
- To exploit genotype, environment, and genotype x environment (G X E) interaction contributions to varietal performance in releasing breeding products to one or more target environments;
- To generate earlier feedback to breeders on trait performance and identify trait packages needed for molecular breeding;
- To improve partnerships with public, NGO, and private sectors who may have roles to play at certain testing/variety development stages. .

TRIAL COMPOSITION

This entry phase into the MET process is designed to: (a) eliminate lines with poor performance relative to checks in 3-4 key sites representing the target population environment (TPE) of the breeding pipeline; and (b) to select promising breeding lines and undertake panicle to row nucleus or breeder seed production in order to produce genetically pure seeds to be used in successive stages of the MET. The selected superior breeding materials will further be tested in the succeeding stages of the MET to see their stability and adaptability across locations. The trial consists of 472 test entries and 8 check varieties (4 each module). All the test entries were developed by IRRI and PhilRice. The designation, source and other information of each entry are provided in Table 1.

The check varieties and their corresponding entry numbers are as follows:

Designation	Classification	MET No.	Entry No.
PSB Rc10	Very early	MT4901	-1
PSB Rc82	Early	MT4902	-2
NSIC Rc238	Early	MT5433	-3
NSIC Rc132H (Mestizo 6)	Early (Hybrid)	MT5434	-4
NSIC Rc222	Medium/Late	MT4903	-1
PSB Rc18	Late	MT4904	-2
NSIC Rc158	Late	MT5435	-3
NSIC Rc124H (Mestizo 4)	Late (Hybrid)	MT5432	-4

THE EXPERIMENTAL SITE

An experimental field uniform in soil texture, depth and fertility should be chosen for the trial. It should have not been used previously for fertilizer experiments. It should have adequate irrigation and drainage systems. The area covers 0.5 hectare of land per site. It is suggested that the same area be utilized for MET trial every season.

EXPERIMENTAL DESIGN

The trial will be conducted using the Augmented Latin Square design for Module 1 and the Augmented Randomized Complete Block design for Module 2. These two modules are based on the flowering time of entries - Module 1 for very early/early flowering; and, Module 2 for medium/late flowering, as shown in the table below:

Flowering	Classification
90 days and below	Very early/Early
Above 90 days	Medium/Late

***This fieldbook contains the plot randomization (Tables 2 and 3), field plan and data sheets of MET0 for Irrigated Lowland Rice 2013 for Dry Season.**

For each module, the test entries and checks are randomly assigned plot numbers. Within each module, checks are replicated four times. Different trial sets have different randomization of entries. The plot randomization of entries is given in Tables 2 and 3. There are 336 plots for Module 1, while Module 2 has 168 plots. The seed packets are arranged and numbered according to plot numbers.

The field layout in Figure 1 is provided for your reference. Please do not modify the design or the layout.

Prepare the field thoroughly at least one month before transplanting following the locally recommended standards. Lay out rows in beds before seeding.

The experimental field should be properly labeled. The field layout in Figure 1 is provided for your reference. Please do not modify the design or the layout. The plot size for each entry is 7.28m^2 = 1.4 m x 5.2 m (7 rows by 26 hills with 20 cm distance between hills). There should be no vacant rows between plots (entries). Label all plots before distributing the seedlings for transplanting. Place the stakes bearing the plot number at the first hill of the left-most row of each plot.

Apply molluscicide two times – once at four days before and another immediately after transplanting.

NURSERY ESTABLISHMENT AND MANAGEMENT

Initially all seeds are placed in an oven for breaking dormancy at 50^{o}C for 5 days. A total of 50 grams of seeds for each entry are seeded, which should allow the planting of 1 plot of 1.4 m width (7 rows) x 5.2 m length. The seeds could be seeded in either wet or dry beds where they are grown for 21 days. The seedling beds are carefully kept free from insect and diseases and properly irrigated. After seeding, apply uniformly 1kg/100m^2 of Ammonium Sulfate (21-0-0 S) in the seedbed. If the seedlings show yellowing (N deficiency), apply another 1kg/100m^2 of Ammonium Sulfate (21-0-0 S) 10-12 days after seeding (DAS).

Prior to pulling, prepare tags to mark seedlings to be transported from seedbed to the field. After 21 days of sowing, each seedling of the entries are pulled out from the seedling beds, bundled and tied with G.I. wire marked with pot labels bearing the plot numbers. Distribute seedlings in the field corresponding to the lay-out. Check the entries and the plots for any possible mistake(s) before transplanting the seedlings.
Alternatively, apply zinc sulfate in the nursery seedbed, or dip seedlings in 2-4% zinc oxide suspension before transplanting (if zinc sulfate is to be applied on the soil as basal, dipping is no longer necessary).

The seedlings are transplanted into the field in 1-3 seedlings per hill following a spacing of 20 cm x 20 cm (1 seedling for hybrid rice). Keep some seedlings at the end of the plot near the plot label to replant missing hills.

Shallow water depth should be maintained starting from about 3 days after transplanting and is gradually increased to 3-5 cm until the hard dough stage. Replant missing hills within 7 days after transplanting to obtain uniform plant population. Care should be taken for uniform distribution of fertilizers and plant protection chemicals. The following tables provide the recommended fertilizer rate (kg/ha) for different test sites:

Recommended at IRRI

Season	Stage	N[1]	P[2]	K[3]	Zn[4]
DRY (*Dec-May*)	*Total*	160	30	40	5
	Basal	60	30	40	5
	Mid Tiller	40	-	-	-
	Panicle Initiation	60	-	-	-
WET (*June-Nov*)	*Total*	90	15	20	5
	Basal	30	15	20	5
	Mid Tiller	30	-	-	-
	Panicle Initiation	30	-	-	-

For PhilRice – Nueva Ecija and Isabela

Season	Stage	N[1]	P[2]	K[3]	Zn[4]
DRY	*Total*	150	60	60	5
	Basal	60	60	60	5
	Mid Tiller	40	-	-	-
	Panicle Initiation	50	-	-	-
WET	*Total*	90	60	60	5
	Basal	60	60	60	5
	Mid Tiller	15	-	-	-
	Panicle Initiation	15	-	-	-

[1] In the form urea
[2] As P_2O_5 from triple superphosphate or solophos
[3] K_2 from KCl
[4] As $ZnSO_4$

For PhilRice – Agusan

Season	Stage	N[1]	P[2]	K[3]	Zn[4]
DRY	*Total*	90	40	70	5
	Basal	40	40	70	5
	Mid Tiller	25	-	-	-
	Panicle Initiation	25	-	-	-
WET	*Total*	90	40	70	5
	Basal	40	40	70	5
	Mid Tiller	25	-	-	-
	Panicle Initiation	25	-	-	-

For DA – Bohol

Season	**Stage**	**N[1]**	**P[2]**	**K[3]**	**Zn[4]**
DRY (*Nov-Apr*)	*Total*	91	24	14	-
	Basal	22	24	14	-
	Mid Tiller	34.5	-	-	-
	Panicle Initiation	34.5	-	-	-
WET (*May-Sept*)	*Total*	91	24	14	-
	Basal	22	24	14	-
	Mid Tiller	34.5	-	-	-
	Panicle Initiation	34.5	-	-	-

[1] In the form urea
[2] As P_2O_5 from triple superphosphate or solophos
[3] K_2 from KCl
[4] As $ZnSO_4$

For weed control, a pre-emergent herbicide (Sofit EC if available) and molluscicide may be applied uniformly in the experimental immediately after transplanting following the recommended rate. Maintain a shallow water depth of 2-5 cm for at least 2 weeks after herbicide/molluscicide application. Subsequent hand weeding may be done if needed.

For disease and insect control, the experimental field should be well protected. Choose the appropriate cultural, chemical and biological control to effectively manage insects and diseases. If available, carbofuran may be applied at around 15 DAT and at PI. Do prophylactic application of Benlate at PI and follow up spray 2 weeks later for sheath blight. Rouging should be done to remove off-type plants. Rouge the field repeatedly up to the hard dough stage or for as long as off-types can be identified. These off-types should be cut at the base.

At harvest, collect all the plants in a plot except the 2 border rows on each side of the plot and 2 border rows on both ends of all the plots (the total number of plants harvested from a plot is 5 rows x 24 plants – 120 hills). The harvest from each plot is placed in clean net bags. Put the plot labels, bearing the entry number and plot number, inside the bag. A vogel thresher is used to thresh the samples. Clean the thresher well after every sample. Put the plot label inside the bag after threshing. All threshed samples are dried in a batch dyer at 45^{o}C for 4-5 days. In removing unfilled grains, clean the seed blower before each sample to avoid grain mixtures. Transfer clean seeds into labeled paper bags bearing the MET name, MET entry number, plot number, year and season.

DATA COLLECTION

The general reference for data collection is the Standard Evaluation System for Rice (SES, 1996). The following agronomic data are collected:

Trait — Explanation

VG: Vegetative Vigor. 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.

1	Extra vigorous (very fast growing; plants at 5-leaf stag have 2 or more tillers in majority of population)
3	Vigorous (fast growing; plants at 4-5 leaf stage have 1-2 tillers in majority of population)
5	Normal (plants 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)

ZN: Zinc Deficiency

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

FLW (DAS): Days to flowering. Number of days from seeding to 50% flowering. Fifty percent of the main tillers of the whole population (in a plot) are flowering.

MAT: Days to maturity. Number of days from seeding to grain ripening (85% of grains on panicle of the whole plot are mature, i.e. color is yellow).

HT (cm): Plant height. Average of five samplings measured in centimeters from soil surface to the tip of the tallest panicle (awns excluded) and can be measured when 80% are mature (i.e. HT1 = height for sample 1, and so on…).

TILLER: Tiller Number. Average of five samplings taken from inner hills by counting the number of productive tillers (the same samples used in measuring plant height). (i.e. TILLER1 = number of productive tillers for sample 1, and so on…)
Note: 1-3 seedlings per hill.

LDG: Lodging incidence. Percent of plants that lodged with at least 45 degree angle.

PACP: Phenotypic acceptability

Scale* (the grain type will depend on the market demand of each NARES)

1	Excellent = very good plant type, dense medium slender grains, no grain discoloration, without awns, no symptoms of diseases or deficiencies, medium to high tillering, comparable or better than the best check.
3	Good = good plant type, medium to high tillering, no symptoms of diseases and deficiencies, no grain discoloration, comparable to the check varieties
5	Fair = moderate tolerance to diseases and deficiencies, acceptable plant type, medium tillering and good grains.
7	Poor = poor plant type, awns, discolored grains, low tiller number, showing disease and deficiency problem
9	Unacceptable = very poor plant type, all plants have diseases and showing symptoms of deficiencies.

* *based on grain type demand of the Philippines and other SE Asian countries*

YLD: Plot yield in grams (excluding borders). Weigh the samples using appropriate equipment. *Note: Upon weighing, simultaneously measure MC.*
Adjust to 14% moisture content: Adjusted Yield = (plot yield)*MF
Where MF = (100 – MC at harvest)/86

MC: Moisture content in percent. After weighing the samples, measure the moisture content of the grains.
Note: To be simultaneously done with weighing of plot yield.

NO_PLANTS: Number of plants harvested. Standard number of hills to harvest = 120

Data are to be recorded in electronic field books utilizing a Samsung Galaxy Tablet with an App (FieldLab v2) developed by IRRI. Protocol on data gathering using this system will be provided later.

DATA REPORTING

Data can be reported to the MET Coordinator -- electronic copy (sent as e-mail attachment) or hard copy (via courier). The weekly update is done by filling up a google form accessed from the internet via the following link: https://spreadsheets.google.com/a/irri.org/spreadsheet/viewform?hl=en&key=0AoDI0s3ahqzFdGJESXVpR0MxY0VHTkl4Q2NZLXV3QXc. Weekly pictures of the trial can be submitted via www.dropbox.com under the MET Files folder which will be shared with the contact persons of each site. This www.dropbox.com can be freely downloaded from the internet.

There is also an excel file for data recording that corresponds to a trial-year-set number combination. A set number refers to a specific testing site. Examples of excel files are:

a. MET1-IR 2010/Set No. 1 - _____ (PHILRICE Nueva Ecija, Philippines)

The data sheet names and data to be entered in each sheet are summarized below:

Excel file sheet name	**Data to be entered**
LOCATION and EXPT-DESC (experiment-description)	Test site data, names of cooperators and data about agronomic practices
WEATHER-OBS (weather-observation)	Monthly weather data
PEST-OBS (pest-observation)	Pest type, pest name and degree of pressure
EXPT-OBS (experiment-observation)	Entry data (plant height, days to heading, etc.)

In excel data sheets, only rows and columns important to cooperators are shown. Hidden rows and columns are for MET use only. For example, in sheet LOCATION and EXP-DESC, rows 2-3 and columns C - T are hidden while in sheet WEATHER-OBS, rows 1-13, 19, 33-34 and columns H - I are all hidden.

Please fill-in the excel data sheet and send to IRRI as an email attachment to: a.tabanao@irri.org and a.galang@irri.org

You may send printed data sheets of this field book to:

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