

EXPERIMENTING ON FARM

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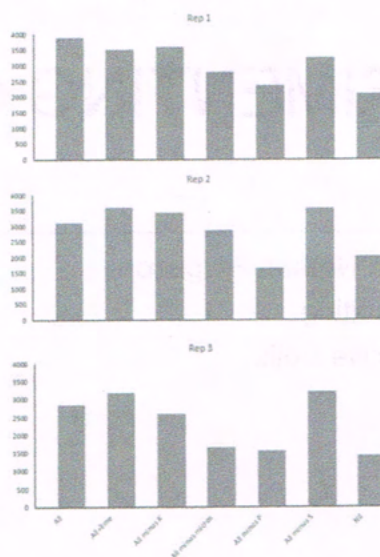
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The design

- Compare a range of treatments that leave out one critical nutrient
- In this case treatments were
 - All – includes phosphorus (P), sulphur (S), Potassium (K) and Micronutrients (bundled together)
 - All minus P
 - All minus S
 - All minus K
 - All minus micronutrients
 - None
 - (plus another treatment added in – All + Lime)

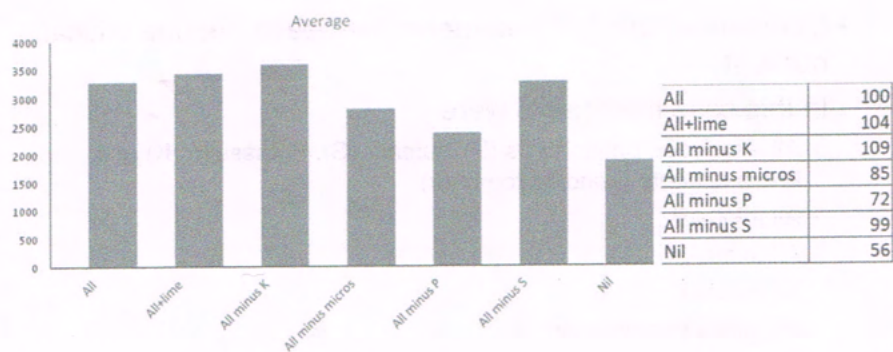
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Its actually one experiment



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And now the average.....



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So what does a good experiment look like?

- First step - select treatments – ask a simple question (most important step – get this right)
 - How much extra growth from Nitrogen?
 - Is my pasture short of Molybdenum?
 - Is this P fertiliser as good as that one?
- Don't get distracted adding treatments that will not answer the question

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So what does a good experiment look like?

- Second step - select treatments
 - Make it simple and don't over complicate
 - Depends on experiment BUT always include a "Control" – is no N added, no Mo added etc
- Third step – the design
 - ALWAYS replicate the treatments – remember our example today
 - ALWAYS randomise the treatments within each replicate....
 - Imagine a simple experiment – three nitrogen treatments on pasture replicated 4 times
 - N_0 – No nitrogen
 - N_{100} – 100 kg/ha Nitrogen
 - N_{200} – 200 kg/ha Nitrogen
 - Here are some layouts....

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Agricultural experiments and blocking

- We know to replicate but why place the replicates in blocks?
- Putting the replicates in blocks allows us to reduce the noise and amplify the signal. Sources of noise...
 - Seen and unseen
 - Slope
 - Soil depth
 - Previous history – uneven fertiliser strips
 - Gradients in pasture composition
- Each block contains one replicate of each treatment
- Locate the block where you think it will reduce unexplained variation in the results

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Treatments need to be randomised

- Within each replicate treatments need to be randomised
- We don't need all of one particular treatment on one side of the trial
- How to randomise?
 - Computer programs
 - Random number generators
 - Tossing a coin...
 - Thoughts?
- When we randomise our design it will look like this...

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So what does a good experiment look like?

Rep 1	N_0	N_{100}	N_{200}
Rep 2	N_{100}	N_{200}	N_0
Rep 3	N_0	N_{100}	N_{200}
Rep 4	N_{200}	N_0	N_{100}

This is as good as can be achieved with a small number of treatments – there are many options

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Here's a quick quiz.....

- If you had to layout an experiment with three replicates of three treatments (A,B,C) how would you do it?
- Which would be better

A	B	C
B	A	C
B	C	A

or

A	B	C
C	A	B
B	C	A

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Is this all just fussing

- Surely if the result is clear enough then we don't need to do all this stuff?
- WRONG
- Demos versus experiments
- Replication is the big difference.....how much of the Demo result is...noise?
- Guilty of doing demos to sort out on farm problems. No longer.
- Discuss – implications for on farm experiments and demonstrations

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Final words

- All good experimentation in the field includes treatments that are replicated and randomised.
- Ultimately such trials must be properly analysed and the results presented to reflect this
- Demonstrations are a poor substitute for properly designed trials
- There are many operators in the wider agricultural industries that ignore these simple rules

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Today's experiment

- Had a problem finding a paddock with an outstanding problem that we could attack
- Newly purchased block had low soil P so we will go with that. Tests from 2020....

Paddock - Just Over		Comment
Colwell P (mg/kg)	10	Very low - 18 below critical
PBI	44	
Critical P (mg/kg)	28.4	
Colwell K (mg/kg)	99	Marginal
Sulphur (KCl40 mg/kg)	6.7	Under critical (8 mg/kg)

- The bad news...already fertilised this year

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Question...

- How much is fertility still holding back the pasture??
- (not a great question)
- A simple set of treatments
 1. **Nil** – no extra fertiliser
 2. **Superphosphate** – 200 kg/ha
 3. **Triple pluS** – 100 kg/ha (same P/ha as Super) –extraneous treatment
 4. **Super + K** (potassium at 200 kg/ha potash)
 5. **Super + N** (urea at 200 kg/ha)
 6. **Super+K+N** (at rates above)
- Three replicates

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Design

- This is what it looks like:

Up Hill

Rep1	1	Super+K	2	Super+N	3	Triple pluS	4	Nil	5	Super+K+N	6	Super
Rep2	7	Super+K+N	8	Triple pluS	9	Super	10	Super+K	11	Nil	12	Super+N
Rep3	13	Super	14	Nil	15	Super+N	16	Super+K+N	17	Triple pluS	18	Super+K

Down Hill