Department of Agriculture and Food

GOVERNMENT OF WESTERN AUSTRALIA

Design and analysis of on-farm trials

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Supporting your success

Successful on-farm trials

A successful on farm trial includes:

- Defining clearly the research question
- Finding out what others have done
- Choosing an appropriate set of treatments
- Selecting a suitable location for the trial
- Including replication of all treatments
- Allocating treatments to plots in a statistically sound way
- Deciding what you are going to measure and how
- Appropriate statistical analysis

Replication

Assume no replication

There is no way to tell if the difference is due to treatment or something else!

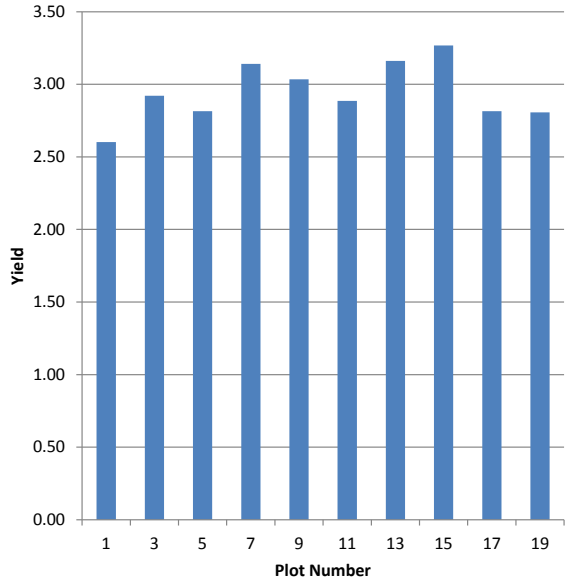
- It could be a ‘once-off’.

Average results from all 13 reps: Untreated 3.4 t/ha vs Seed treated 3.4 t/ha

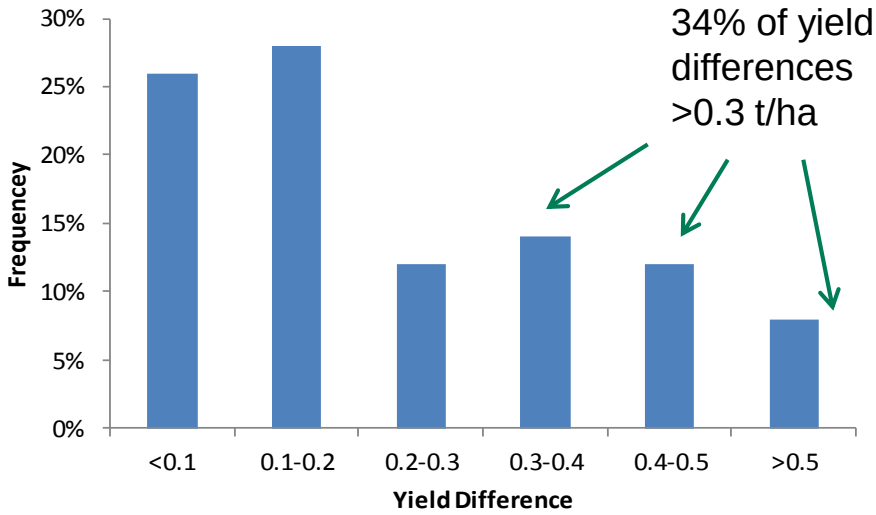
- No difference!

Variation

More on-farm trial variation (source: SEPWA variety trials)



Control yields (every 2nd plot in this trial)



Differences between consecutive control plots (2010 wheat trials, 12 farms, 50 differences)

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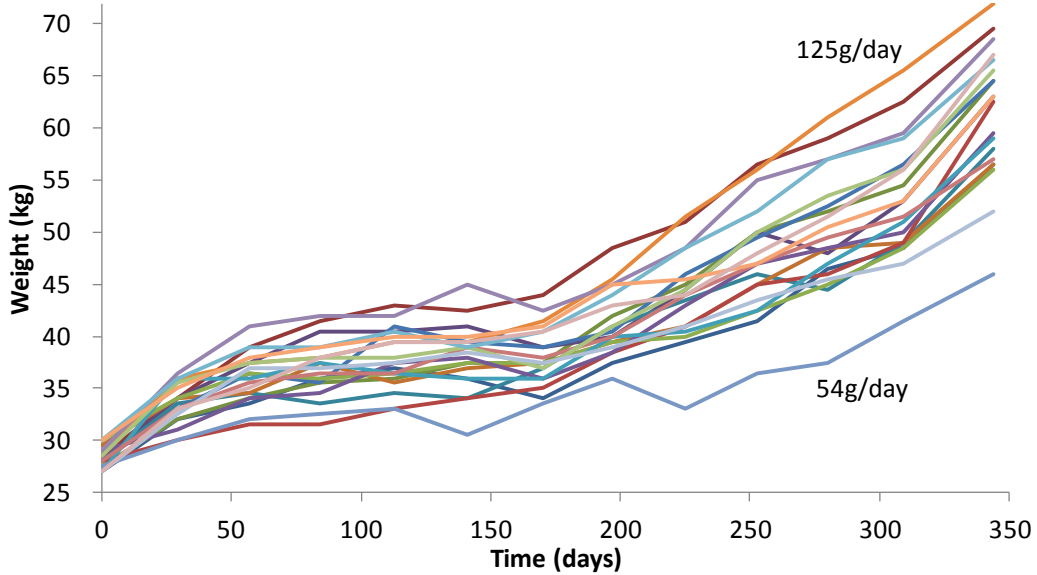
Animal variation example



Variation in growth from animals receiving the same feed treatment

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Replication

What does replication do:

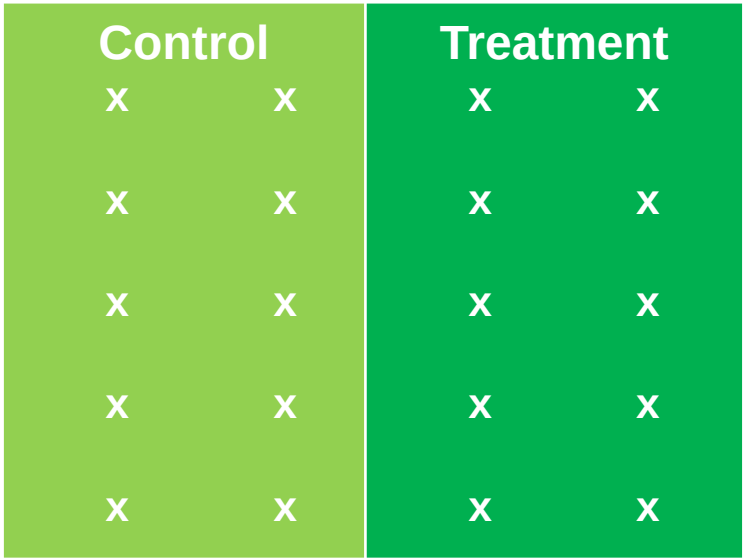
1. increases the accuracy of treatment effects

2. gives a measure of variability

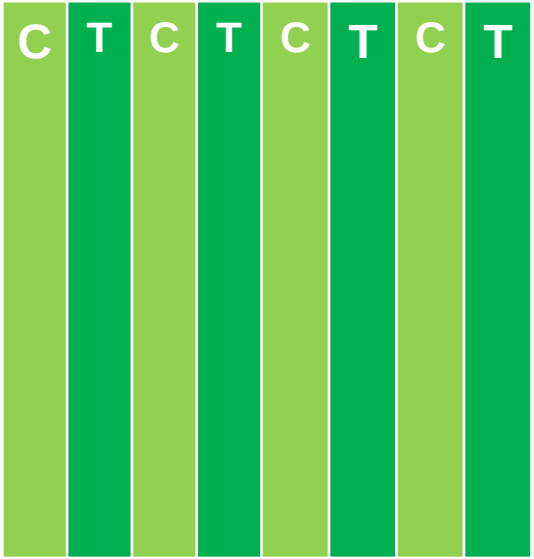
    - which is necessary to calculate confidence that treatment effects are real

Replication

True and false replication



False replication



True replication

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Treatments

Choosing treatments:

1. a small number so that all can repeated at least 2x

2. only treatments that could give a large difference

    - eg. with 2 reps, would need treatments to be different by about 0.4-0.5 t/ha to have high confidence (95%) the difference is real.

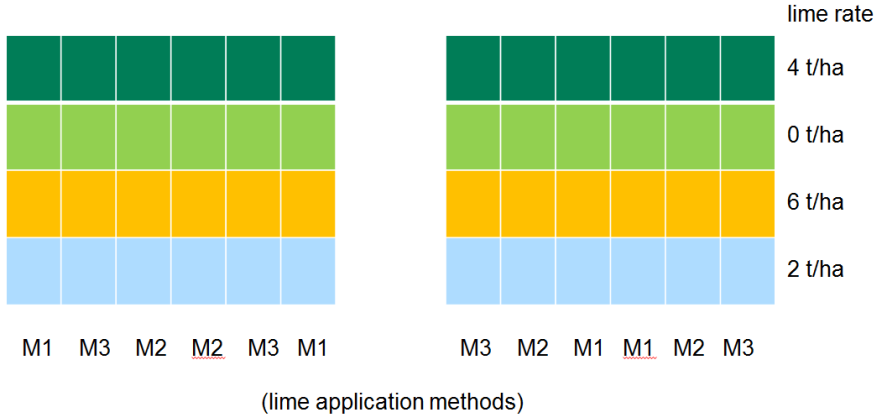
Measurements:

- all plots (within each rep) to be treated consistently
  - eg. harvested in the same direction.
- keep records of anything unusual
  - eg. animal damage, frost, waterlogging (% of each plot impacted)

Trial design

2 examples where the design could be improved

Raised bed and control treatments



4 lime rates by 3 application methods (M1, M2, M3)

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Trial design

Poor design:

1. treatments comparison may not be valid
2. usually can't be fixed by clever analysis
3. can give wrong conclusions:

Real Treatment Effect	Conclusion from Experiment	Industry impact
Yes	No	Lost opportunity
No	Yes	Extra cost for no benefit

Design is a very important step!

- Recommend: careful planning and biometrician input.

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Analysis:

- recommend getting maximum value by using a biometrician
  - DAFWA contact: Andrew van Burgel, Albany office, 9892 8550
  - SAGI (“Statistics for the Australian Grains Industry”) – GRDC funded trials

Analysis of variance example

Analysis of variance

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Rep stratum	3	0.30800	0.10267	2.43	
Rep.*Units* stratum					
Nitrogen	4	0.45300	0.11325	2.68	0.083
Residual	12	0.50700	0.04225		
Total	19	1.26800			

Tables of means

Nitrogen	N0	N20	N40	N60	N80
	2.200	2.425	2.475	2.650	2.550

Least significant differences of means (5% level)

Table	Nitrogen
l.s.d.	0.3167

Conclusion

Take home messages:

- Importance of good trial design
- Minimum 2 reps of all treatments (not just the controls)
- Consult a biometrician for design and analysis

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Thank you

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