

Precision agriculture – Which paddocks will pay, using the PA Calculator

Roger Lawes, Yvette Oliver, Mike Robertson, Mike Wong, Bill Bowden, Roger Mandel

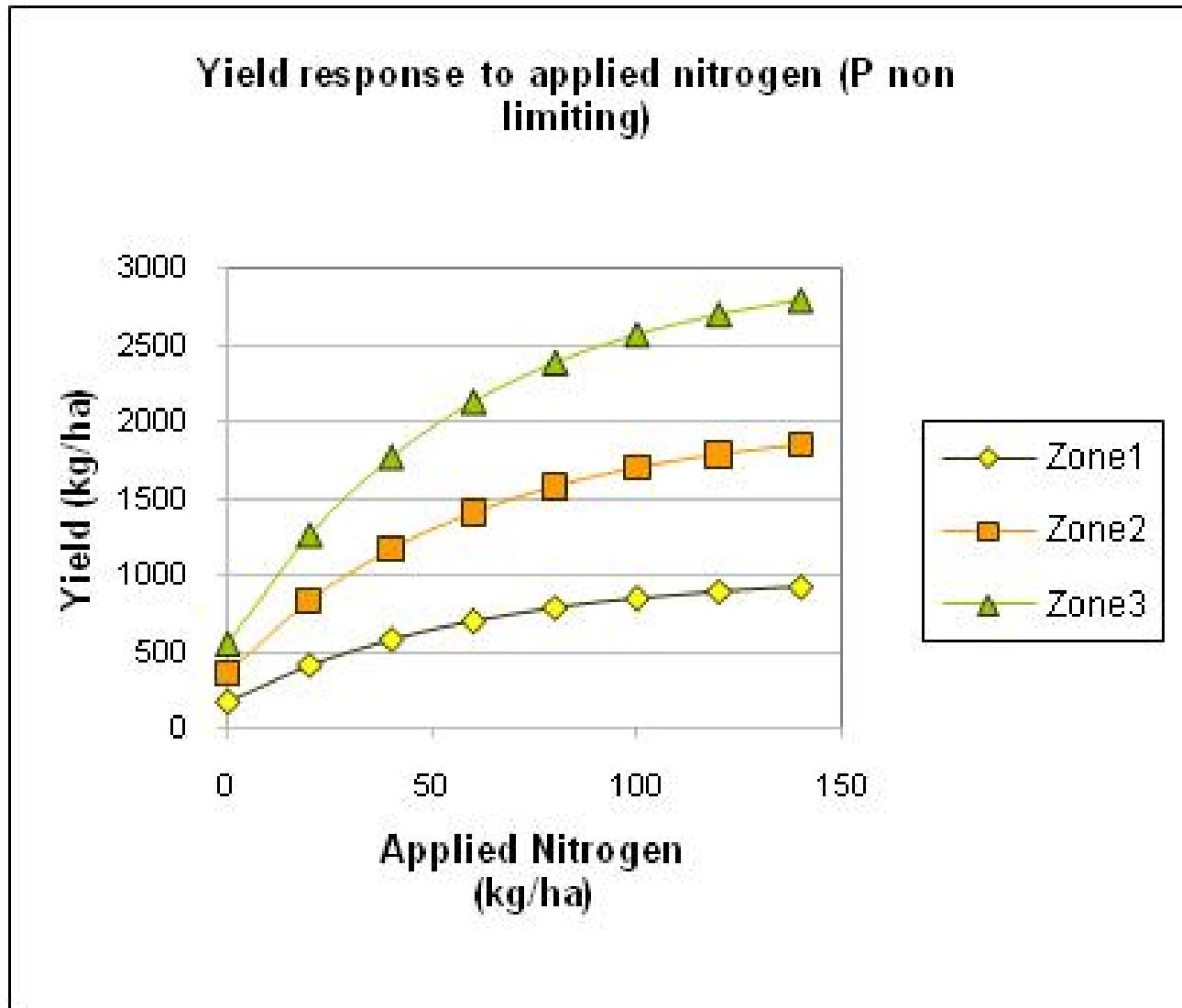
What paddocks should I do PA on?

- PA and VRT can be time consuming
- Assemble Yield Maps
- Assemble other pieces of data (eg EM maps)
- Form Zones
- Ensure controllers 'talk' to each other
- Calculate rates for each zone

PA Questions

- Have I got enough variation in yield?
- What is the reason behind this variation in yield?
 - Understand the soil ; fertility levels, possible constraints
- Relate these constraints to yield
- Get everything to work
- WHAT PADDOCKS SHOULD YOU DO THIS TO?

The classic fertiliser - yield response function.



The PA Calculator – why use it?

- What paddocks will generate a return from VRT?
- What paddocks will generate a return from ameliorants?
- What do you need to know to run the calculator?
 - Number of zones
 - Potential yield of each zone (tonnes)
 - Area of each zone (Hectares)
 - Starting level of N and P in each zone
 - Fertiliser Price (N and P \$/ tonne)
 - Grain Price (\$ / tonne)

A worked example – straight VRT with uniform soil fertility

	Zone 1 (33 Ha)	Zone 2(33 Ha)	Zone 3 (33 Ha)
Yield (T/Ha)	1.0	2.0	3.0
Soil N kg/ha	25	25	25
Soil P kg/ha	8	8	8

Key Outputs	
Pay Off from VRT	\$12.3 / ha
Whole Paddock return from VRT	\$1214
Fertiliser savings with VRT (if any)	\$14.22 /ha
Average Fert spend	\$142 / ha

A worked example – straight VRT – variable soil fertility

	Zone 1 (33 Ha)	Zone 2(33 Ha)	Zone 3 (33 Ha)
Yield (T/Ha)	1.0	2.0	3.0
Soil N kg/ha	35	25	15
Soil P kg/ha	16	8	4

Key Outputs	
Pay Off from VRT	\$28.1 / ha
Whole Paddock return from VRT	\$2772
Fertiliser savings with VRT (if any)	\$20 /ha
Average Fert spend	\$150 / ha

A worked example – restricted fert budget VRT

	Zone 1 (33 Ha)	Zone 2(33 Ha)	Zone 3 (33 Ha)
Yield (T/Ha)	1.0	2.0	3.0
Soil N kg/ha	35	25	15
Soil P kg/ha	16	8	4

Key Outputs	
Pay Off from VRT	\$39 / ha
Whole Paddock return from VRT	\$3836
Fertiliser savings with VRT (if any)	N/A
Fert spend constrained	\$100 /ha

A worked example – ameliorating a zone

	Zone 1 (33 Ha)	Zone 2(33 Ha)	Zone 3 (33 Ha)
Yield (T/Ha)	1.5	2.0	3.0
Soil N kg/ha	35	25	15
Soil P kg/ha	16	8	4

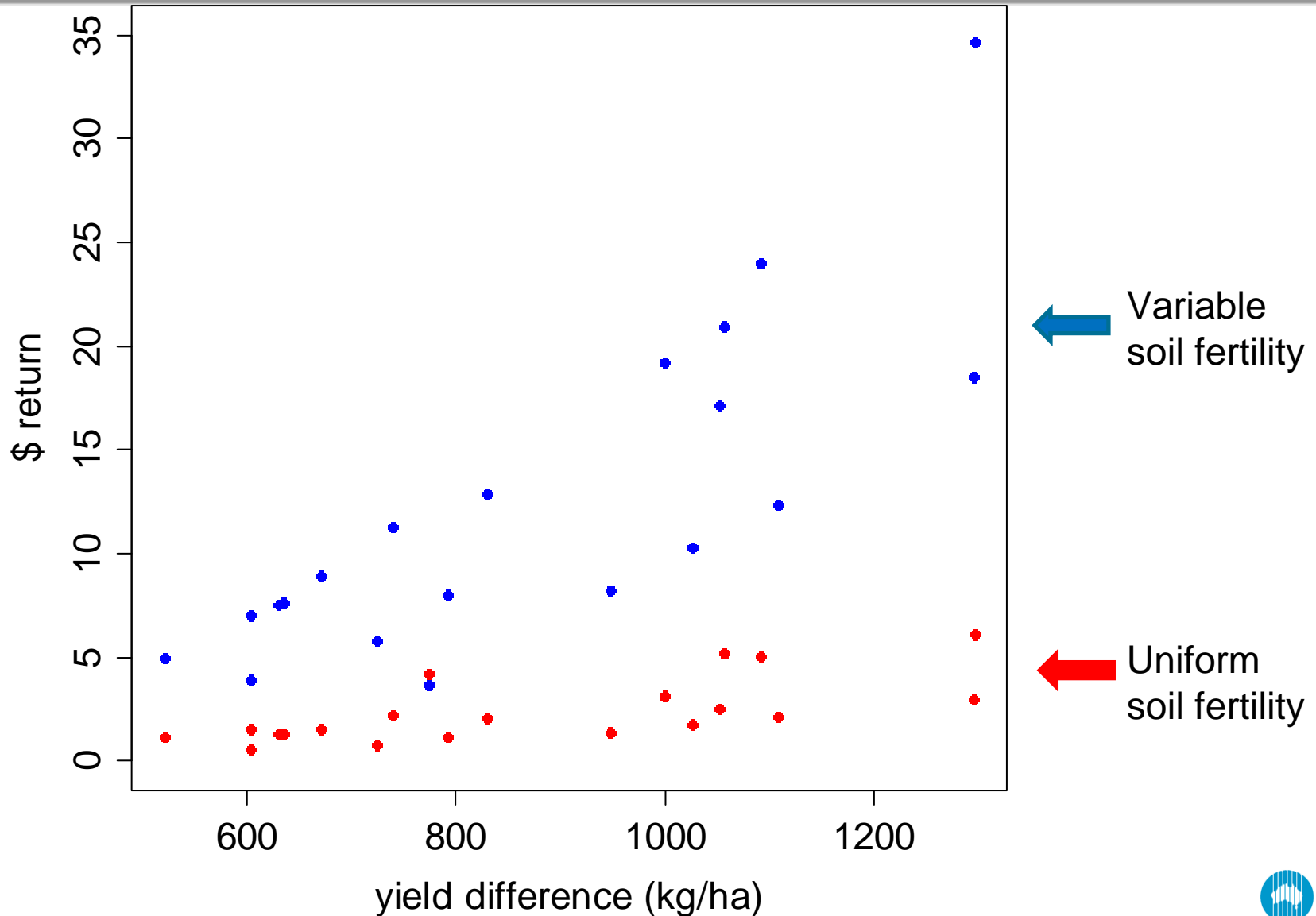
Key Outputs	
Whole Paddock GM – Default	Whole Paddock GM - Ameliorated
\$336.4 / ha	\$372 / ha

This difference is what has to be balanced against the cost of amelioration

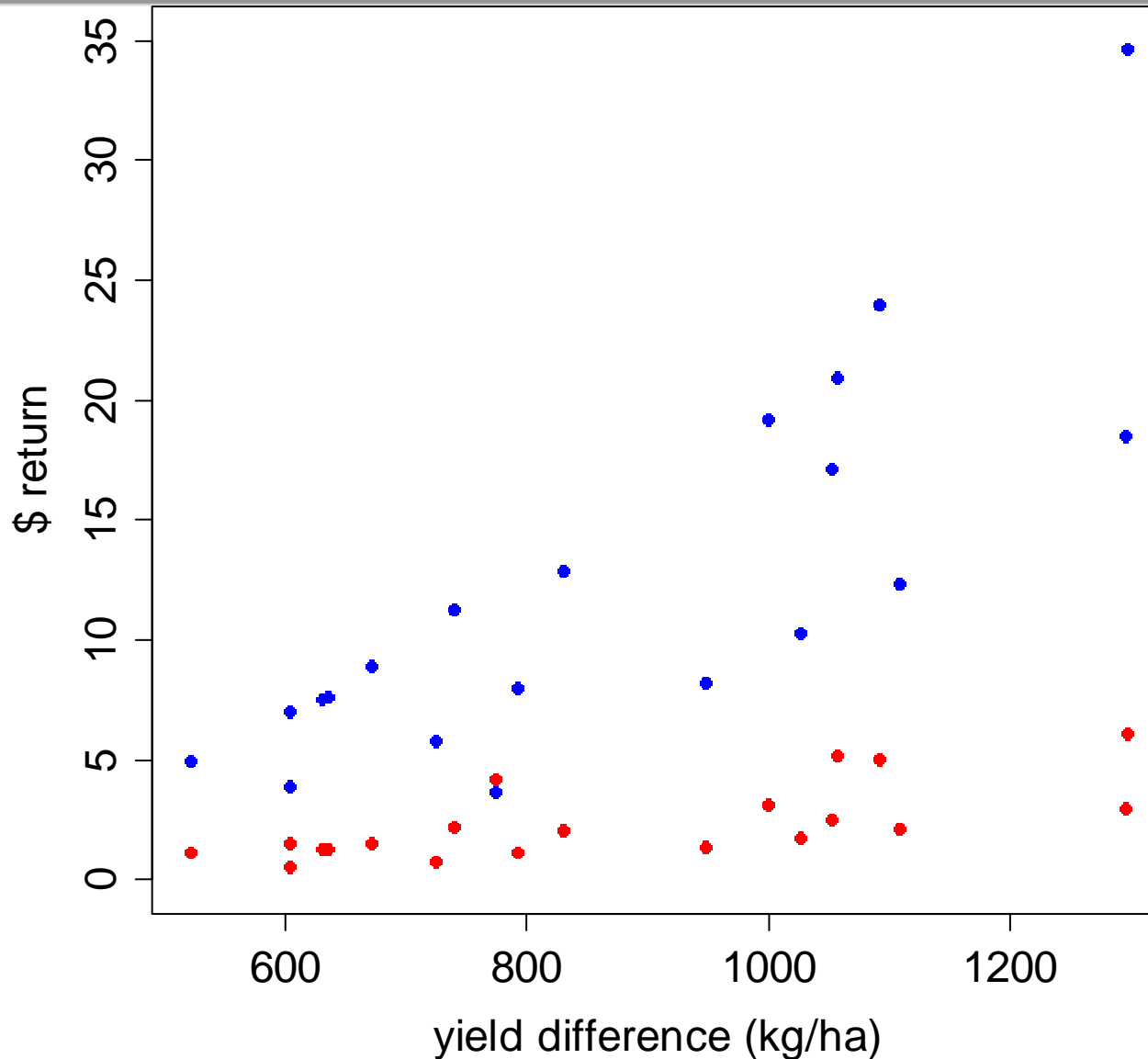
What factors could influence VRT returns – A case study in the Eastern Wheatbelt

- Grain price
- Fertiliser price
- Starting levels of soil fertility
(supply side of the equation)
- Amount of variation in crop yield
(demand side of the equation)

Effect of yield difference between zones and soil fertility on VRT returns

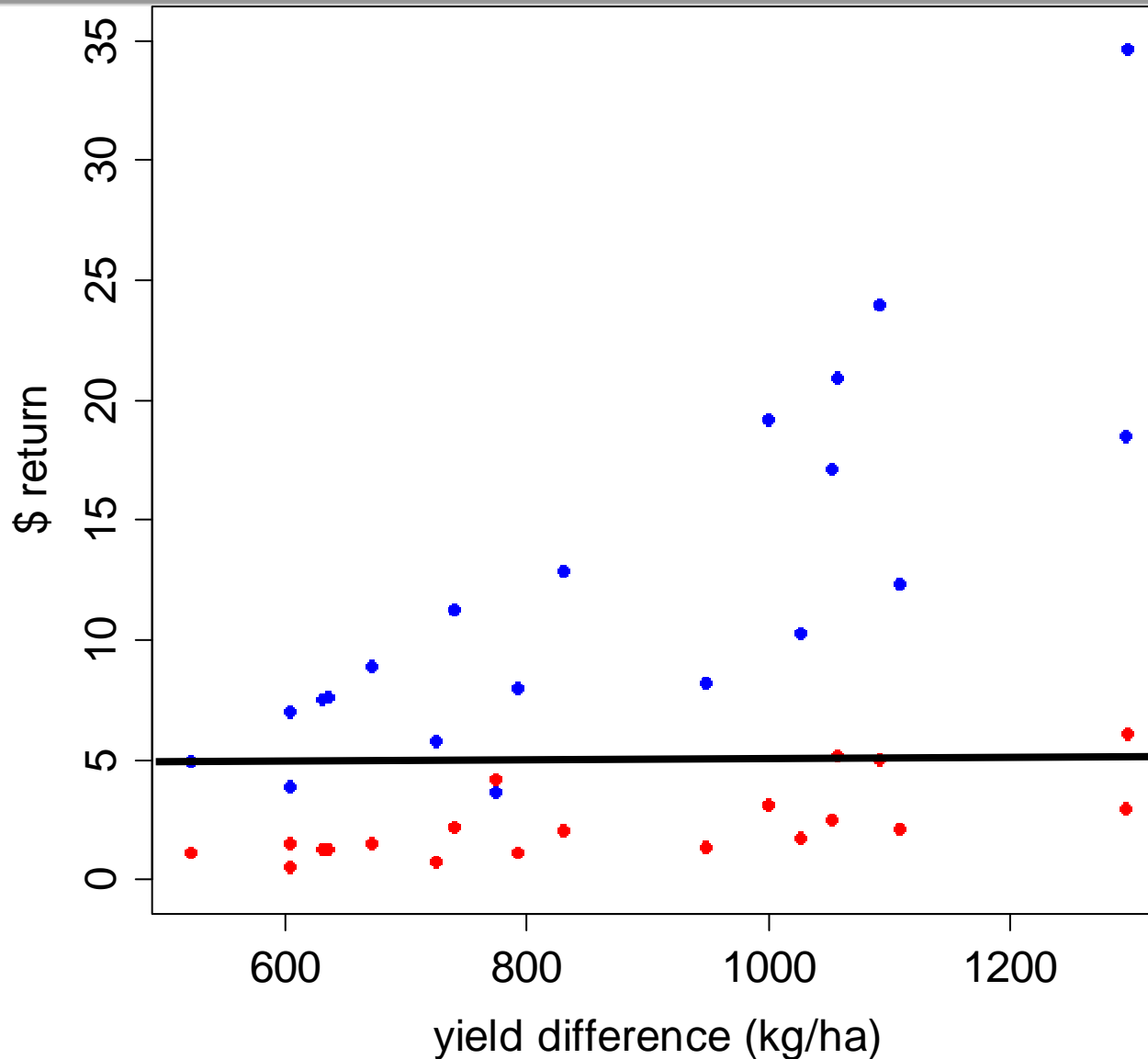


So how many paddocks does VRT pay on?



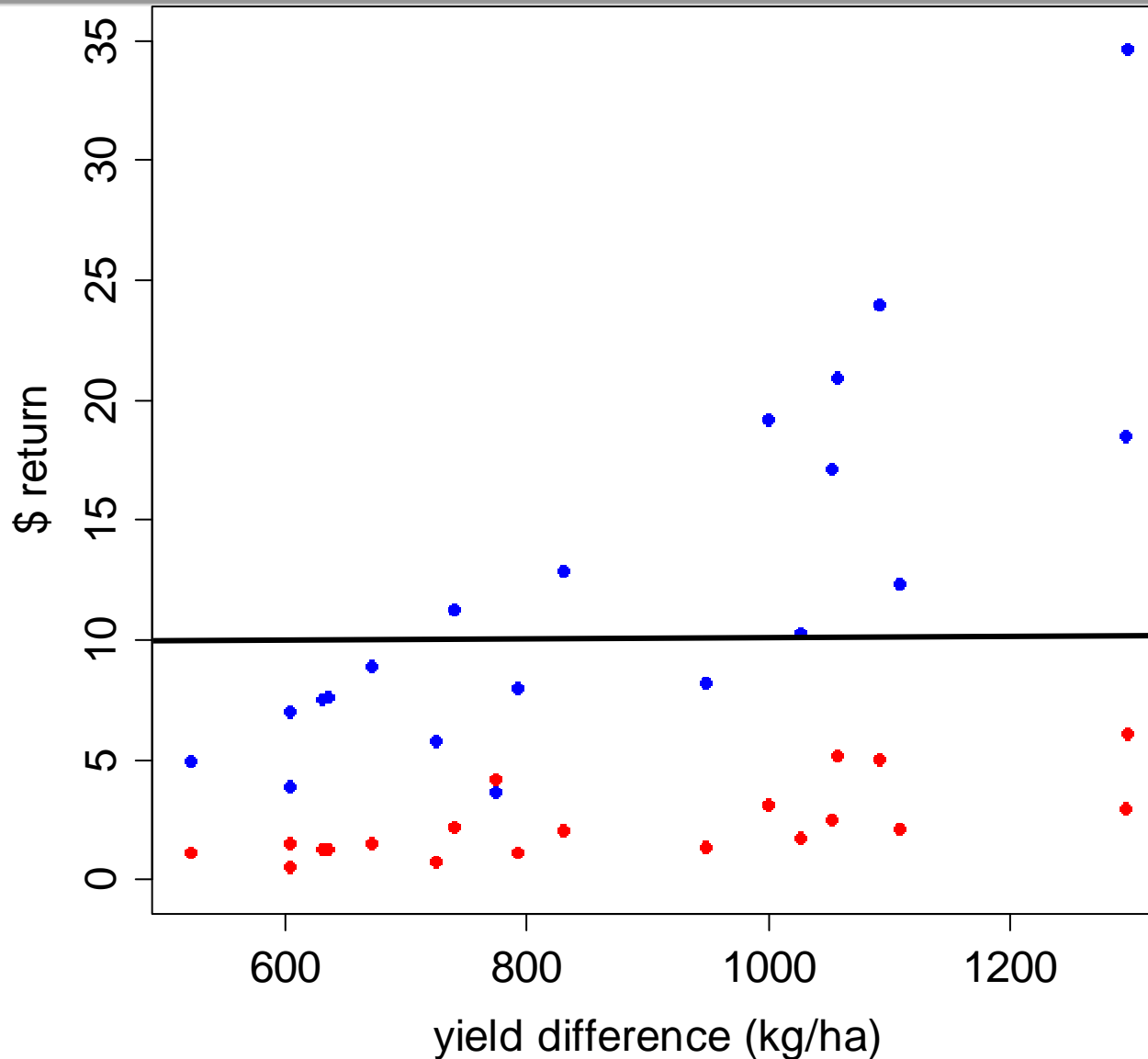
What is your cut off \$ return?

So how many paddocks does VRT pay on?



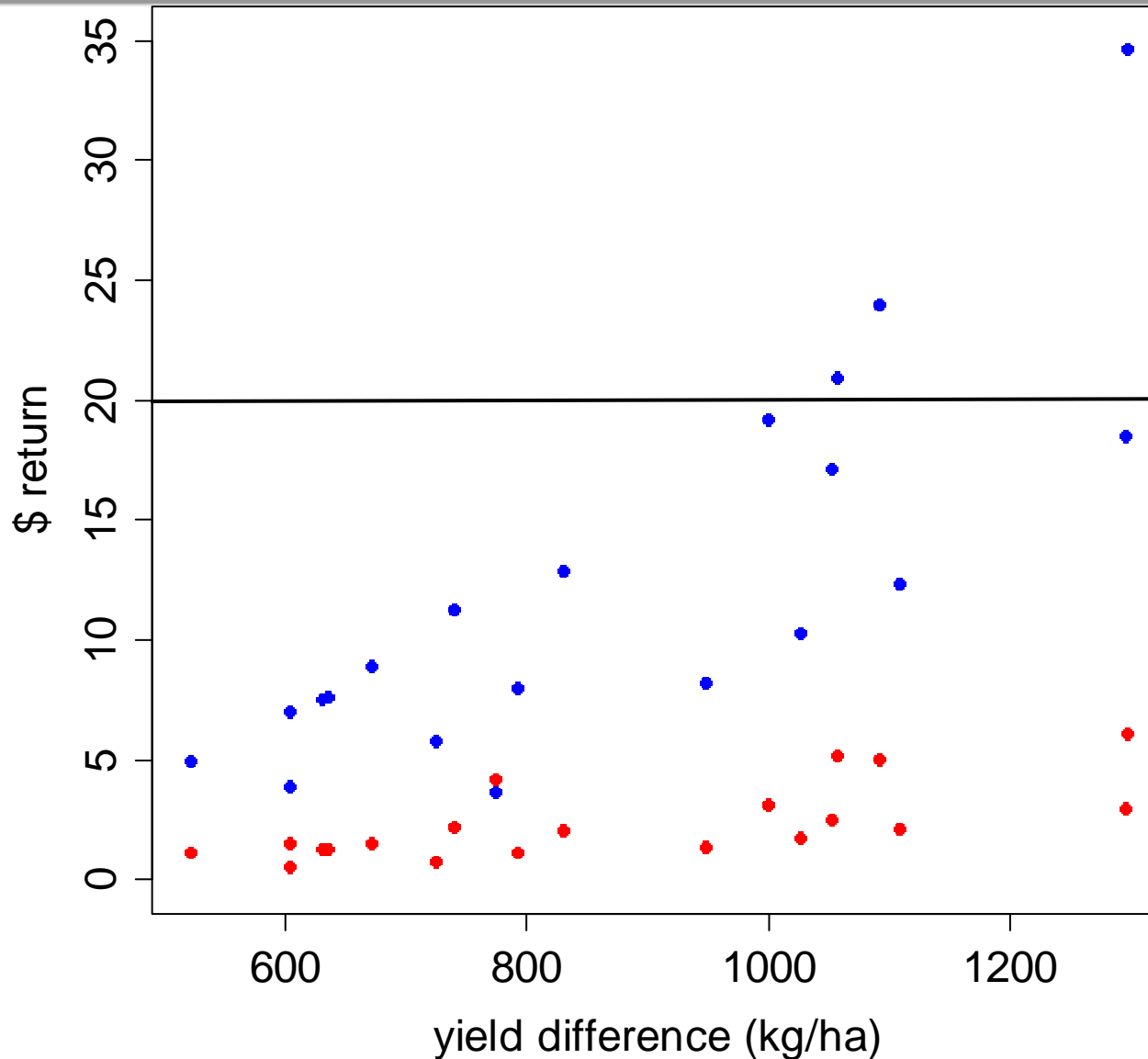
What is your cut off \$ return?

So how many paddocks does VRT pay on?



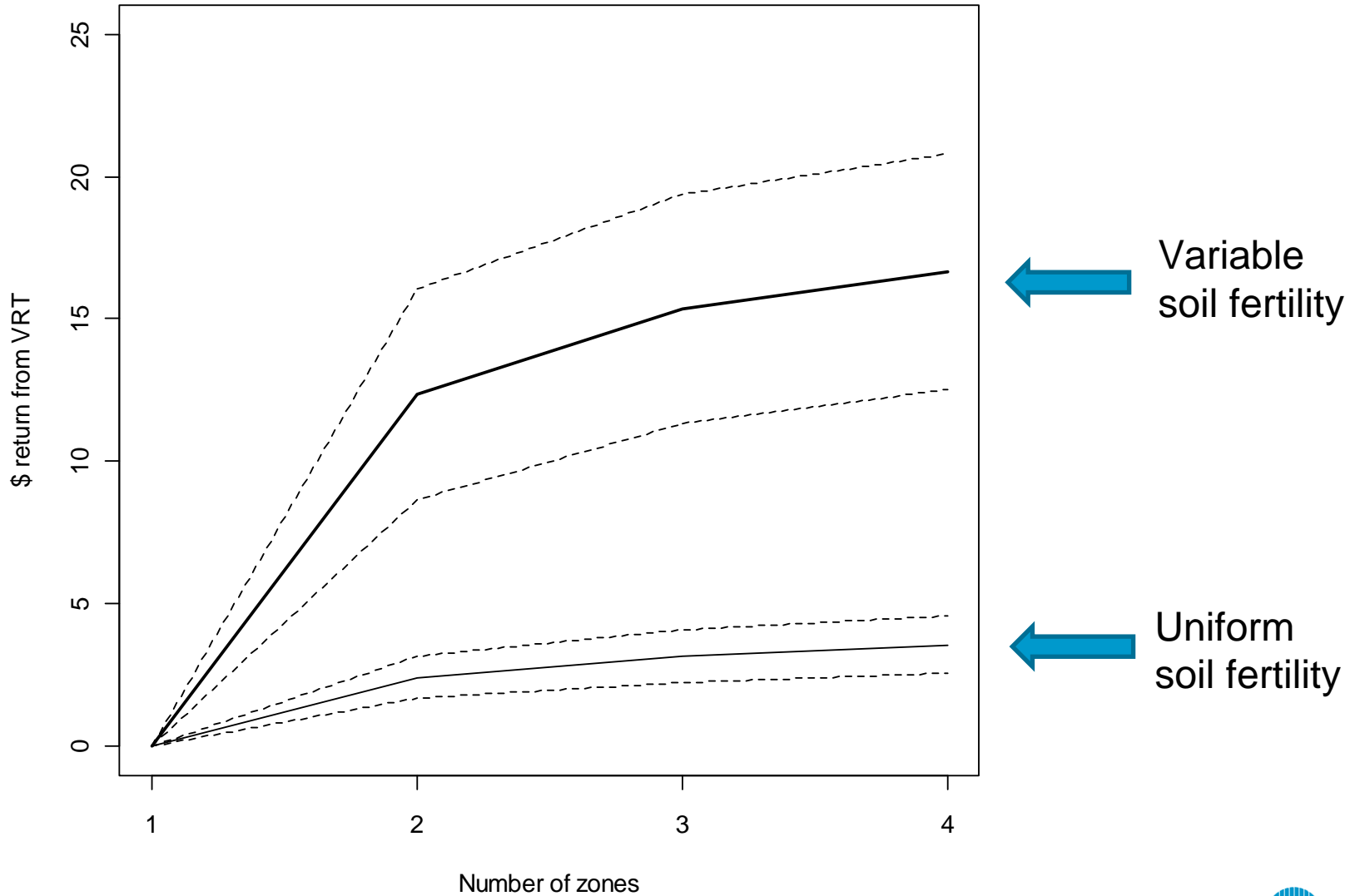
What is your cut off \$ return?

So how many paddocks does VRT pay on?



What is your cut off \$ return?

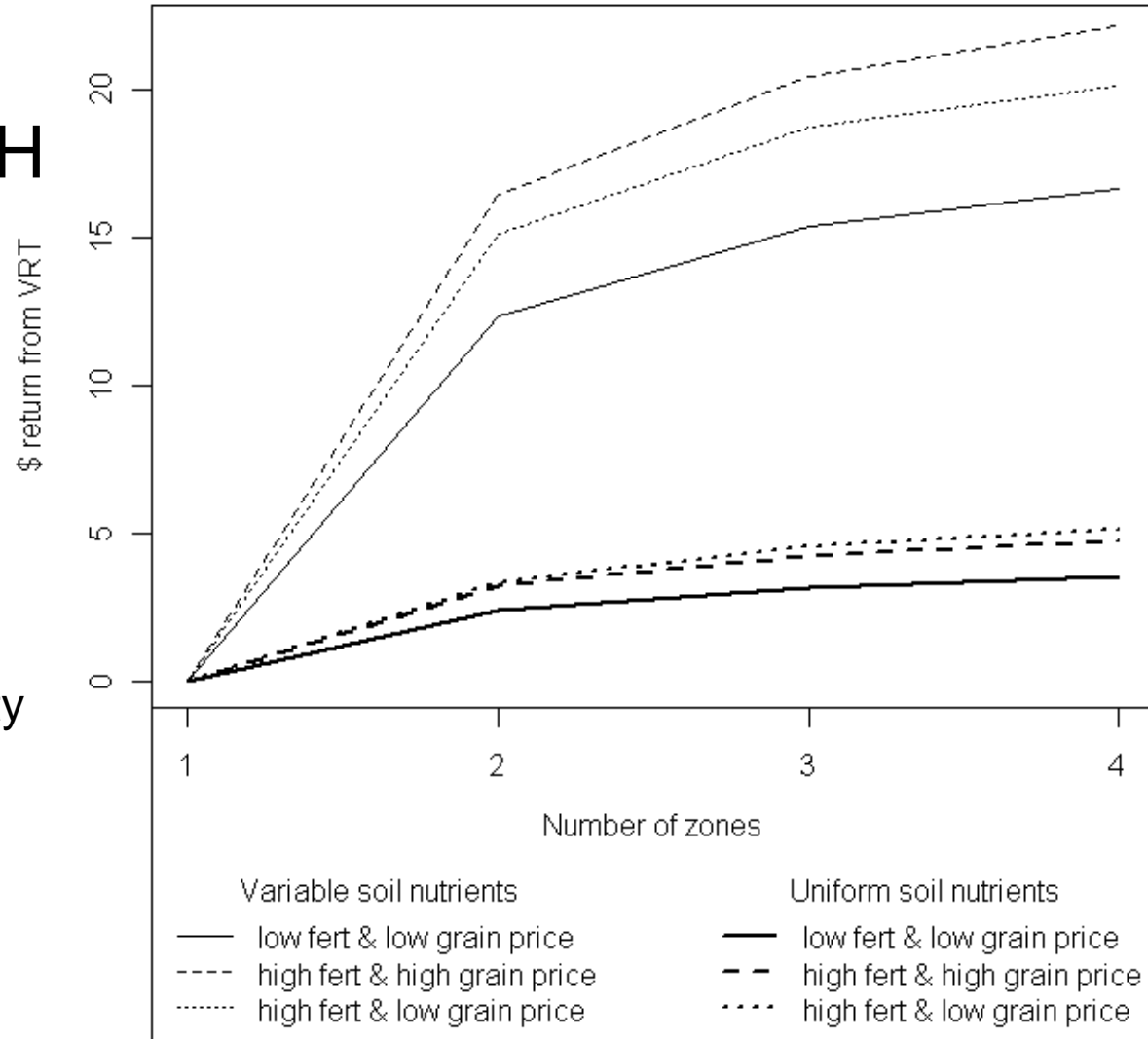
How many zones do I need to get a return from VRT?



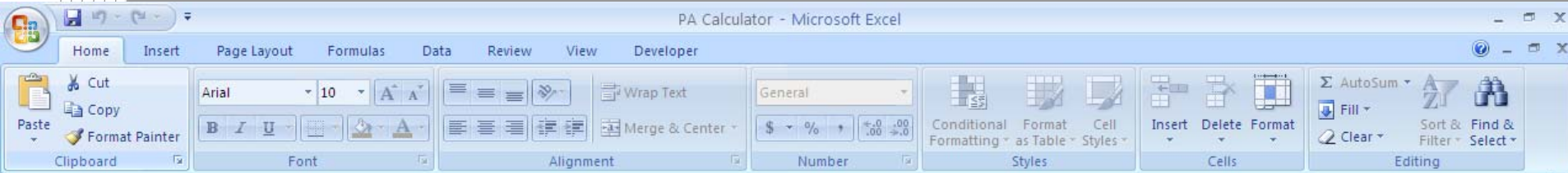
How important are grain and fertiliser prices?

NOT MUCH

Yield and soil nutrient variability matter most!



The PA calculator



VARIABLES

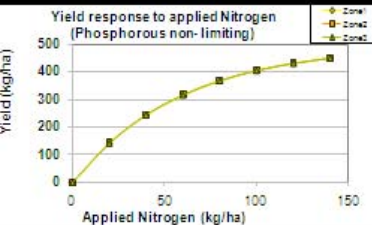
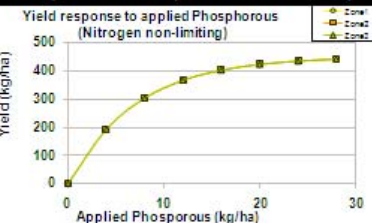
Grain Price \$100 /tonne
Nitrogen Price \$500 /tonne
Phosphorous Price \$750 /tonne
Fertiliser Limit \$600 /ha
Fertiliser Limit \$1,800 /pdk (calculated)

Convert Fert Price to \$ / Tonne

Min rate of N 0 kg/ha
Max rate of N 200 kg/ha
Min rate of P 0 kg/ha
Max rate of P 40 kg/ha

Min & max allowable fertiliser rates kg/ha. Available N and P in top 100m soil (kg/ha) = ppm or mg/kg X 1.5. For sandy soil, conversion of ppm to kg/ha = ppm soil basis x 0.15 x cm of soil

Response Curves (based on NP Decide)



ZONE 1 ZONE 2 ZONE 3

Yield Potential	500 kg/ha	500 kg/ha	500 kg/ha
Available N in Soil	0 kg/ha	0 kg/ha	0 kg/ha
Available P in Soil	0 kg/ha	0 kg/ha	0 kg/ha
Zone Area	1 ha	1 ha	1 ha

Recommended Gross Margin Maximization Fertiliser Rates

Recommended N Rate	1 ha +/-	1 ha +/-	1 ha +/-
Recommended P Rate	0 kg/ha 0	0 kg/ha 0	0 kg/ha 0

* Positive = over fertilized Negative = under fertilized relative to uniform

UNIFORM MANAGEMENT

500 kg/ha
0 kg/ha
0 kg/ha
3 ha
 * Calculated from zones

0 kg/ha
0 kg/ha

Results Based on Profit Maximization Fertiliser Rates

Predicted Yield based on VR	0 kg/ha	0 kg/ha	0 kg/ha
Predicted Value of Wheat	\$0 / ha	\$0 / ha	\$0 / ha
Fertiliser Cost	\$0 / zone \$0 / ha	\$0 / zone \$0 / ha	\$0 / zone \$0 / ha
Partial Gross Margin	\$0 / zone \$0 / ha	\$0 / zone \$0 / ha	\$0 / zone \$0 / ha

Total for Paddock based on sum of zones
0.98 Tonne
\$0.00 / Paddock
Fertiliser cost
\$0.00 / zone
\$0.00 / ha
Partial Gross Margin
\$0.00 / zone
\$0.00 / ha

0 kg/ha Predicted Yield based on Uniform
\$0 / ha Predicted Value of Wheat
\$0 / paddock Fertiliser Cost (Uniform)
\$0 / ha Fertiliser Cost (Uniform)
\$0 / paddock Uniform Partial Gross Margin
\$0 / ha Uniform Partial Gross Margin / ha

Determine Best Rates

\$0.0 / ha Advantage of VR
\$0 Whole Paddock Advantage of VR
\$0 / ha Advantage of VR on fertiliser cost



This spreadsheet was designed by Roger Mandel & Robert Beardsmore (Curtin University), Roger Lawes, Nat Ralsbeck-Brown and Michael Robertson (CSIRO) & Bill Bowden (DAFWA & CSIRO)

Download excel 2007 version.

- <http://environmentagriculture.curtin.edu.au/staff/rmandel.cfm>
- So which paddocks pay?
- More than 1 t/ha yield variability between zones
- Paddocks with variable soil nutrient status between zones