

# **Focus on the field— Insight from 7 Experienced Research Agronomists on How to put out Trials to get Meaningful Agronomic Data**

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# INTRODUCTION

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# WHAT IS MEANINGFUL DATA?

- ✖ Low and behold the United Nations has a couple of publications on this--“Making Data Meaningful”—Parts 1 and 2
  - + And it is just about what you would expect from the UN

# DATA?

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- ✖ Data are the building blocks (the bricks and mortar) and information is the finished house. The raw materials are useless as a pile but once organized into a structure they becomes someone's home. Likewise data are useless for managers unless organized into information.
- ✖ A piece of datum has to go through considerable amount of manipulations before it becomes meaningful information.

# MEANINGFUL DATA

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- ✗ For our purposes... Meaningful Data is data upon which the user can determine if the various treatments had an affect on the question.
  - + Be those effects Positive, Negative or Null

# HIGH STANDARDS TO ACHIEVE

- ✘ When we were counting weeds or worms, variability could be 30, 50 or more %
- ✘ The bar is higher... when trying to separate 3-5% yield differences, CV's of 15% are generally considered to be the top end of acceptable...
- ✘ Lower CV's for more refined programs

# REALITY CHECK

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- ✗ The field work we are doing is taking that concept from the lab and moving it to the real world to see if the preliminary work translates.
- ✗ This is probably the most critical part of the process

# SO WHAT DOES IT TAKE ?

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- ✖ In short, properly designed experiments are those which control all of the variables so the treatment affects can be determined.
- ✖ That was easy... Class Dismissed.

# CONSISTENCY

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- ✗ The underlying principal is consistency.

Being consistently consistent is a  
consistent attribute of the consistently  
successful researcher....

# VINCE LOMBARDI

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✘ When Asked about Ag Research said

Consistency is not the important thing,  
it is the **ONLY** thing

# ERROR AS NOISE

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- ✖ Three Primary Areas of Error in a Trial
  - + Think of this as Background Noise which makes it harder to hear the results that you are looking for.

# ERROR AS NOISE

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- ✗ Poor Design
- ✗ Environmental Aspects
  - + Weather, Soils, Seed, etc..
- ✗ Mechanical
  - + Everything we do...

# WHERE IT ALL STARTS—THE TRIAL PLAN

- ✘ Without clear objectives and then a well thought out plan, efforts are hamstrung from the start.

# WHERE ARE WE IN THE BIG PICTURE?

- + Part of the mix is where this trial sits in the Sponsor's program
  - × Are you getting a gallon of “bugs in a jug” and then designing a trial to see if this product has a yield effect?
  - × Are you one of 20 sites doing the same trial and your samples are part of a bigger picture?

# HOW MUCH INPUT?

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- ✗ The big programs typically are detailed with minimal or zero input desired or accepted on design.

Some programs are looking for a fit for their product and very much want to test it according to local conditions. Input is desired and encouraged

**HOW MUCH INPUT?**

# HOW MUCH INPUT?

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- ✖ Others are looking to see what something does. They desire and need design and evaluation assistance.

# HOW MUCH INPUT?

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- ✗ And yet others are a combination—a regimented protocol but they have that catch phrase “and any other effects you observe”

# PRECISION

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- ✖ Residue or Composition trials need the least
- ✖ Yield trials need the most
- ✖ The fewer trial sites there are, the greater the precision at each one needs to be.
- ✖ This field work is a balance between cost and the needed precision.

# NOISE ABATEMENT PART 1

## ✕ Site Selection and Trial Layout

- + As I interviewed the various agronomists and program managers for this talk, there was one common thread...



# SITE SELECTION AND TRIAL LAYOUT

“We expect the researcher to know her fields, conditions and abilities and then tell us honestly what her capability is to layout the trial as requested and accomplish the objectives”

# SITE SELECTION

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When asked about the factors / tools used to help select a site, Service Provider knowledge was ALWAYS the first thing cited

# THE OBVIOUS IN SITE SELECTION

- ✖ Is the field the right size for the intended layout?
- ✖ Can you grow the crop reliably here?
- ✖ Soil Maps and aerial photography (such as Google Earth)

# SADISTICAL DESIGN

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- ✗ I will leave much of this to the next speaker, and this will involve various statistical designs, Degrees of Boredom, Reps, Alleys, Borders etc. etc. etc..
  - + Neighbors next to neighbors in multiple reps is not good,
  - + Pay attention to the outside blocks so the treatments are not repeated on edges.
  - + The Stats Handbook which you can get from GDM is a good reference.

# TRIAL LAYOUT

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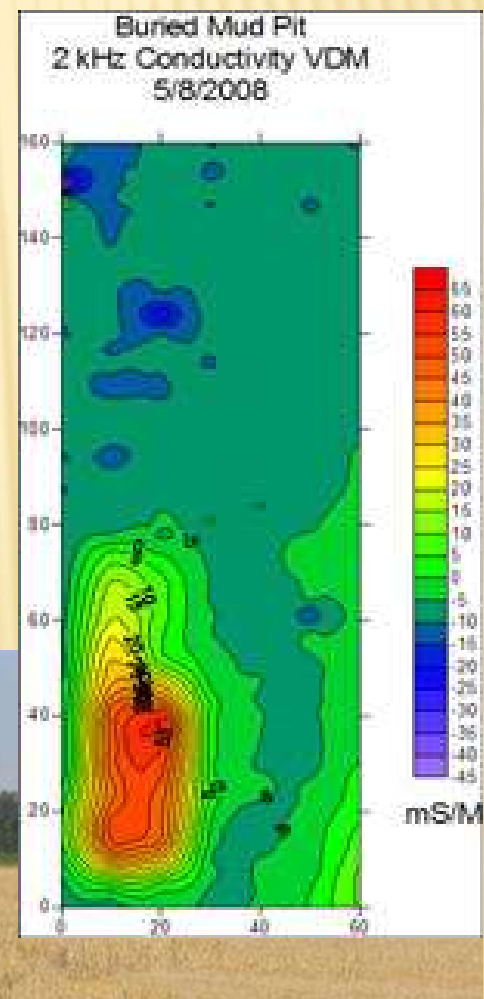
- ✖ From the field perspective, the general advice which came back, and summarized in a nutshell, is to know your variability and block it accordingly.
  - + Topography—Hills, river bottoms, sand bars, etc..
  - + Soil Types from the USDA
  - + Soil Sampling to the appropriate depth for the objectives

# SOIL MAPPING

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- ✖ Soil mapping technology usually focusing on EC, such as
  - + Veris, which uses a disk mounted system
  - + GSSI (Geophysical Survey Systems, Inc.) with a Electromagnetic rod
  - + Some companies are using these technologies as part of their field qualification procedure
  - + This mapping can be had commercially as well
  - + Use this information and overlay it with soil maps, crop canopy temperatures, etc. to design a thorough map of a block
  - + In Theory, these tools could be used to group or exclude particular plots from a trial

# SOIL MAPPERS



# IT STARTS WITH THE SEED

- ✖ The right varieties and good quality seed
  - + Evaluating a seed treatment with an out of slot variety
  - + Measuring fertilizer effects when the seed is of poor vigor



# IT STARTS WITH THE SEED

- ✖ Planting in the right window
  - + Getting the materials to be tested on a timely basis



# MECHANICAL

- ✖ This means everything we do during the course of the trial



# PRIOR TO SETTING A FLAG

## ✖ Irrigation systems

- + Wheel tracks on side rolls or pivots,
- + head gates on flood blocks
- + If you need to irrigate as a backup measure, is your trial oriented so that this irrigation is uniformly applied?



# PRIOR TO SETTING A FLAG

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## ✕ Field Drainage

- + If it rains a ton, is half your trial going to drown?
- + If you have tile system installed, Does your plot layout need to be modified to the drains?

# PRIOR TO SETTING A FLAG

## ✗ Previous Crop

- + Trial orientation so that the field history is uniform—half the trial area following Soy and the other half following Maize is not a great recipe for success
- + Herbicide carryovers going to be an issue?
  - ✗ And will your herbicide this year be an issue for your rotational plots next year?

# PRIOR TO SETTING A FLAG

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- ✕ Weather and local conditions
  - + Dusty Roads
  - + A wind storm which defoliates the first 50 foot of the field
  - + Thievery

# THE GOPHER IN THE GARDEN

Problem is that sometimes you do not know what the variability will be... Until it is way too late.

# MECHANICAL ISSUES PART 2

- ✗ In Season Management
  - + The perfect site is selected
  - + The protocol is perfect
  - + The seed is perfect

Now let's not screw it up.

# BEFORE THE SEED HITS THE PLANTER

- ✗ Use the right Land Prep
  - + Was all of it ripped, disked, plowed the same?
  - + Is the leveling consistent?
  - + Is the drip tape in consistently—depth and location to the planted row?
  - + Has the sprinkler been checked for uniformity?



# PLANTING=NOISE CENTRAL

- ✗ Go swear at the planter a bunch
  - + Consensus is that more Noise comes from planting than anywhere else.
    - ✗ Plant Population is spot on
    - ✗ In row spacing is spot on
    - ✗ Alleys are spot on—
      - ★ if you are planting round-robin, are your setbacks correct?
  - + A 20 foot plot with a 2.5 foot alley leaves little margin for error. And I have seen some very high dollar GPS planting systems totally choke on this...

# ALLEYS AND BORDERS

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- ✖ Decide how your alleys are going to be managed
  - + Planted to crop?
  - + Herbicide or hand hoed out?
  - + Mowed or disked?
  - + Used as a place to set the harvester?

# ALLEYS



# PLANT DENSITY

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- ✗ Plant density has to be uniform if Yields are to be meaningful
  - + Seed must be plantable
    - ✗ The love affair with consistently sized seed
  - + Counts made after emergence
    - ✗ Various statistical hoopla can cancel some noise if the density is known

# MARKED PLOTS

- ✗ Get it marked at planting!
  - + The sad story of the guy who planted East and West, and the spray operator who applied the glyphosate used the map North and South...
  - + Durable plot markings
    - ✗ Every plot, every 5<sup>th</sup> or ?
      - ★ We are leaning to each one with a tag which follows it all the way.



# NON TREATMENT ACTIVITIES

- ✗ Everything we do which is not a treatment requirement must be consistent across the whole trial, or at the very least, a replication block.
  - + Cultivations
  - + Irrigations
  - + Maintenance Sprays
    - ✗ Spray tank carryover
    - ✗ Right boom widths



# IRRIGATION

# FAIL



# IRRIGATION PREP

FAIL



# IRRIGATION AND LASER JOB

## Double FAIL



- ✗ Fertilizer

- + Confident of analysis
  - + Using just one lot



- ✗ Sampling from the correct rows

## NON TREATMENT ACTIVITIES

- ✗ Wheel traffic uniformly in all plots, or reps at least
- ✗ Cultural practices such as hand weeding done by rep if over multiple days

# MECHANICAL ISSUES PART 2,945

## ✕ Data Collection

- + When data / samples are to be compared across sites uniformity is critical
  - ✕ Clear on what is being done
  - ✕ Verify the growth stages and understanding



# CASTAWAY—WILSON, WHAT AN ACTOR

- ✖ Talking among ourselves, the networking we have here, is crucial to our success
  - + Most clients are too pushed to provide good instructions so the aid from your peers is best for them as well
  - + Make sure your team understands the tasks



# ACCURACY AND PRECISION

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- ✖ Two different things which go hand in hand

A 5 by 10 foot wheat plot at 80 bu produces 5 pounds, and 3% yield difference is about 75 grams so using a 60 pound analog scale to weigh will not give the accuracy nor precision needed

# HARVESTING

- ✗ Not having the combine set up well prior to harvest, and worse, not having border or buffer to



harvest and set the machine is problematic

# HARVESTING

- ✕ Harvesting over multiple dates



# HARVESTING

- ✕ Hand harvest some plots, machine other plots



# HARVESTING

- ✖ Sample by reps when appropriate



# HARVESTING

- ✗ Everything must be the same moisture, trimmed the same, sized correctly and so on.



# THE MENTORS

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- ✗ Zhongjin Lu—Arcadia
- ✗ Curt Kallal--Pioneer
- ✗ Blake Cooper—Limagrain Cereals USA
- ✗ Doug Nubel—Pioneer
- ✗ Dana Eaton—Biogemma
- ✗ Fred Salzman—Pioneer
- ✗ Scott Jones—Monsanto

# THANK YOU

