



Recommendation for Rice Research in Africa — from my experience —

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18 September, 2012

2004 10 26

Today's Topics

- Experiment planning - make a simple design -
Replicates, the number of factors and treatments,
- Field management – treatment & growth -
Timing of water stress and fertilizer application
- Data collection in your field
Seeding rate, tillerings or panicles of rice plant
- Data Processing
How to use MS Excel (Basic function of MS Excel)

Simplify your experiment

Key words: factor(s) and treatment(s)

Many factors such as seeding method, plant density, fertilizer rates, etc. are in one trial.

Each factor influence the conclusion of your trial.

Complicate experimental Design

→ Difficult to analyze the main factor(s)

After the calculation we can get results but it is difficult to understand what is the most important factor among them.

Control and Treatment (1)

— Example of complicated design —

| Drilling | Dibbling | Broadcasting |
|------------------|------------------|------------------|
| N P:K = 40:30:30 | N P:K = 40:30:30 | N P:K = 40:30:30 |
| N P:K = 60:30:30 | N P:K = 60:30:30 | N P:K = 60:30:30 |
| N P:K = 80:30:30 | N P:K = 80:30:30 | N P:K = 80:30:30 |

■ : Variety A

■ : Variety B

■ : Variety C

Control and Treatment — Example of no control —

We must set up the control in our same experiments to compare the other treatment. We select the no treatment as the control like no-fertilizer application or traditional method in case of seeding rates.

We need to compare the control and the other treatments in the same trial.

An example in a report:

First and the most important finding is that the yield of NERICA in the normal cropping season is exceedingly high. The average yield of 2.23 tons per hectare is twice as large as the average in sub-Saharan Africa.

In this paper, the yield of NERICA is compared with the average yield of upland rice in sub-Sahara Africa although the author did not plant other upland rice varieties in the same trial.

Control and Treatment (2)

Table 1. Effects of different seed rate of broadcasting on yield and yield components of rice

| Treatment | Plant height | No. of effective tiller/plant | Panicle length | No. of spikelet /plant | No. of seed /plant | 1000 grains weight | Grain yield (t/ha) |
|-----------|--------------|-------------------------------|----------------|------------------------|--------------------|--------------------|--------------------|
| 50Kg/ha | 69.13 | 4.67 | 17.73 | 8.00 | 66.87 | 25.93 | 1.79 |
| 60Kg/ha | 69.93 | 3.87 | 18.33 | 7.87 | 58.33 | 26.77 | 2.05 |
| 70Kg/ha | 69.87 | 4.53 | 18.33 | 8.27 | 58.80 | 25.87 | 1.68 |
| 80Kg/ha | 64.47 | 4.47 | 17.53 | 7.67 | 55.27 | 25.53 | 1.63 |
| 90Kg/ha | 67.53 | 5.00 | 19.01 | 8.07 | 66.67 | 25.37 | 1.58 |
| 100Kg/ha | 62.73 | 4.13 | 15.90 | 6.73 | 46.87 | 25.17 | 1.60 |
| 110Kg/ha | 60.47 | 3.73 | 16.37 | 7.27 | 49.67 | 24.87 | 1.49 |
| 120Kg/ha | 60.40 | 3.33 | 16.10 | 6.73 | 42.53 | 24.73 | 1.38 |
| 130Kg/ha | 58.60 | 3.60 | 14.57 | 6.13 | 32.33 | 24.80 | 1.43 |
| 140Kg/ha | 68.00 | 4.47 | 17.50 | 7.73 | 62.53 | 25.23 | 2.16 |
| Mean | 65.11 | 4.18 | 17.14 | 7.45 | 53.99 | 25.43 | 1.68 |
| SD | 4.33 | 0.53 | 1.37 | 0.71 | 11.12 | 0.63 | 0.26 |
| CV(%) | 6.64 | 12.77 | 7.97 | 9.47 | 20.60 | 2.47 | 15.21 |

Which is the control?

Was the plant type such as panicle weight type or panicle number type considered?

Field Management in trials

Key words;

Characteristics of rice

- Growth Length (Early, middle, or late varieties)
- Plant Type (Panicle number type or panicle weight type)

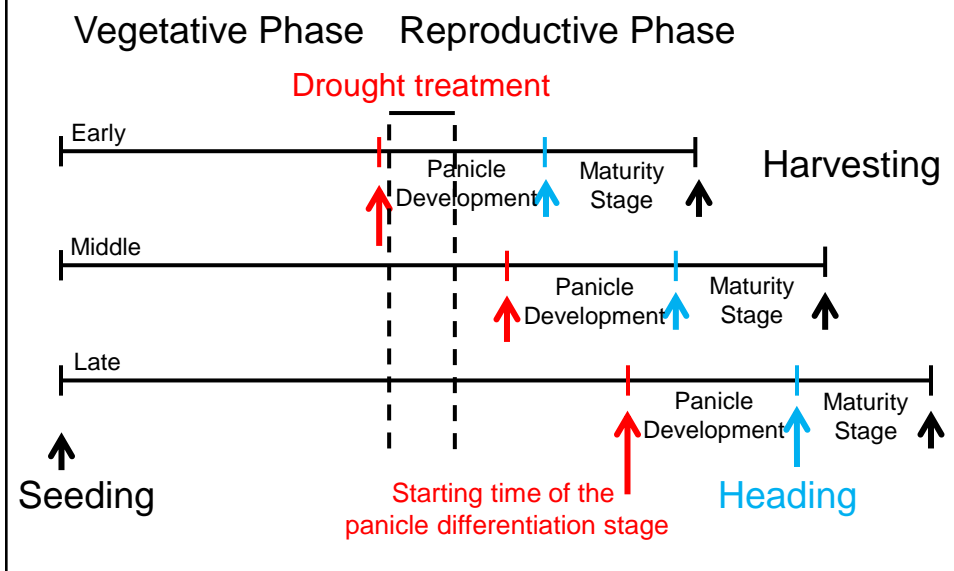
Timing of the treatment

- Water stress timing
- Fertilizer Application Timing

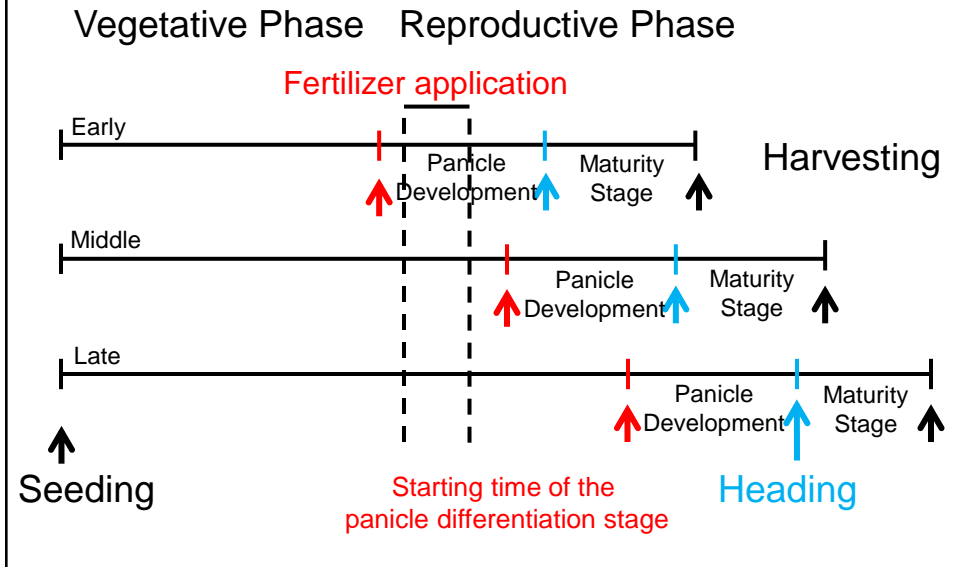
Growth stage & Treatment

The timing of the treatment should depend on each growth stage

Treatment on drought for Early, Middle, and Late Varieties



Treatment on fertilizer for Early, Middle, and Late Varieties



Fertilizer Application Timing & Its Contribution to Each Yield Component

— What is the yield Component? —

The number of hills m^{-2}

The number of panicles / hill

The number of grains / panicle

The percentage of filled grain (%)

1000 grains weight



How can we increase these yield components?

Fertilizer Application Timing & Its Contribution to Each Yield Component

— How to increase the yield component —

- The number of panicles / hill
↳ Fertilizer application at Beginning of the tillering stage
- The number of grains / panicle
↳ Fertilizer application at Panicle Initiation stage
- The percentage of filled grain (%)
↳ Fertilizer application at Meiotic stage

Data collection & Rice characteristics

— Plant type on panicle —

Some author concluded that farmers evaluated NERICA as having excellent tillering ability.

But NERICA was not compared with other *O. sativa* varieties.

Sometimes I found that many culms or panicles are because of the many seeding as shown in the next slide.

Data collection & Rice characteristics — Plant type on panicle —

Few

Many

Panicle weight type
(Heavy panicle type)

Panicle number type
Many tillering type)

Heavy

light

We select the variety because of many tillers



Many seeding or seedlings / hill

Single plant/ hill



Data Collection

Key words

How to collect the data without mistakes

Many chances to mistake in the data collection in the field because

In many case field observers want to finish rapidly the data collection.



Data collection sheets should be in accordance with the field layout

Data Collection

Entry

Field layout

Data sheet

| Variety | Rep 1 | Rep 2 | Rep 3 | Rep 1 | Rep 2 | Rep 3 |
|---------------|------------|------------|------------|-------|-------|-------|
| 1 NERICA 1 | NERICA 1 | NERICA 2 | WAB 56-104 | | | |
| 2 NERICA 2 | IRAT 136 | NERICA 4 | INARIS 88 | | | |
| 3 NERICA 3 | NERICA 4 | CG 14 | NERICA 8 | | | |
| 4 NERICA 4 | INARIS 88 | Kologbe | Yomkoyo | | | |
| 5 NERICA 5 | NERICA 2 | NERICA 1 | NERICA 3 | | | |
| 6 NERICA 6 | WAB 56-104 | NERICA 7 | Sefa fingo | | | |
| 7 NERICA 7 | CG 14 | Yomkoyo | IRAT 136 | | | |
| 8 NERICA 8 | NERICA 8 | NERICA 5 | Kologbe | | | |
| 9 WAB 56-104 | Yomkoyo | NERICA 6 | NERICA 7 | | | |
| 10 CG 14 | NERICA 3 | INARIS 88 | NERICA 5 | | | |
| 11 IRAT 136 | NERICA 6 | Sefa fingo | NERICA 2 | | | |
| 12 INARIS 88 | Sefa fingo | NERICA 3 | CG 14 | | | |
| 13 Yomkoyo | NERICA 5 | IRAT 136 | NERICA 1 | | | |
| 14 Sefa fingo | Kologbe | NERICA 8 | NERICA 4 | | | |
| 15 Kologbe | NERICA 7 | WAB 56-104 | NERICA 6 | | | |

Data Collection

Entry

Field layout

Data sheet

| Variety | Rep 1 | Rep 2 | Rep 3 | Rep 1 | Rep 2 | Rep 3 |
|---------------|------------|------------|------------|-------|-------|-------|
| 1 NERICA 1 | NERICA 1 | NERICA 2 | WAB 56-104 | | | |
| 2 NERICA 2 | IRAT 136 | NERICA 4 | INARIS 88 | | | |
| 3 NERICA 3 | NERICA 4 | CG 14 | NERICA 8 | | | |
| 4 NERICA 4 | INARIS 88 | Kologbe | Yomkoyo | | | |
| 5 NERICA 5 | NERICA 2 | NERICA 1 | NERICA 3 | | | |
| 6 NERICA 6 | WAB 56-104 | NERICA 7 | Sefa fingo | | | |
| 7 NERICA 7 | CG 14 | Yomkoyo | IRAT 136 | | | |
| 8 NERICA 8 | NERICA 8 | NERICA 5 | Kologbe | | | |
| 9 WAB 56-104 | Yomkoyo | NERICA 6 | NERICA 7 | | | |
| 10 CG 14 | NERICA 3 | INARIS 88 | NERICA 5 | | | |
| 11 IRAT 136 | NERICA 6 | Sefa fingo | NERICA 2 | | | |
| 12 INARIS 88 | Sefa fingo | NERICA 3 | CG 14 | | | |
| 13 Yomkoyo | NERICA 5 | IRAT 136 | NERICA 1 | | | |
| 14 Sefa fingo | Kologbe | NERICA 8 | NERICA 4 | | | |
| 15 Kologbe | NERICA 7 | WAB 56-104 | NERICA 6 | | | |

Record the data on the sheet in accordance with the field layout.

Data entering

Mistake of typing some figure of data: type 7 instead of 4, type 6 instead of 3



Check your raw data which you type in the Excel sheet.



Use the Calculator of the MS Excel for mean, SD, SE CV, etc.

Go to the excel sheet

Data Processing

Key words

Calculation by MS Excel

- MS Excel can calculate almost of all basic calculation which we usually use for statistics in our field experiments such as the mean, standard deviation (SD), Standard error (SE), Coefficient of variation (CV), and so on.

Significant figure

- To which decimal place should be written in your table ?

Significant Figure for mean, SD, and SE

Sometimes we find many figures after decimal point like 22.34587 in tables in reports. It is very difficult for us to check and follow the data.

Because MS Excel calculates automatically depending on the size of the cell.

Significant Figure for mean, SD, and SE

There is no need to show many digits after the decimal point when expressing the mean, standard deviation and standard error. As a general guide, divide the standard error by three (3), and look at the digit of not zero. We express the mean until the digit and take one more digit for the standard error.

Example 1: In case the results of calculation for a mean and standard error is 4.895 ± 0.382 , the standard error (0.382) is divided by three ($0.382 / 3 = 0.124$), and the answer is 0.124. Therefore, the mean is expressed until ten's place and standard error is expressed until hundred's place (4.9 ± 0.38). The standard deviation is pursuant to the mean.

Example 2: In case the results of for a mean and standard error is 5.223 ± 0.292 , divide the standard error (0.292) by three ($0.292 / 3 = 0.0973$), and the answer is 0.0973. Therefore, the mean is expressed until hundred's place and standard error is expressed until thousand's place (5.22 ± 0.292). The standard deviation is pursuant to the mean.

Significant figure for mean, SD, and SE

| Variety | Culm length (cm) | Panicle Length (cm) | 1000 GW (g) | Yield (kg/ha) |
|-------------|------------------|---------------------|-------------|---------------|
| 1 FKR 47 | 68.73 | 17.33 | 31.33 | 2472.6 |
| 2 IDSA 27 | 65.27 | 16.20 | 30.07 | 2122.7 |
| 3 IR 74371 | 67.10 | 17.53 | 17.73 | 1645.5 |
| 4 IR 7502 | 77.73 | 19.13 | 19.87 | 3235.4 |
| 5 IR 75506 | 70.77 | 18.47 | 21.07 | 2747.0 |
| 6 IR 75516 | 78.80 | 19.13 | 25.33 | 3089.5 |
| 7 IR 7S517 | 76.67 | 17.53 | 29.53 | 2184.4 |
| 8 IR 75517 | 78.60 | 18.87 | 26.27 | 2288.4 |
| 9 IR 75518 | 83.47 | 19.67 | 24.80 | 2391.8 |
| 10 IR 75518 | 78.20 | 18.87 | 28.87 | 2242.4 |
| 11 IR 75517 | 76.33 | 22.07 | 28.53 | 2485.4 |
| 12 IR 75518 | 79.00 | 20.20 | 29.93 | 1468.2 |
| 13 WAB 100 | 76.27 | 19.40 | 25.67 | 1924.0 |
| 14 WAB 272 | 80.40 | 16.80 | 29.00 | 2400.8 |
| 15 ADO 48 | 83.13 | 19.20 | 25.40 | 3007.2 |
| 16 ADO 12 | 86.60 | 19.87 | 25.33 | 3788.9 |
| Mean | 76.69 | 18.70 | 26.17 | 2468.4 |
| CV (%) | 7.8 | 7.8 | 14.9 | 24.2 |
| LSD (5%) | 7.5 | 1.9 | 3.9 | 903.7 |
| SD | 5.98504271 | 1.45006537 | 3.90901432 | 597.43999 |
| SE | 1.49626068 | 0.36251634 | 0.97725358 | 149.359997 |

We use the value of the SE.
For example, we use 1.49626.

We divide 1.49626 by 3.
And the answer is 0.478...

The figure which is not zero is 4.
It is the figure of ten's place.
So we understand the mean of figure of the culm length should be Shown 76.7,
SD = 6.0
SE = 1.50

Important issues in the trial

The **homogeneous rice growth** and **few missing hills** in the field are the most important.

If you have a good skill on the statistics, But in case rice growth in the field has some problems such as many missing hills, heterogeneous growth, and so on, the results of the field trial may not be able to reflect the field situation properly in particular for the yield component.

Field management, therefore, is also very important as well as field layout, data collection, and data processing

