

Using @ RISK modelling to examine risk in Mallee cereal and legume rotations



Visual representation of risk in nine northern Mallee rotation sequences over six years.

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“Take calculated risks,

That is quite different from being rash.”

General George Patton



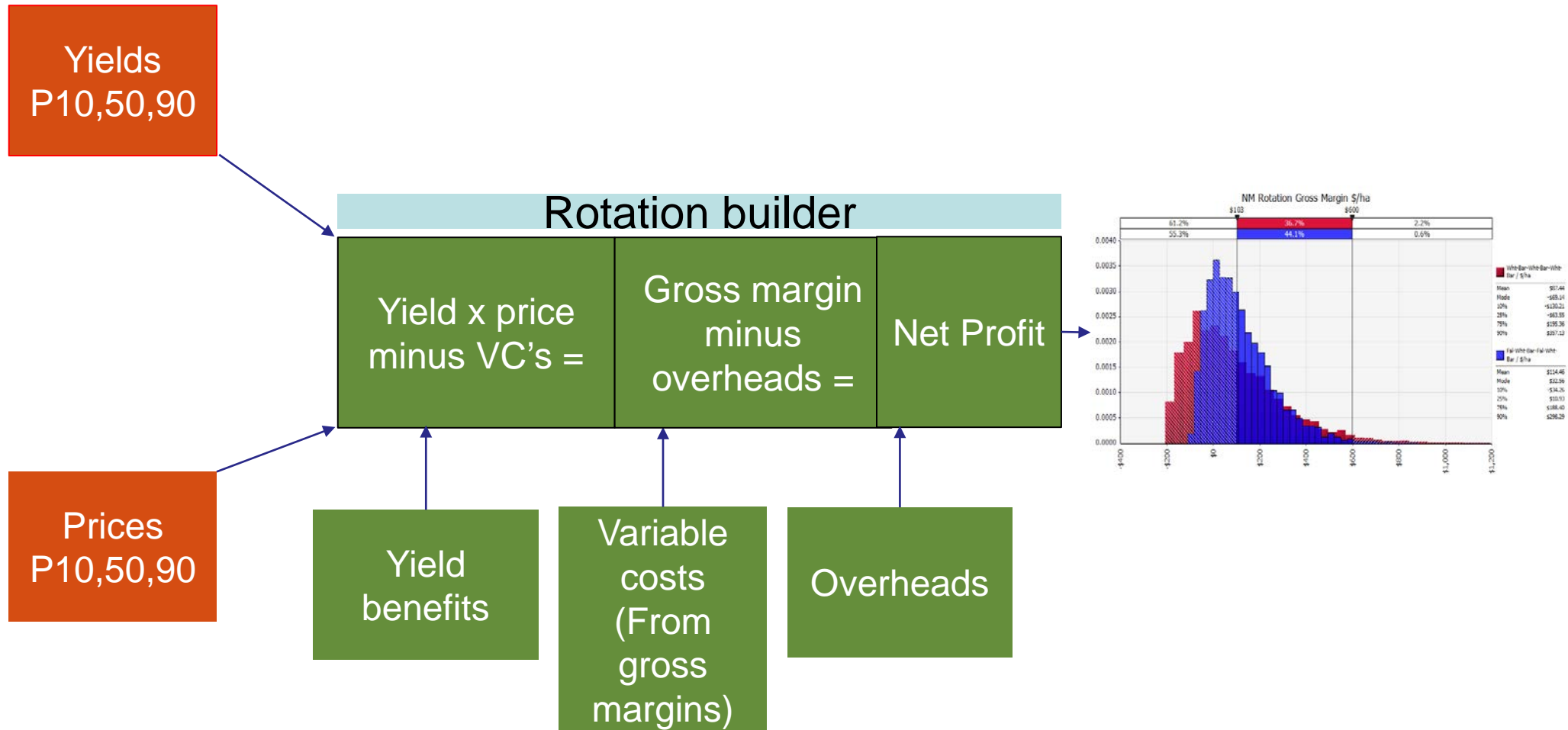
@RISK analysis – the benefits for growers...

- Do Grain Legumes reduce or increase the risk in a rotation? What about Fallow? Canola? Pasture? Hay? Can we get a better answer to these questions for each region that accounts for risky variables?
- This is a tool – it is not a prescription. The devil is in the detail so there is an ability to tailor to individual situations. The better the information in the better the analysis. Growers can line up their own risk profile.
- Growers tend to be more visual - @RISK is a method of visually showing the good/bad and everything in between. Risk traditionally tends to focus on downside but what about the upside?
- Provides a robust level of analysis to at least ask questions as to “why” or “why not”.

@RISK – simulating the gross margin risk of grain legumes

- @RISK is an add-in to Microsoft Excel which allows you to analyse risk using simulation model.
- @RISK uses 'Monte Carlo simulation', also known as multiple probability simulation. Each 'roll of the dice' is random and unaffected by previous events.
- @RISK model randomly samples the different combinations of inputs (including the 'risky' inputs) and calculates '000's of possible future outcomes and the chances they occur.
- @RISK modelling provides a means to better assess the risk of a rotation – the rotations to avoid and which ones to examine further.
- Growers can better match rotations and crops to their own particular risk profile

How the model works for each crop



Assumptions - Price input (\$/t) –deciles (farm gate price)

Price (\$/t)	Percentiles		
	P10	P50	P90
Wheat	180	230	280
Barley	140	190	240
Canola	450	490	530
Lentils	415	660	1000
Chickpeas	620	1000	1400
Peas	200	320	485
VeHay	120	200	300
Vetch seed	300	650	1000
MePast	70	79	90
VePast	70	79	90

Yield Assumptions (t/ha) for rainfall deciles (Northern SA Mallee)

Yield	Percentiles		
	P10	P50	P90
Wheat APW	0.36	1.20	2.64
Barley - Malt	0.39	1.30	2.86
Canola TT	0.15	0.50	1.10
Lentils	0.15	0.50	1.10
Chickpeas	0.18	0.60	1.32
Peas	0.21	0.70	1.54
Vetch Hay	0.75	2.50	5.50
Vetch seed	0.21	0.70	1.54
MePast	2.20	2.50	2.80
VePast	2.50	2.80	3.20

Variable costs and gross margins for each crop ...

Variable Costs and Gross Margins		
	VCs	GM
Wheat APW	222.20	95.00
Barley - Malt	213.98	69.89
Canola TT	326.95	-45.37
Lentils	232.42	163.68
Chickpeas	311.67	382.09
Peas	250.82	17.78
VeHay	298.61	293.63
Vetch seed	224.93	297.99
Vetch BM	107.11	-107.11
Fallow	50.00	-50.00
MePast	42.60	156.50
VePast	111.61	113.72



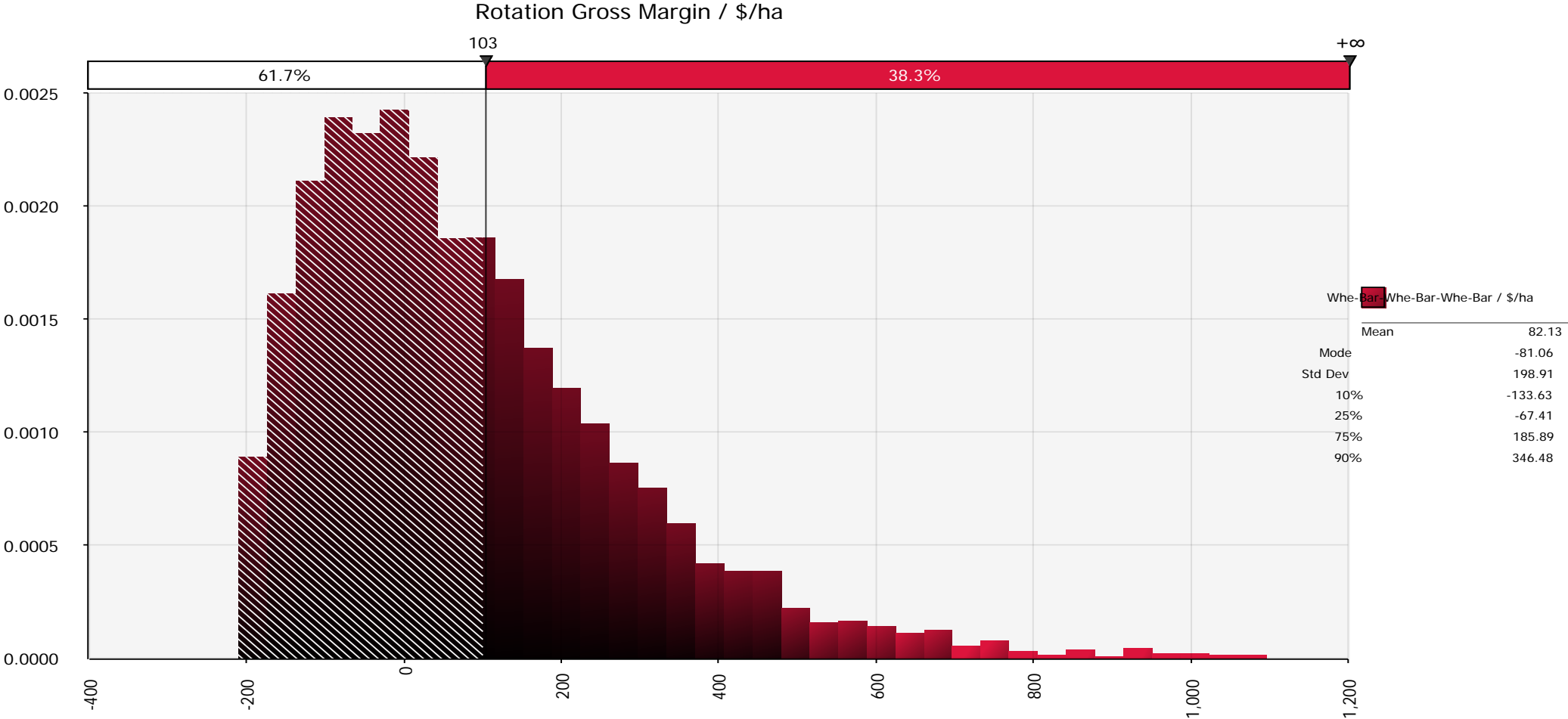
Assumptions - Fixed Costs

Fixed Costs - Loxton Farm Assumptions	Loxton	3000 ha
3000 ha		\$/ha
Overhead Costs	\$ 150,000	\$ 50
Depreciation	\$ 120,000	\$ 40
Finance Costs	\$ 40,000	\$ 13
		\$ 103

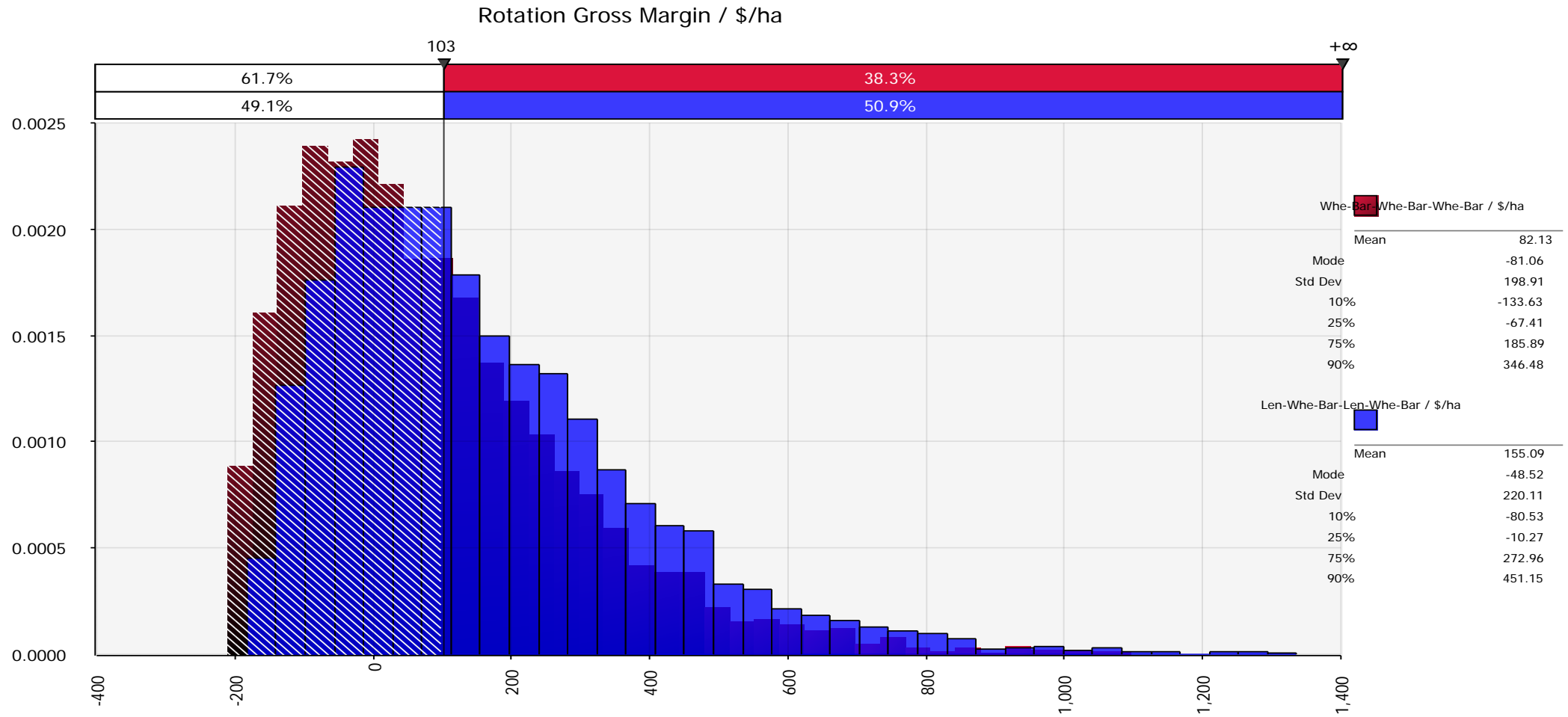
Northern Mallee Rotations – 9 rotations, 2 cycles of 3 year rotations

	<i>Rotations To Model - Loxton</i>					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Lentils	Wheat APW	Barley - Malt	Lentils	Wheat APW	Barley - Malt
2	Chickpeas	Wheat APW	Barley - Malt	Chickpeas	Wheat APW	Barley - Malt
3	Canola TT	Wheat APW	Barley - Malt	Canola TT	Wheat APW	Barley - Malt
4	VePast	Wheat APW	Barley - Malt	VePast	Wheat APW	Barley - Malt
5	VeHay	Wheat APW	Barley - Malt	VeHay	Wheat APW	Barley - Malt
6	Wheat APW	Barley - Malt	Wheat APW	Barley - Malt	Wheat APW	Barley - Malt
7	Fallow	Wheat APW	Barley - Malt	Fallow	Wheat APW	Barley - Malt
8	Peas	Wheat APW	Barley - Malt	Peas	Wheat APW	Barley - Malt
9	Fallow	Wheat APW	Wheat APW	Fallow	Wheat APW	Wheat APW

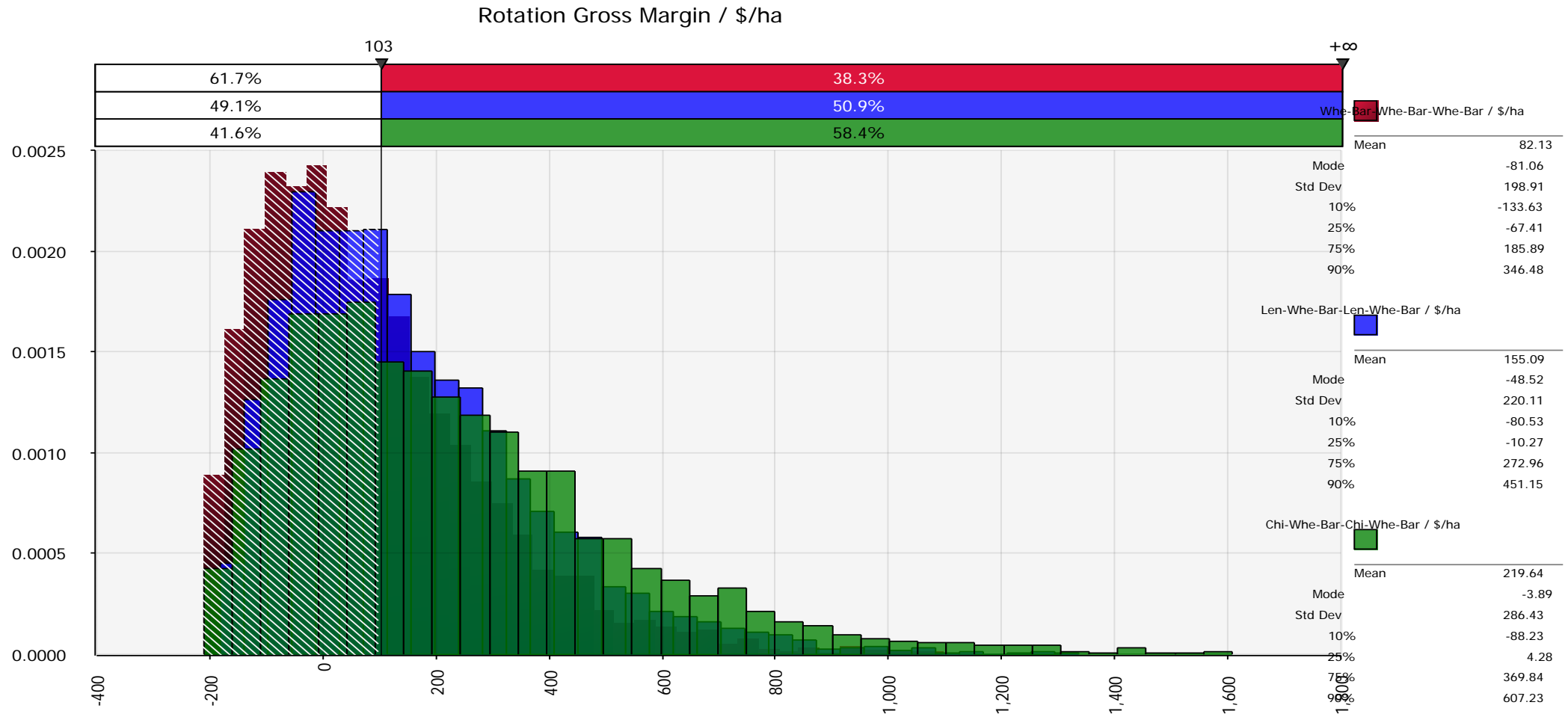
@RISK Output – Visual representation of risk – Wht Bar Wht Bar Wht Bar...



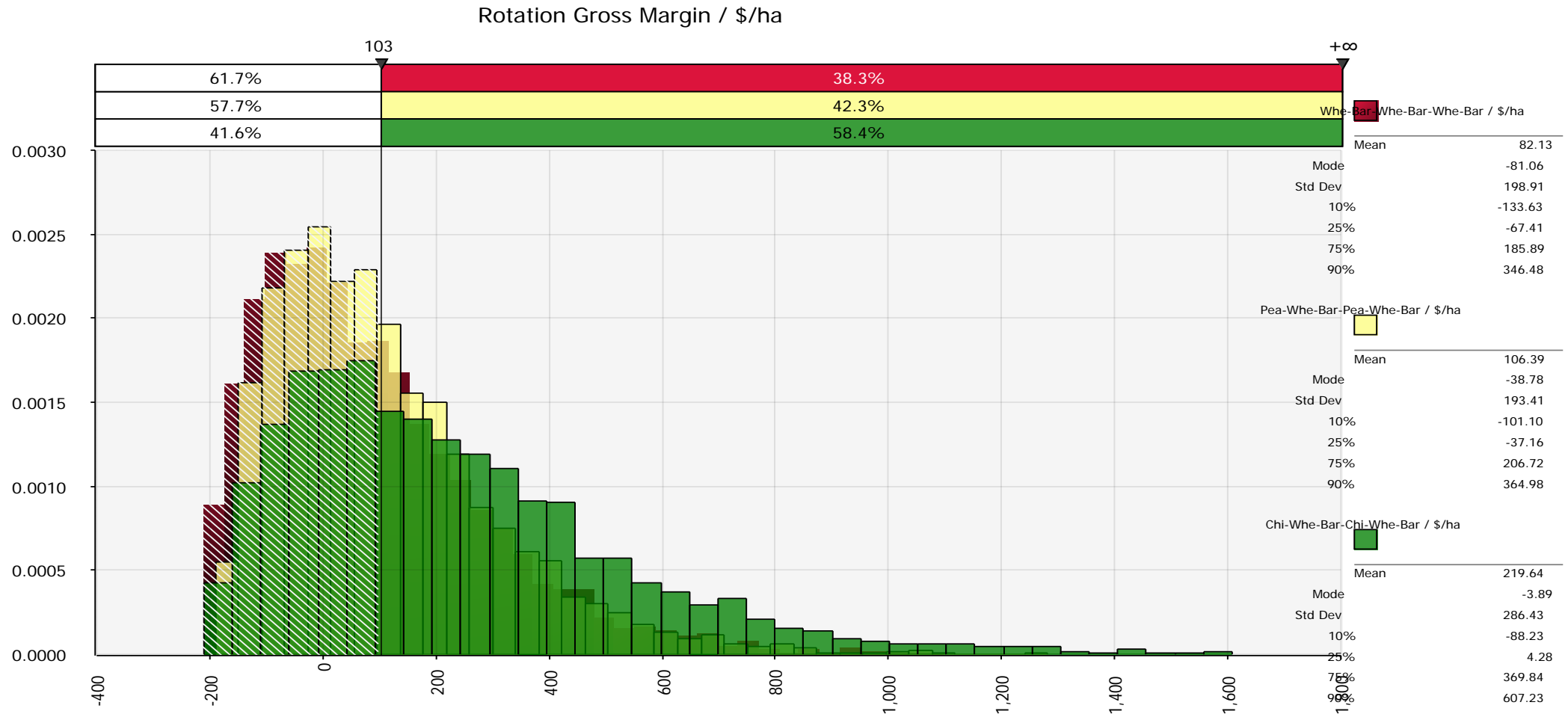
Grain legumes - Lentils



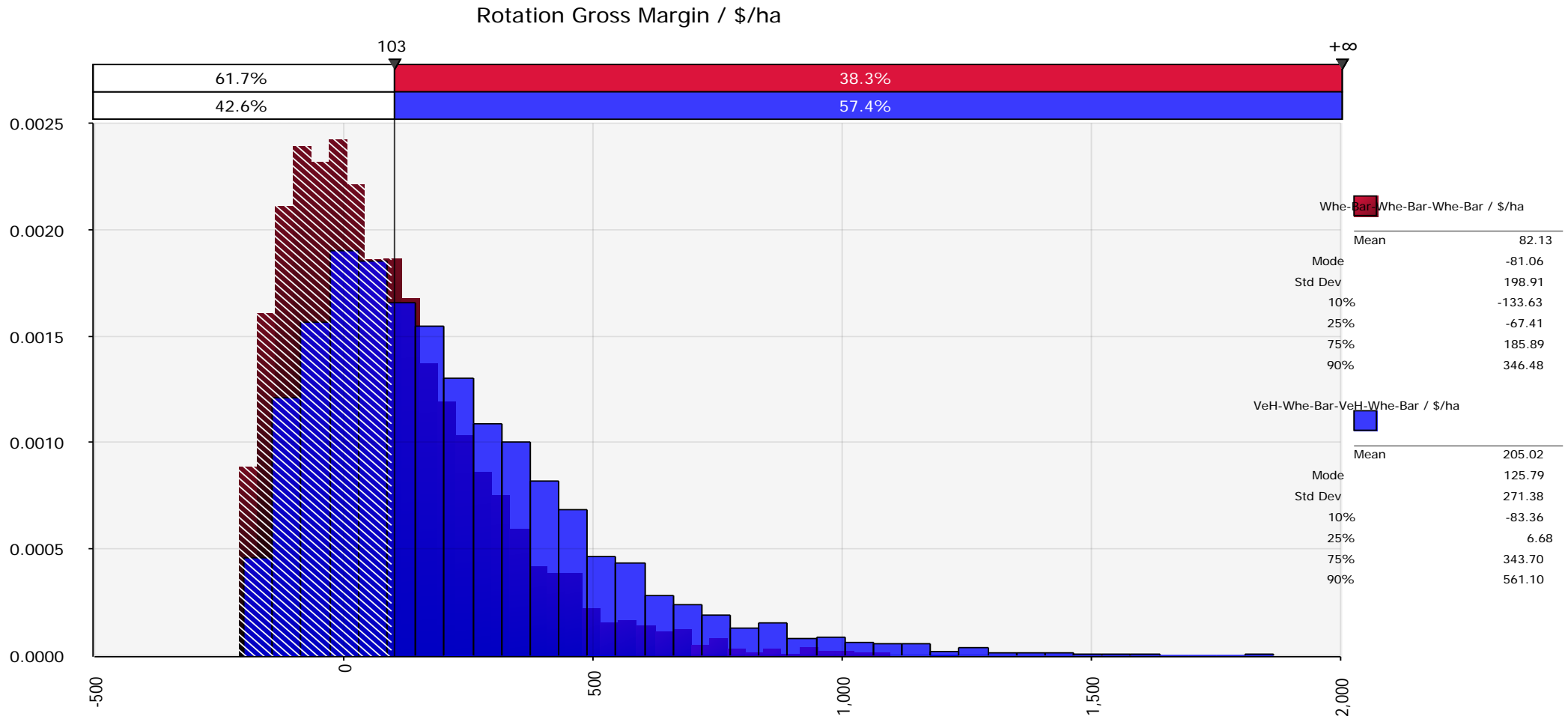
Lentils and Chickpeas



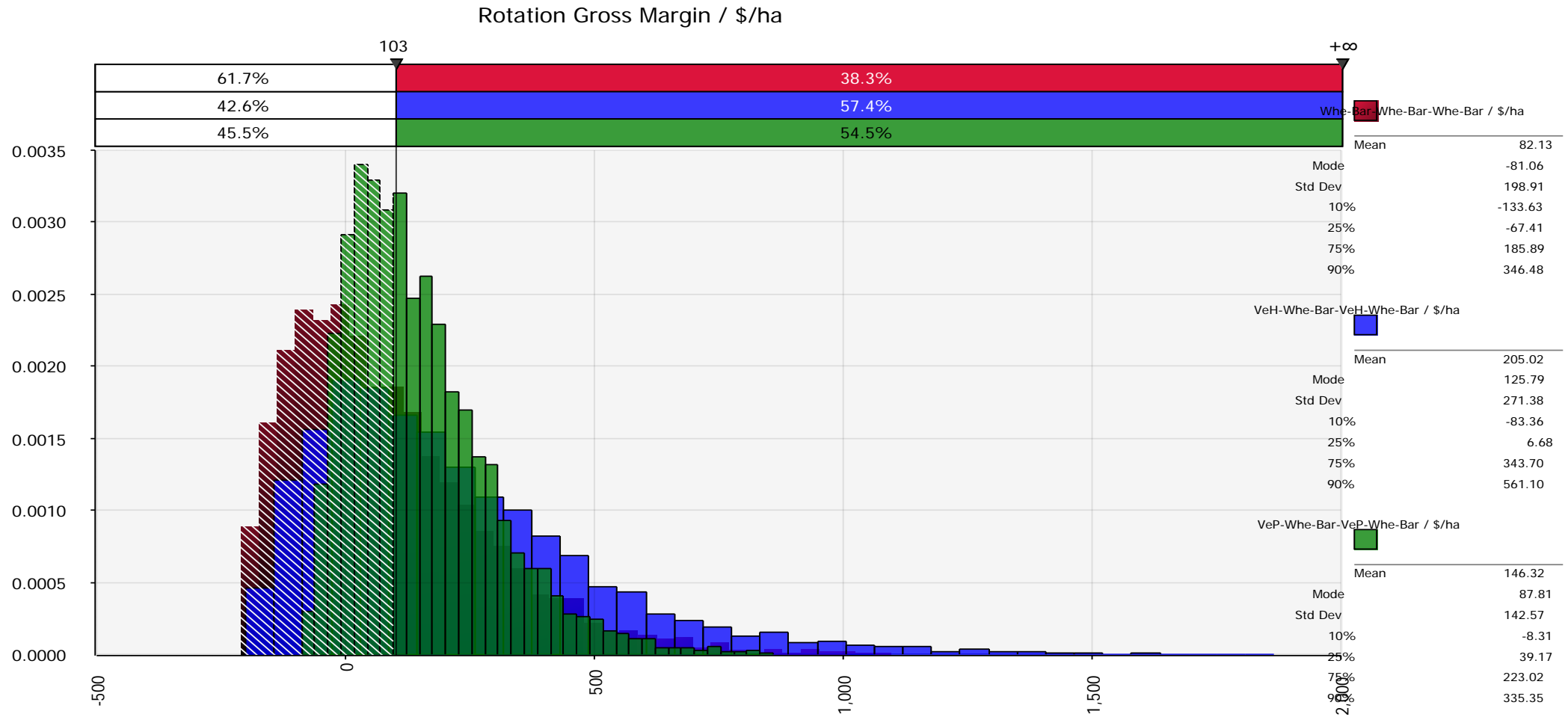
Field Peas



Vetch Hay



Vetch Hay and Vetch Pasture



Comparison of profitability across six years

<i>Loxton Cumulative 6 year result</i>				
Rotation sequence	Av. GM	Av. NP	6 Year Cumulative Net Profit	
	\$/ha	\$/ha	\$	Rank
Len-Whe-Bar-Len-Whe-Bar	155.53	52.19	939,473.41	3
Chi-Whe-Bar-Chi-Whe-Bar	220.66	117.33	2,111,941.32	1
Can-Whe-Bar-Can-Whe-Bar	78.17	-25.16	-452,862.86	9
VeP-Whe-Bar-VeP-Whe-Bar	146.54	43.21	777,705.59	4
VeH-Whe-Bar-VeH-Whe-Bar	206.51	103.18	1,857,162.59	2
Whe-Bar-Whe-Bar-Whe-Bar	82.45	-20.89	-375,939.68	8
Fal-Whe-Bar-Fal-Whe-Bar	114.97	11.63	209,373.55	5
Pea-Whe-Bar-Pea-Whe-Bar	106.89	3.56	64,028.85	7
Fal-Whe-Whe-Fal-Whe-Whe	108.00	4.67	84,027.32	6

Customisable @ RISK model

- For each pulse check group it is possible to prepare an @RISK simulation based on prevailing rotations, local yield deciles, numbers of years, variable and fixed costs, etc.
- Run @RISK simulation very quickly and assess the results.
- Risk and Net Profit calculated for each rotation.
- Change any unreasonable inputs and quickly run again.

How have we used the @Risk analyses?

- @ RISK provides a reasonable means of comparing the future risks of crop rotations over time and season and markets.
- We have presented @RISK analyses at a number of Pulse Check groups with data (yield, benefits, variable costs and fixed costs) for each individual group.
- Gives opportunity to assess and weigh the risk profiles – is it high risk, low profit or moderate profit but low risk or other combination?
- Downside – cost of @RISK from Palisade is \$2 785 for single-user, perpetual license.

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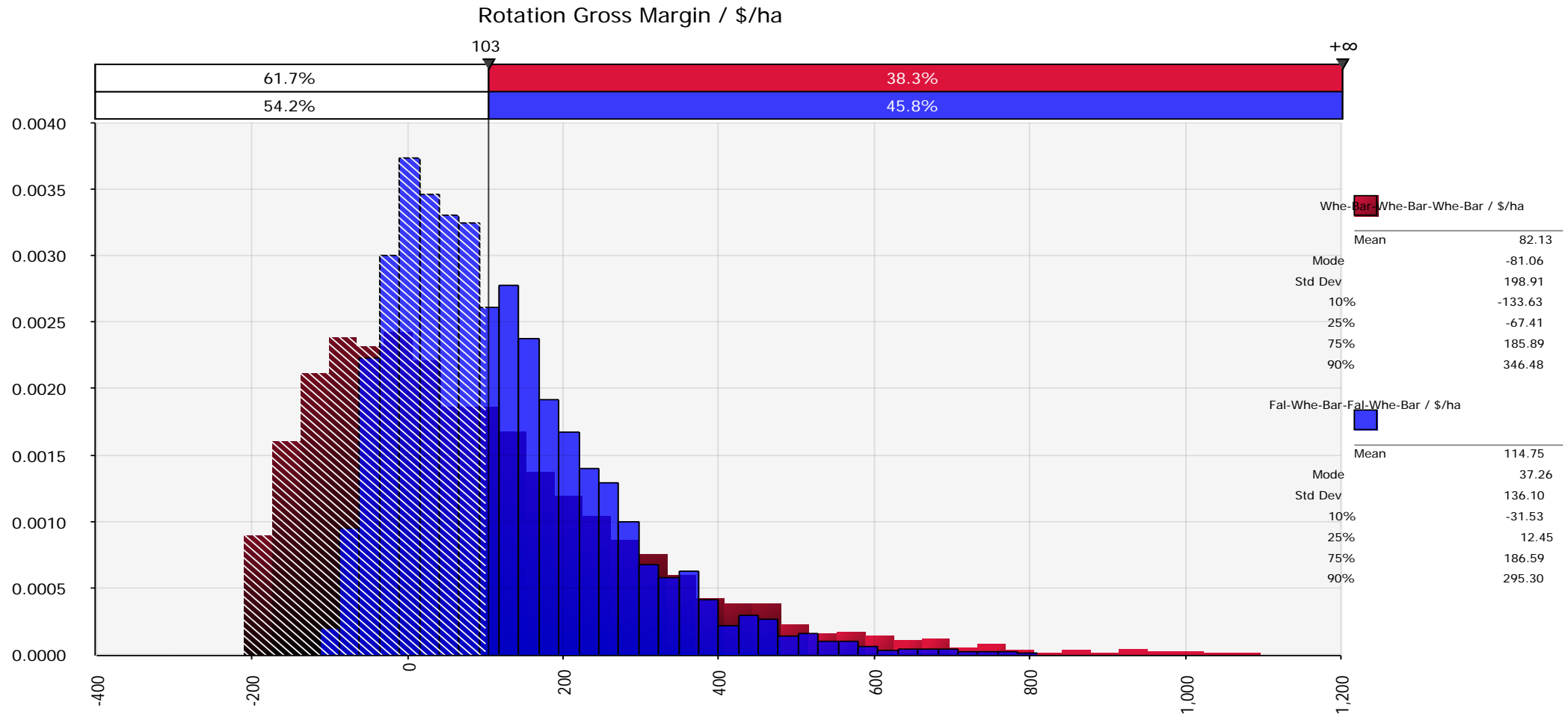
@Risk analysis – the Assumptions used in this scenario...

- Rotational yield responses are best estimates for the northern Mallee,
- Yields are estimated Percentiles 10, 50 and 90 yields are inputs for the target Pulse Check Group district,
- Variable costs are built into the model and are tailored to each Pulse check group, in this case the Northern Mallee group
- Price percentiles are from Rural Directions historical pricing data and assumptions around a farm gate price
- Fertiliser prices are delivered to farm,
- Barley - Malt refers to variety selection only - prices are based on F1.

@RISK analysis – the Assumptions in this scenario - #2...

- There is an increase in wheat yield after pulses.
- Fixed costs are calculated at \$103/ha. Net profit is GM minus Fixed costs.
- Nine rotation sequences – including canola, grain legumes, cereal, vetch pasture and hay, and fallow options.
- Sequences were two rounds of the same three-year rotation.
- Based on a 3 000 ha farm.

Overlaying Fallow



Overlaying Canola

