

TWEAKING THE MANAGEMENT OF MALT BARLEY

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19th Australian Barley Technical Symposium

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19th AUSTRALIAN BARLEY TECHNICAL SYMPOSIUM



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9th to 12th September 2019
Perth - Western Australia
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AUSTRALIAN BARLEY - A GROWING OPPORTUNITY

Key Messages



Targeting N at Z31-Z37 can boost protein without sacrificing yield



“FlowerPower” barley can be used to compare phenology with TOS



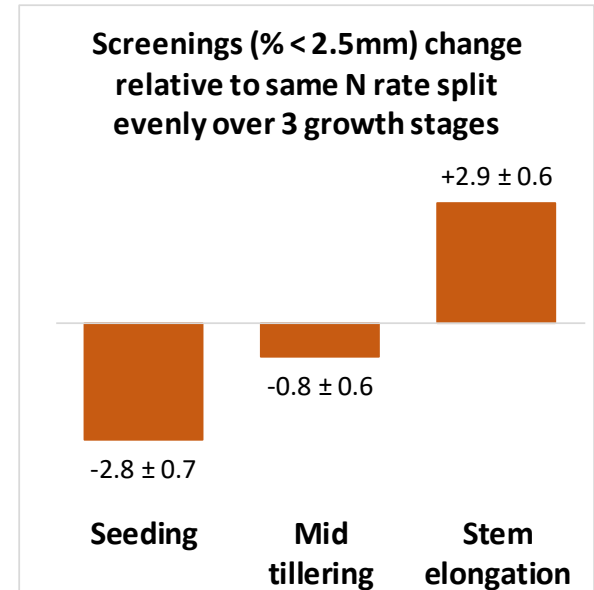
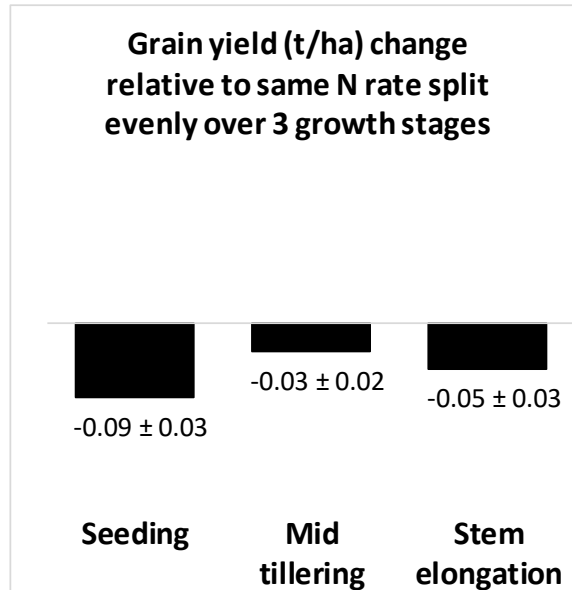
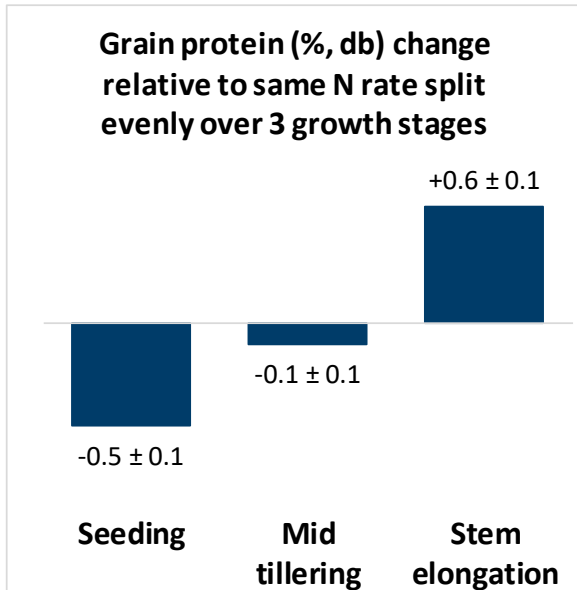
Banks and RGT Planet provide different opportunities for growers



N timing

Nitrogen timing series – 2012-2016

“N applied at Z31 increased grain protein relative to the same rate applied at seeding or at mid tillering or evenly split over three applications with no grain yield loss but with a slightly increased screenings risk”



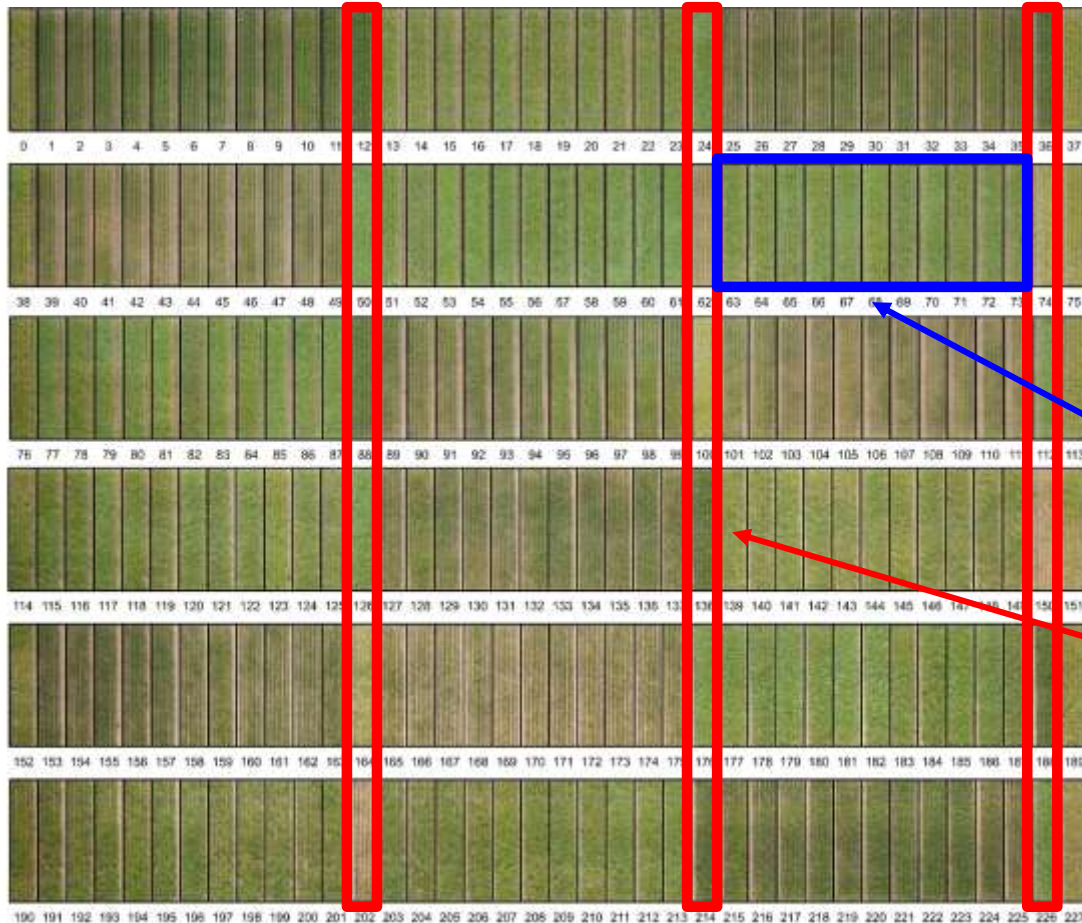
Nitrogen timing series – 2018

Aim:

Further increase the grain protein boost with other delayed N strategies (Z31-Z49) without increasing (preferably decreasing) the screenings risk

- **Design:** 2 varieties x 3 N rates x 11 N timing x 3 reps
- **Block structure:** (rep+colrep)/(variety.N rate)/N timing
- **Varieties:** RGT Planet and Spartacus CL
- **N rates:** 60, 90 and 120 kg N/ha
- **N timing:** 11 different combinations of each rate
- **Locations** (May-Oct rainfall, previous crop): Yerecoin (298 mm, canola), Brookton (290 mm, canola), Kojonup-W (321 mm, canola) and Wittenoom Hills (228 mm, canola)


Yerecoin – 04 September 2018



11 plots of same variety
& same N rate
but different timings

Strips of extra N rates
(10, 170 & 220 N)
at one N timing

Nitrogen timing series – 2018

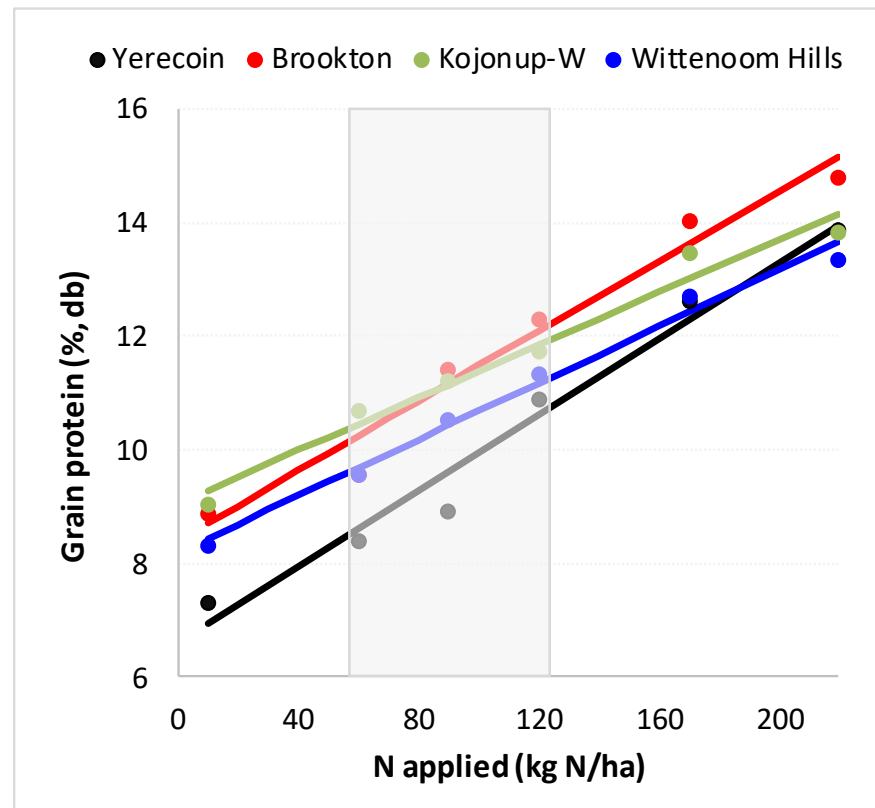
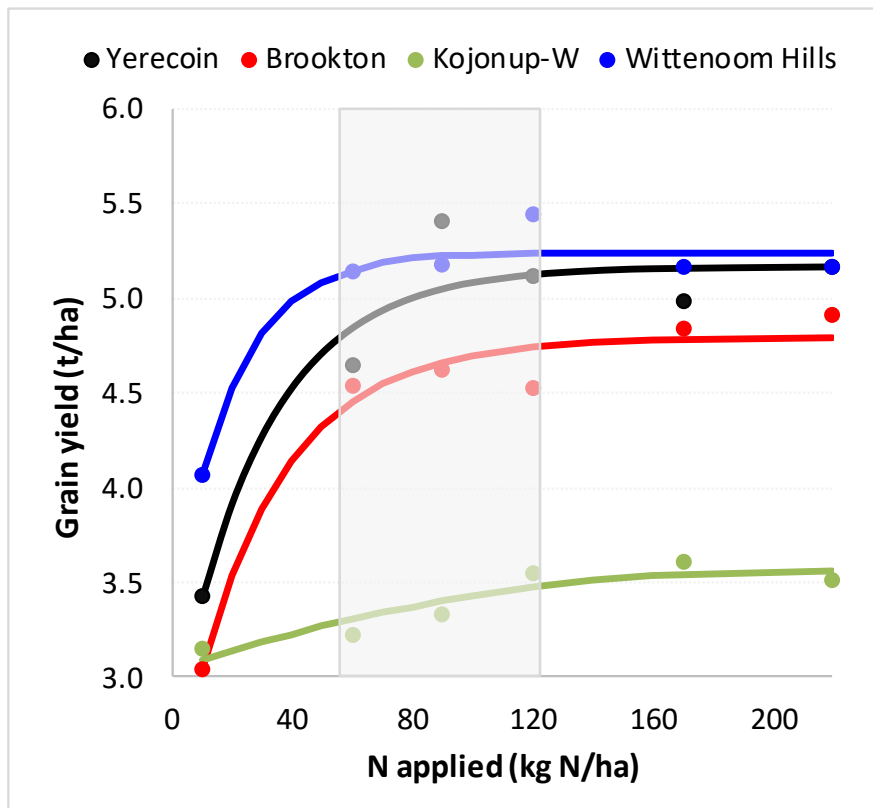


N timing	1	2	3	4	5	6	7	8	9	10	11
Seeding	1/3 Total N	1/3 Total N	10 N	1/3 Total N	10 N	10 N	10 N	10 N	10 N	1/3 Total N	1/3 Total N
4WAS	1/3 Total N	-	-	-	-	-	-	-	-	-	-
Z31	1/3 Total N	2/3 Total N	Balance N	1/3 Total N	1/2 Balance N	-	Balance N	Balance N	1/3 Balance N	1/3 Total N	1/3 Total N
Z33	-	-	-	1/3 Total N	1/2 Balance N	Balance N	-	-	1/3 Balance N	-	-
Z37	-	-	-	-	-	-	10 N	25 N	1/3 Balance N	1/3 Total N	-
Z49	-	-	-	-	-	-	-	-	-	-	1/3 Total N
Last N application	Z31	Z31	Z31	Z33	Z33	Z33	Z37	Z37	Z37	Z37	Z49

Some of the questions we were asking:

1. **1/3 strategy:** what happened if I shifted my mid tillering N to Z31, Z33, Z37 or Z49?
2. **Starter N:** can I get away with 10N at seeding and focus my N at Z31 and/or Z33?
3. **Starter N + Z37:** if I go with 10N at seeding, should I put some out at Z37 too?

Yield and protein response to N



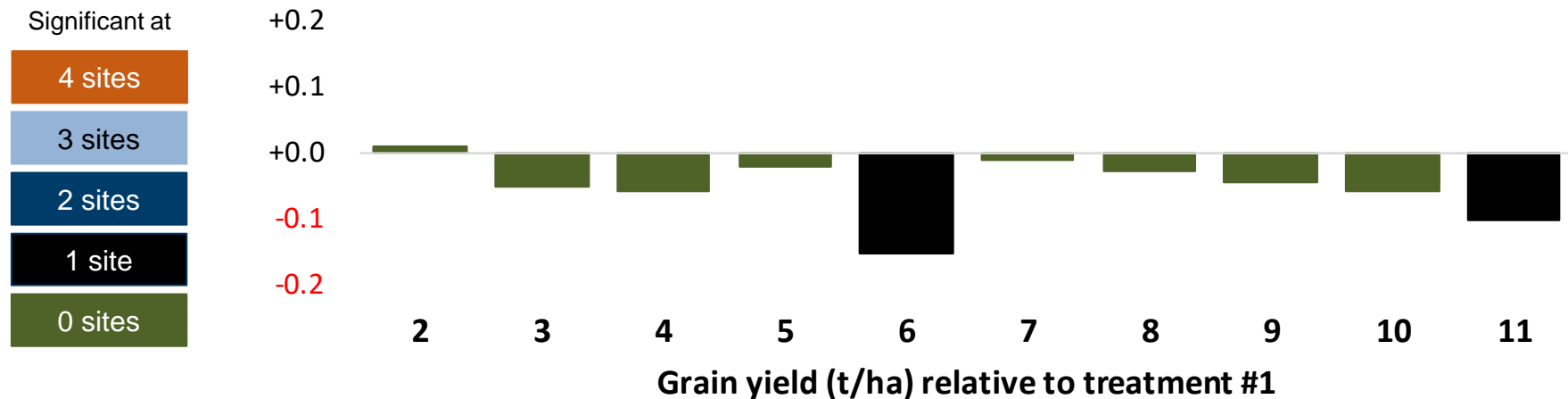
Did N timing influence yield and quality?

Percent of four trials with a significant response						
Treatment	Grain yield (t/ha)	Grain protein (%, db)	Hectolitre weight (kg/hL)	Screenings (%<2.5mm)	Grain brightness ('L*')	Grain protein yield (kg/ha)
N rate	50%	100%	50%	75%	0%	100%
N timing	50%	100%	75%	100%	75%	100%
N rate x N timing	0%	25%	0%	0%	25%	25%

Shifting fertiliser N supply from seeding/mid tillering to Z31-Z49:

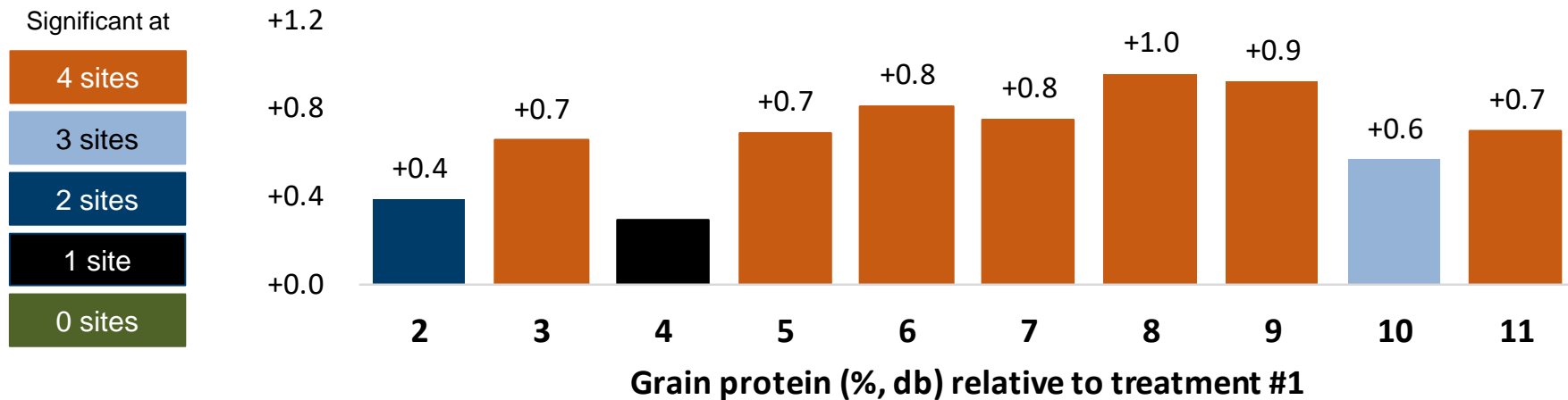
- increased grain protein, screenings and grain protein yield
- no consistent effect on grain yield, hectolitre weight (except treatment 6) or grain brightness

N timing didn't influence grain yield



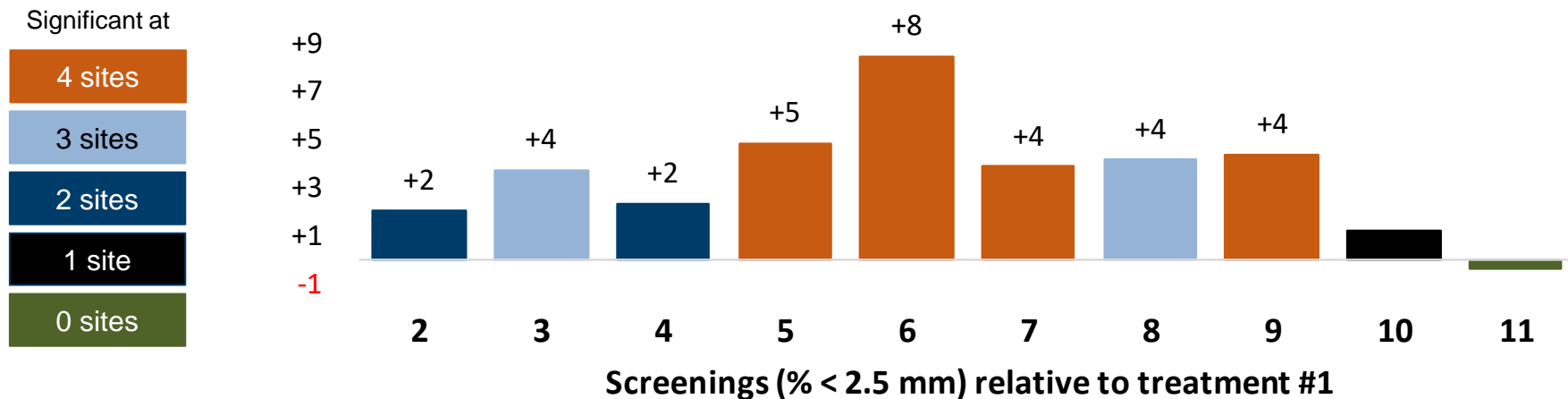
N timing	1	2	3	4	5	6	7	8	9	10	11
Seeding	1/3 Total N	1/3 Total N	10 N	1/3 Total N	10 N	10 N	10 N	10 N	10 N	1/3 Total N	1/3 Total N
4WAS	1/3 Total N	-	-	-	-	-	-	-	-	-	-
Z31	1/3 Total N	2/3 Total N	Balance N	1/3 Total N	1/2 Balance N	-	Balance N	Balance N	1/3 Balance N	1/3 Total N	1/3 Total N
Z33	-	-	-	1/3 Total N	1/2 Balance N	Balance N	-	-	1/3 Balance N	-	-
Z37	-	-	-	-	-	-	10 N	25 N	1/3 Balance N	1/3 Total N	-
Z49	-	-	-	-	-	-	-	-	-	-	1/3 Total N
Last N application	Z31	Z31	Z31	Z33	Z33	Z33	Z37	Z37	Z37	Z37	Z49

Shifting N from up-front benefited grain protein



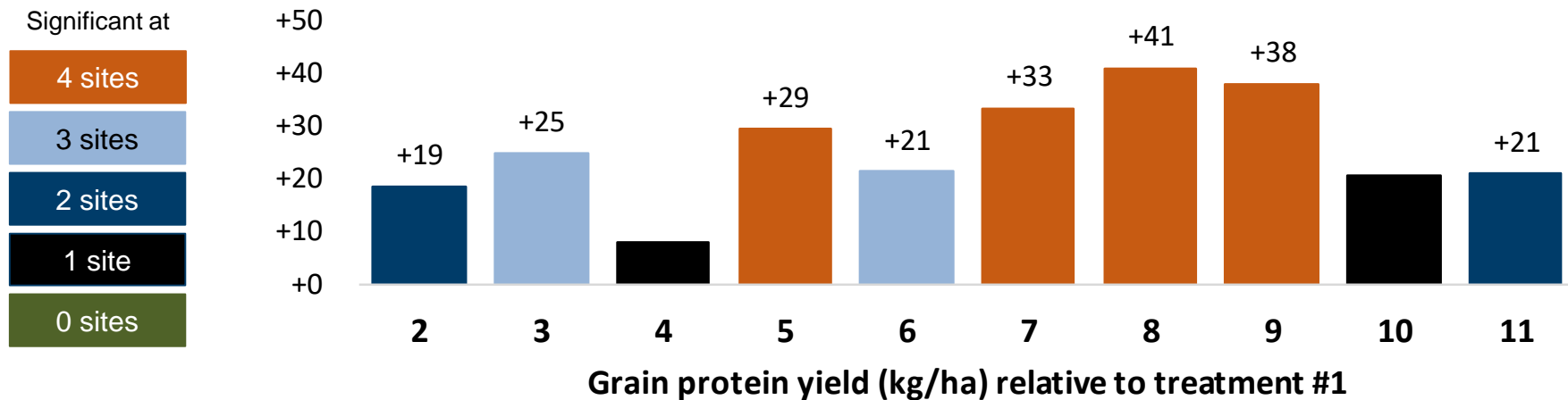
N timing	1	2	3	4	5	6	7	8	9	10	11
Seeding	1/3 Total N	1/3 Total N	10 N	1/3 Total N	10 N	10 N	10 N	10 N	10 N	1/3 Total N	1/3 Total N
4WAS	1/3 Total N	-	-	-	-	-	-	-	-	-	-
Z31	1/3 Total N	2/3 Total N	Balance N	1/3 Total N	1/2 Balance N	-	Balance N	Balance N	1/3 Balance N	1/3 Total N	1/3 Total N
Z33	-	-	-	1/3 Total N	1/2 Balance N	Balance N	-	-	1/3 Balance N	-	-
Z37	-	-	-	-	-	-	10 N	25 N	1/3 Balance N	1/3 Total N	-
Z49	-	-	-	-	-	-	-	-	-	-	1/3 Total N
Last N application	Z31	Z31	Z31	Z33	Z33	Z33	Z37	Z37	Z37	Z37	Z49

Shifting N from up-front increased screenings



N timing	1	2	3	4	5	6	7	8	9	10	11
Seeding	1/3 Total N	1/3 Total N	10 N	1/3 Total N	10 N	10 N	10 N	10 N	10 N	1/3 Total N	1/3 Total N
4WAS	1/3 Total N	-	-	-	-	-	-	-	-	-	-
Z31	1/3 Total N	2/3 Total N	Balance N	1/3 Total N	1/2 Balance N	-	Balance N	Balance N	1/3 Balance N	1/3 Total N	1/3 Total N
Z33	-	-	-	1/3 Total N	1/2 Balance N	Balance N	-	-	1/3 Balance N	-	-
Z37	-	-	-	-	-	-	10 N	25 N	1/3 Balance N	1/3 Total N	-
Z49	-	-	-	-	-	-	-	-	-	-	1/3 Total N
Last N application	Z31	Z31	Z31	Z33	Z33	Z33	Z37	Z37	Z37	Z37	Z49

Shifting N from up-front increased protein yield



N timing	1	2	3	4	5	6	7	8	9	10	11
Seeding	1/3 Total N	1/3 Total N	10 N	1/3 Total N	10 N	10 N	10 N	10 N	10 N	1/3 Total N	1/3 Total N
4WAS	1/3 Total N	-	-	-	-	-	-	-	-	-	-
Z31	1/3 Total N	2/3 Total N	Balance N	1/3 Total N	1/2 Balance N	-	Balance N	Balance N	1/3 Balance N	1/3 Total N	1/3 Total N
Z33	-	-	-	1/3 Total N	1/2 Balance N	Balance N	-	-	1/3 Balance N	-	-
Z37	-	-	-	-	-	-	10 N	25 N	1/3 Balance N	1/3 Total N	-
Z49	-	-	-	-	-	-	-	-	-	-	1/3 Total N
Last N application	Z31	Z31	Z31	Z33	Z33	Z33	Z37	Z37	Z37	Z37	Z49

Q1 – 1/3 strategy

N timing	1	2	4	10	11
Seeding	1/3 Total N	1/3 Total N	1/3 Total N	1/3 Total N	1/3 Total N
4WAS	1/3 Total N	-	-	-	-
Z31	1/3 Total N	2/3 Total N	1/3 Total N	1/3 Total N	1/3 Total N
Z33	-	-	1/3 Total N	-	-
Z37	-	-	-	1/3 Total N	-
Z49	-	-	-	-	1/3 Total N
Last N application	Z31	Z31	Z33	Z37	Z49

Change relative to treatment 1				
Grain yield (t/ha)	-	-	-	-0.10
Grain protein (% db)	+0.4	+0.3	+0.6	+0.7
Screenings (%<2.5mm)	+2.0	+2.3	-	-0.4
Hectolitre weight (kg/hL)	-	-	-	+0.4
Grain brightness ('L*')	-	+0.1	-0.2	-0.3
Protein yield (kg/ha)	+19	+8	+20	+21

Significant at

0 sites	1 site	2 sites	3 sites	4 sites
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Summary:

Moving 1/3 N applied at mid tillering to Z31 or Z33 did little to boost grain protein, with a better result achieved at Z37 and Z49

Strategy of 2/3 N applied at Z31 did not provide a consistent protein boost, suggesting you need to apply more than 2/3 of the recommended N at Z31

Q2 – Starter N

N timing	1	2	3	5	6
Seeding	1/3 Total N	1/3 Total N	10 N	10 N	10 N
4WAS	1/3 Total N	-	-	-	-
Z31	1/3 Total N	2/3 Total N	Balance N	1/2 Balance	-
Z33	-	-	-	1/2 Balance	Balance N
Z37	-	-	-	-	-
Z49	-	-	-	-	-
Last N application	Z31	Z31	Z31	Z33	Z33

Summary:

Strategy of applying bulk of the N at Z31 with 10N at seeding was better than split treatment 1

Applying bulk of N at Z33 or split over Z31+Z33 gave same protein boost but increased screenings risk

Applying more than 2/3 of the recommended N at Z31 provided a more consistent protein boost than 1/3 at seeding + 2/3 N at Z31

Change relative to treatment 1				
Grain yield (t/ha)	-	-	-	-0.15
Grain protein (% db)	+0.4	+0.7	+0.7	+0.8
Screenings (%<2.5mm)	+2.0	+3.7	+4.9	+8.4
Hectolitre weight (kg/hL)	-	-	-0.4	-0.4
Grain brightness ('L*')	-	+0.0	+0.3	+0.4
Protein yield (kg/ha)	+19	+25	+29	+21

Significant at

0 sites	1 site	2 sites	3 sites	4 sites
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Q3 – Starter N + Z37

N timing	1	3	7	8	9
Seeding	1/3 Total N	10 N	10 N	10 N	10 N
4WAS	1/3 Total N	-	-	-	-
Z31	1/3 Total N	Balance N	Balance N	Balance N	1/3 Balance
Z33	-	-	-	-	1/3 Balance
Z37	-	-	10 N	25 N	1/3 Balance
Z49	-	-	-	-	-
Last N application	Z31	Z31	Z37	Z37	Z37

Summary:

Strategy of applying bulk of the N at Z31 with 10N at seeding can be enhanced by allocating some to a Z37 application

A larger dose at Z37 was slightly more effective than a smaller dose

Change relative to treatment 3					
Grain yield	-		-	-	-
Grain protein	-0.7		+0.1	+0.3	+0.3
Screenings	-		-	-	+0.6
Hectolitre weight	-		-	-	-
Grain brightness	-0.0		-	-	-
Protein yield	-25		+9	+16	+13

Significant at

0 sites	1 site	2 sites	3 sites	4 sites
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Nitrogen timing series – 2018

Summary:

“Shifting N allocated for seeding and/or mid tillering to the period from Z31 to Z49 can boost grain protein without sacrificing grain yield, hectolitre weight or grain brightness but can increase screenings”

“Getting the right N rate for the crops’ yield potential is the key, N timing is a tool for increasing the efficiency of application for protein management”

What worked best in 2018:

- **1/3 N strategy:** 1/3 N at seeding, Z31 & Z37 [mitigated screenings risk too]
- **Starter N strategy:** 10N at seeding & balance of N at Z31
- **Starter N strategy with protein boost:** shifting 25N from Z31 to Z37

“FlowerPower” for barley



“FlowerPower” – barley module

- **What is it:** barley module of “FlowerPower” is a statistical model to predict the date of awn emergence (Z49) for barley in WA environments
- **Data:** developed from hill plot data (2007-2018) and validated against phenology scores from NVT sites (2016-2018)
- **Locations and varieties:** 75 locations and 23 varieties
- **Sowing window:** 10-April thru to 10-July [assumes wet sowing]
- **Predictions:** presents data for colder than, normal and warmer than years based on historical weather (1966-2018) in graphical and tabular formats
- **Frost/heat risk:** provides probability (graphically) of a stress event, cold after and heat before the predicted flowering date
- **Where can I find it:** biometricsdpirod.shinyapps.io/dmmodel5/

“FlowerPower” – a couple of outputs

DM model version 5.1a

1. Select your crop at Zadoks stage:

Barley at ear emergence (Z49)

2.1 Select your nearest port zone:

Kamama

2.2 Select your nearest location (PPD code):

CUNDERDIN 10035

3. Compare 2 varieties:

Variety1: La Trobe Sowing date1: Apr-10

Variety2: La Trobe Sowing date2: May-10

Compare up to 3 more varieties (must select both variety and date in each pair):

Variety3: La Trobe Sowing date3: Jun-10

Variety4: La Trobe Sowing date4: Jul-10

Variety5: Sowing date5: --



DM Model predictions Graphic predictions Graphic-frost/heat risk

Summary table for site (with PPD number): CUNDERDIN 10035
Predictions for warmer seasons (deciles 8-10)

SowingDate	Variety	10%	50%	90%
10-Apr	La Trobe	21-Jun	03-Jul	12-Jul
10-May	La Trobe	02-Aug	06-Aug	16-Aug
10-Jun	La Trobe	26-Aug	03-Sep	11-Sep
10-Jul	La Trobe	13-Sep	21-Sep	27-Sep

Predictions for normal seasons (deciles 4-7)

SowingDate	Variety	10%	50%	90%
10-Apr	La Trobe	25-Jun	12-Jul	16-Jul
10-May	La Trobe	10-Aug	20-Aug	24-Aug
10-Jun	La Trobe	04-Sep	11-Sep	17-Sep
10-Jul	La Trobe	21-Sep	27-Sep	03-Oct

Predictions for colder seasons (deciles 1-3)

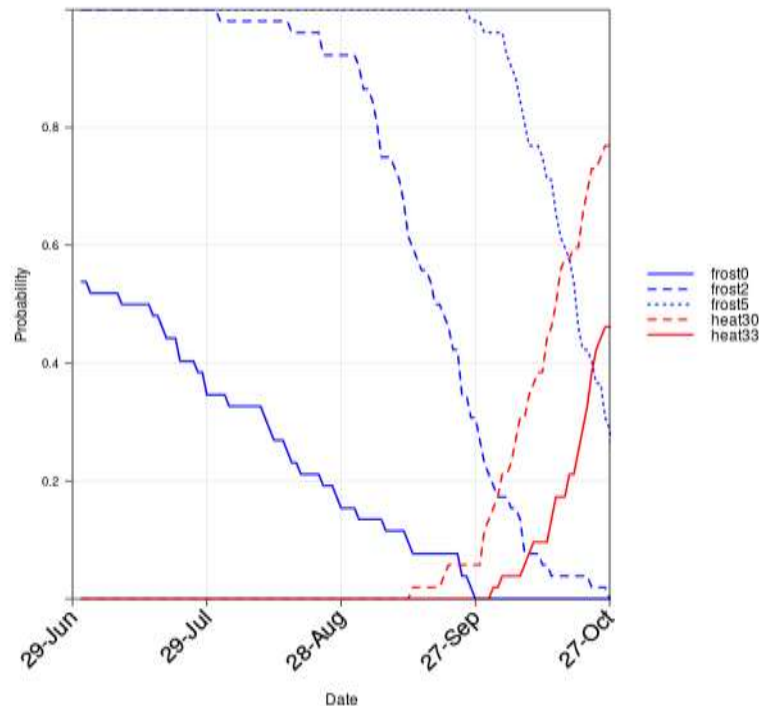
SowingDate	Variety	10%	50%	90%
10-Apr	La Trobe	06-Jul	23-Jul	29-Jul
10-May	La Trobe	14-Aug	26-Aug	06-Sep
10-Jun	La Trobe	07-Sep	19-Sep	29-Sep
10-Jul	La Trobe	22-Sep	04-Oct	11-Oct

DM model decile rankings of the last 5 seasons:

locppd	Year	decile_year	Season
CUNDERDIN 10035	2017	5	(normal season)
CUNDERDIN 10035	2016	1	(colder season)
CUNDERDIN 10035	2015	9	(warmer season)
CUNDERDIN 10035	2014	9	(warmer season)
CUNDERDIN 10035	2013	8	(warmer season)

DM Model predictions Graphic-predictions Graphic-frost/heat risk References, te

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Some learnings about Banks and RGT Planet



Banks & RGT Planet – phenology

days to Z49 relative to La Trobe at Cunderdin				
Variety	15-Apr	05-May	25-May	15-Jun
Banks	+10	+9	+8	+7
Flinders	+11	+10	+8	+8
RGT Planet	+6	+5	+5	+5
Bass	+9	+6	+6	+5
La Trobe	18-Jul	14-Aug	01-Sep	15-Sep

days to Z49 relative to La Trobe at Grass Patch				
Variety	15-Apr	05-May	25-May	15-Jun
Banks	+10	+8	+8	+6
Flinders	+10	+8	+9	+8
RGT Planet	+5	+4	+5	+4
Bass	+8	+6	+5	+4
La Trobe	27-Jul	23-Aug	07-Sep	21-Sep

Banks: similar to Flinders and 3-5 days later than RGT Planet

RGT Planet: similar to Bass, except April where it is 3 days earlier to flower

RGT Planet – straw strength

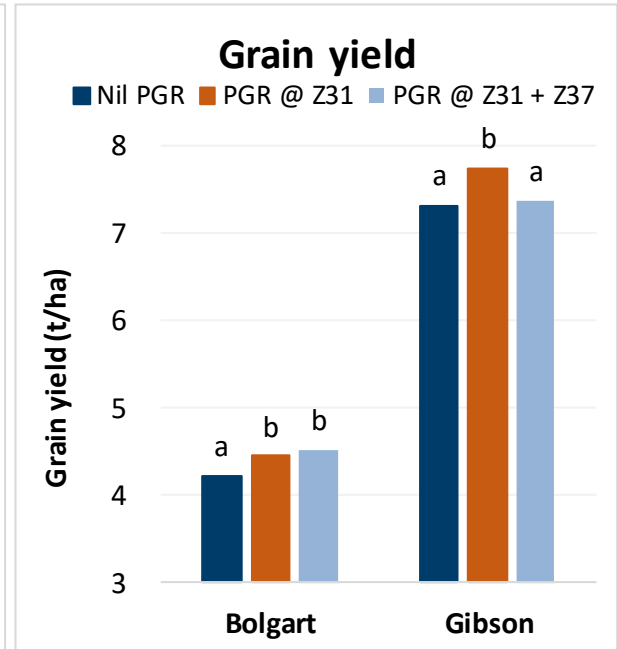
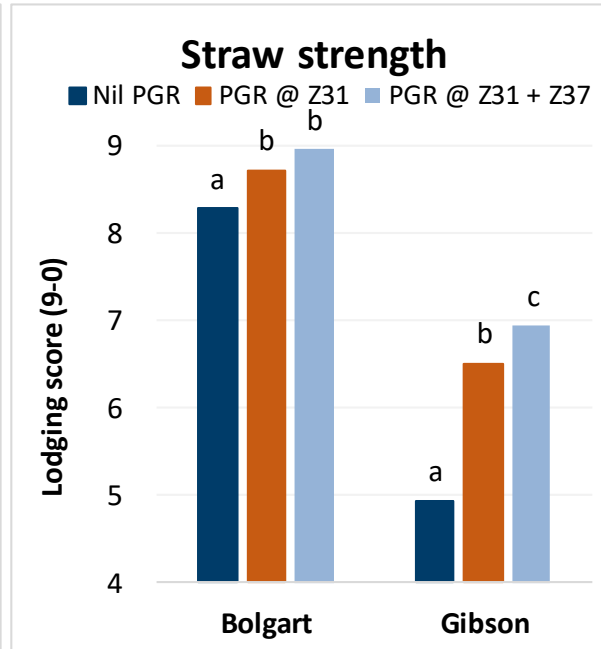
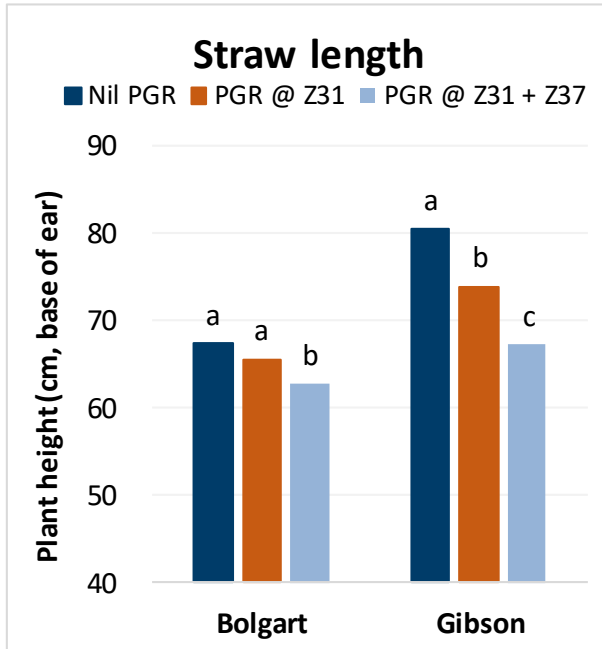


No PGR



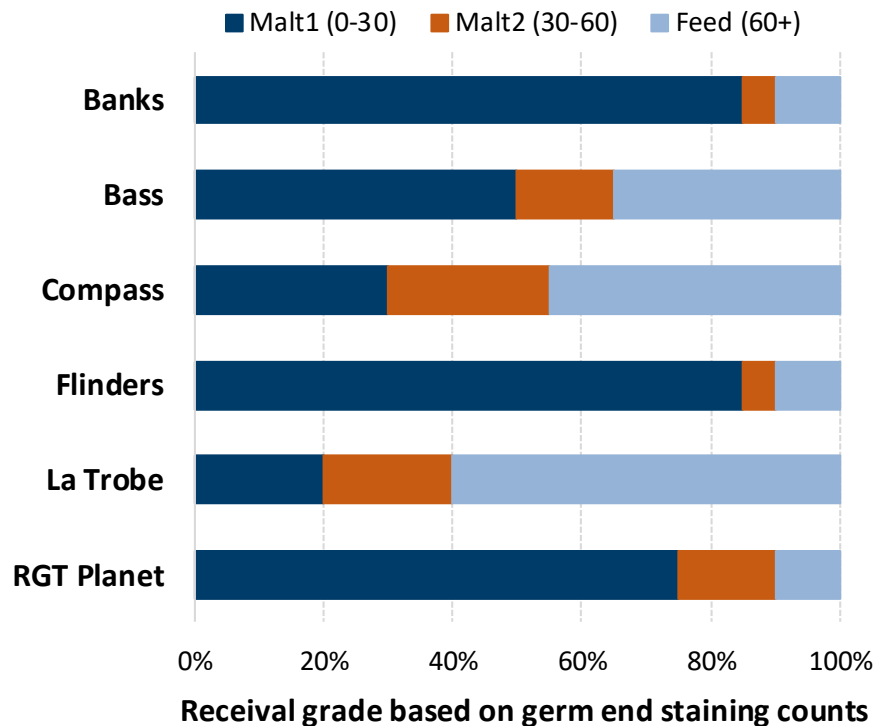
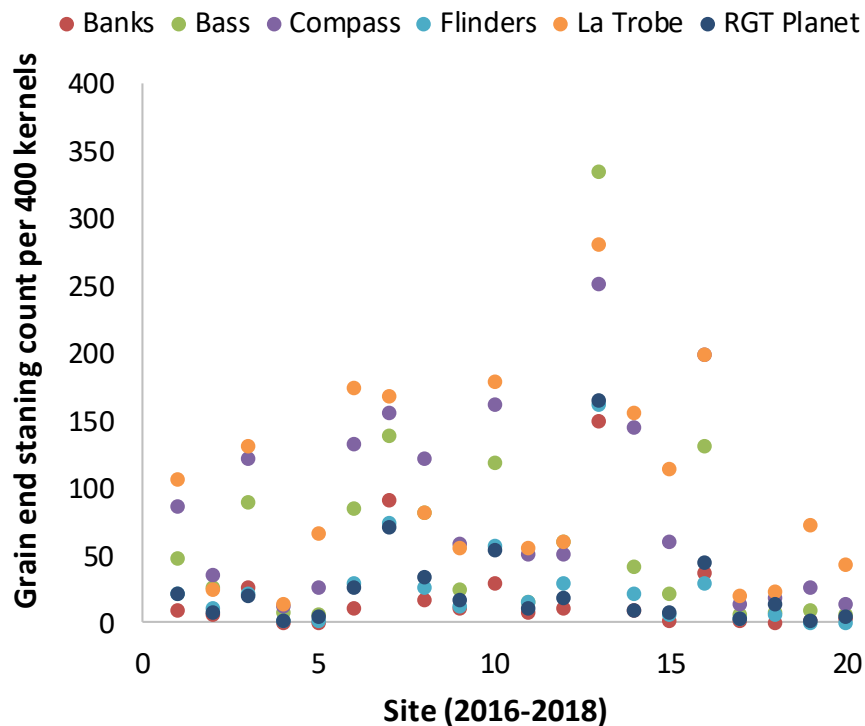
300 ml/ha Moddus Evo® applied at Z31

RGT Planet – straw strength



In high yielding (6+ t/ha) + high nitrogen (120+ kg N/ha) situations a single PGR application at Z31 may benefit straw strength in RGT Planet and result in increased grain yield

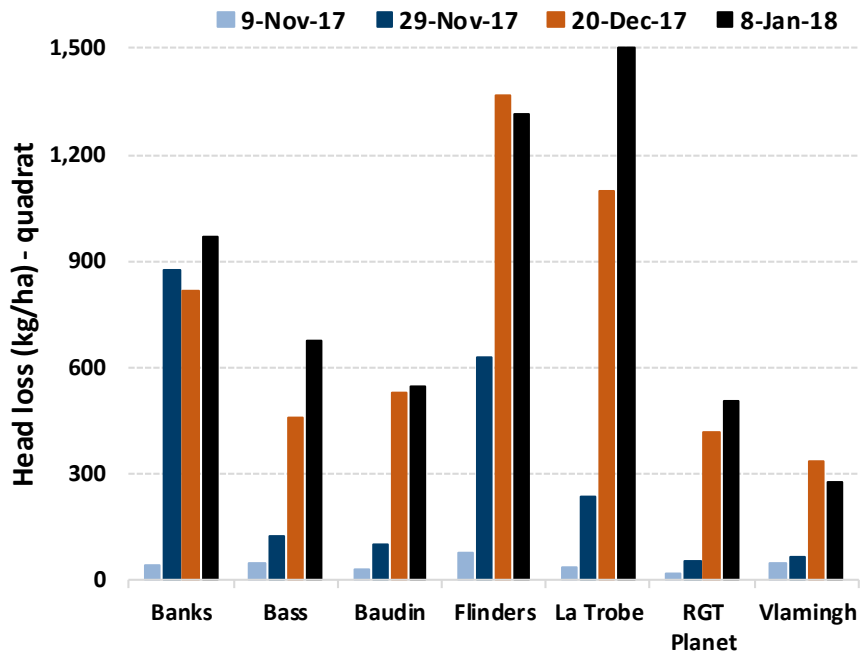
Banks & RGT Planet – germ end staining



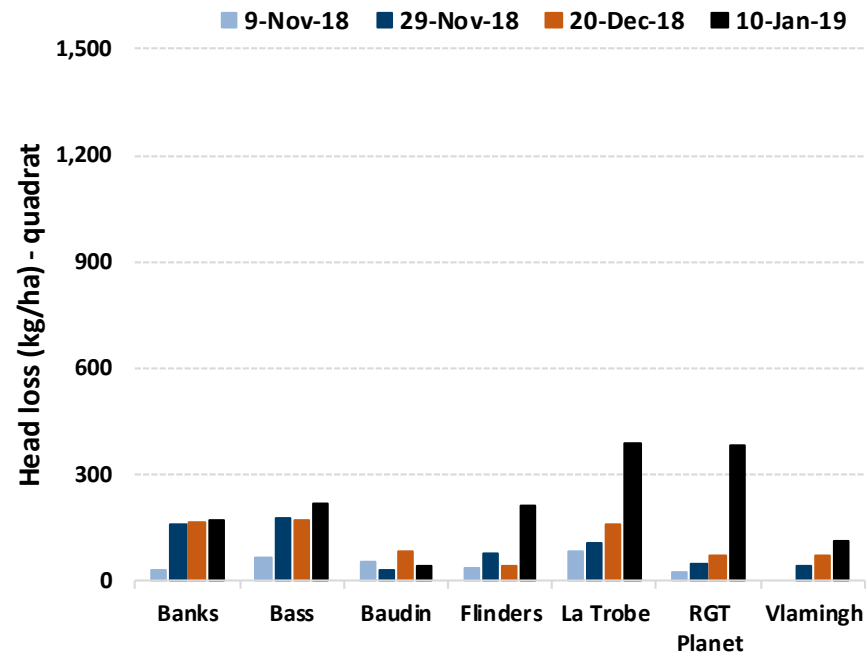
Banks and RGT Planet, like Flinders, would be classed as lower risk

Banks & RGT Planet – head loss

Gibson harvest delay trial - 2017



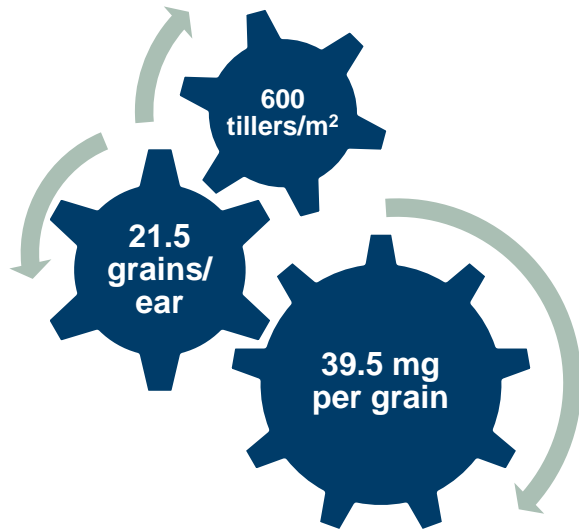
Gibson harvest delay trial - 2018



Don't really have enough data to be conclusive either way
[Baudin and Vlamingh are the benchmark varieties]

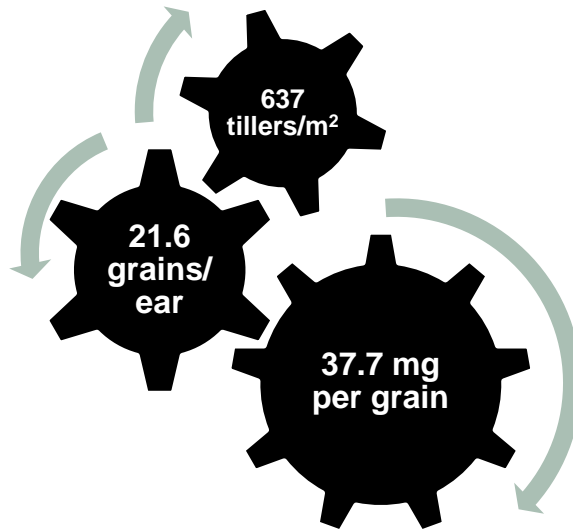
Banks & RGT Planet – yield pathways

Banks



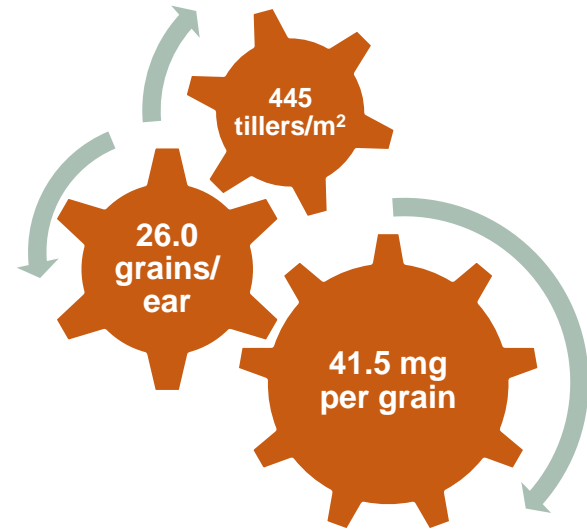
3.03 t/ha @ 11.3%

La Trobe



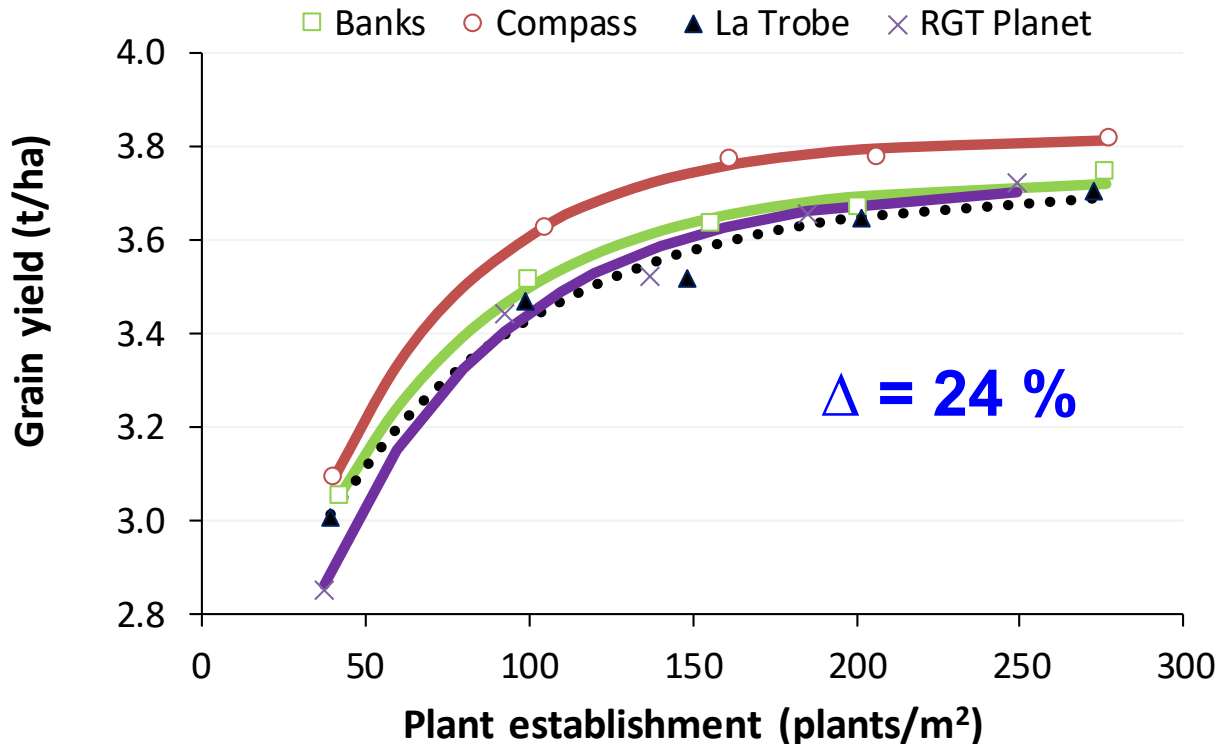
3.08 t/ha @ 10.3%

RGT Planet



3.01 t/ha @ 10.7%

Banks & RGT Planet – plant density



Banks & RGT Planet respond similarly (for grain yield) to increasing plant density as La Trobe, despite different yield pathways

Agronomic attributes – Banks & RGT Planet

Comparisons relative to La Trobe

Agronomic trait	Banks	RGT Planet
Phenology	later (like Flinders)	later
Straw length	shorter (like Bass)	similar
Straw strength	similar	similar
Head loss risk	? (lower)	? (lower)
Grain yield	similar	depends on yield
Hectolitre weight	similar	lower
Screenings	slightly plumper	slightly narrower
Grain brightness	brighter (like Flinders)	slightly brighter
Germ end staining risk	lower (like Flinders)	lower (like Flinders)

Key Messages



Grain protein can be lifted without applying more N thru better timing



Flowering dates can be compared with “FlowerPower” barley



Banks and RGT Planet are good options, but neither is perfect

Thank you

Communication support: Georgia Trainor

Professional support: Raj Malik

Technical support: Helen Cooper, Rod Bowey and Shelley Hall

Trial seeding, spraying and harvesting: DPIRD Technical Support Units

Statistical support: Andrew van Burgel and Mario D'Antuono

Research funding: DPIRD and the GRDC (DAW00224)

Important disclaimer

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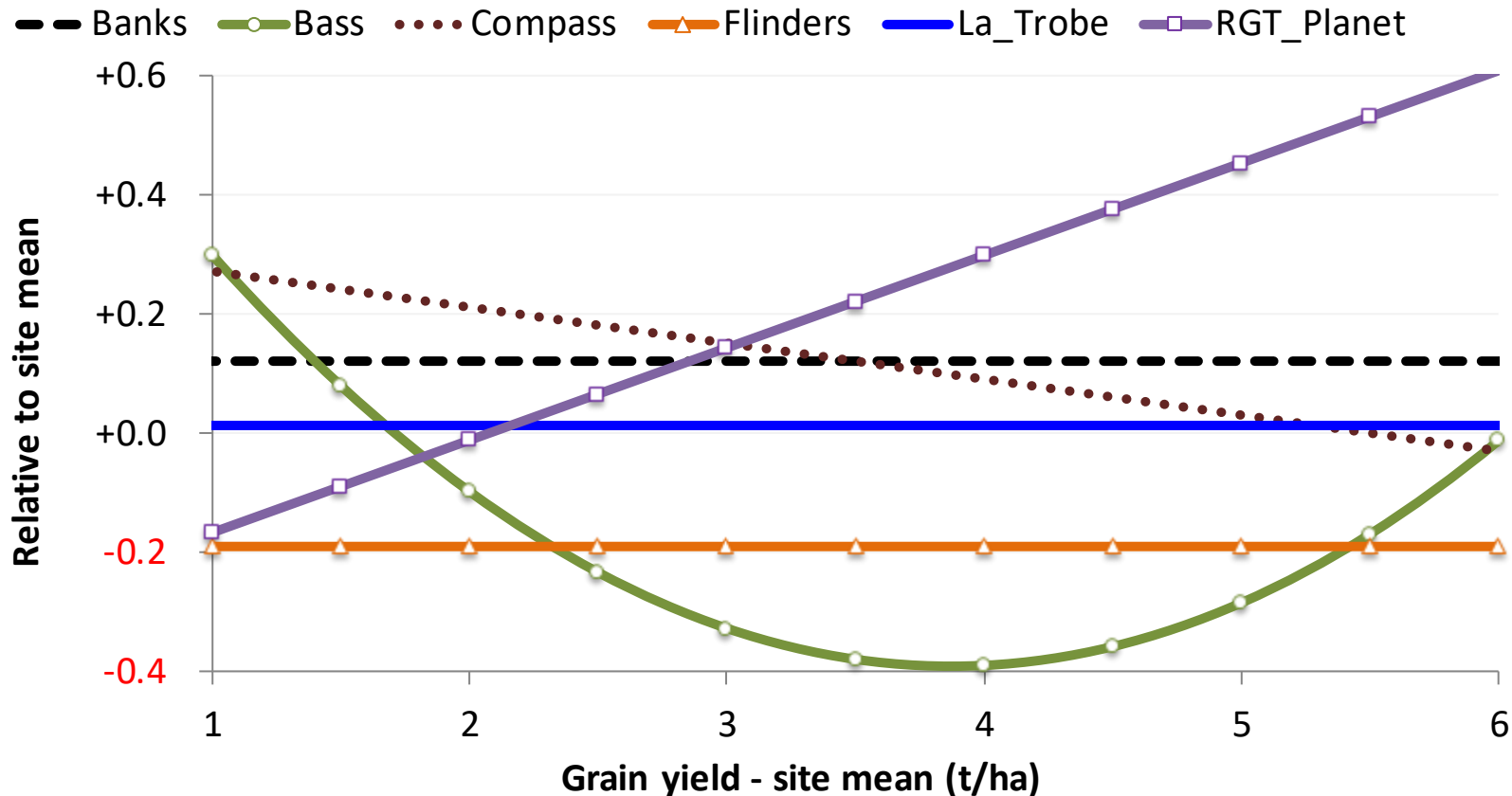


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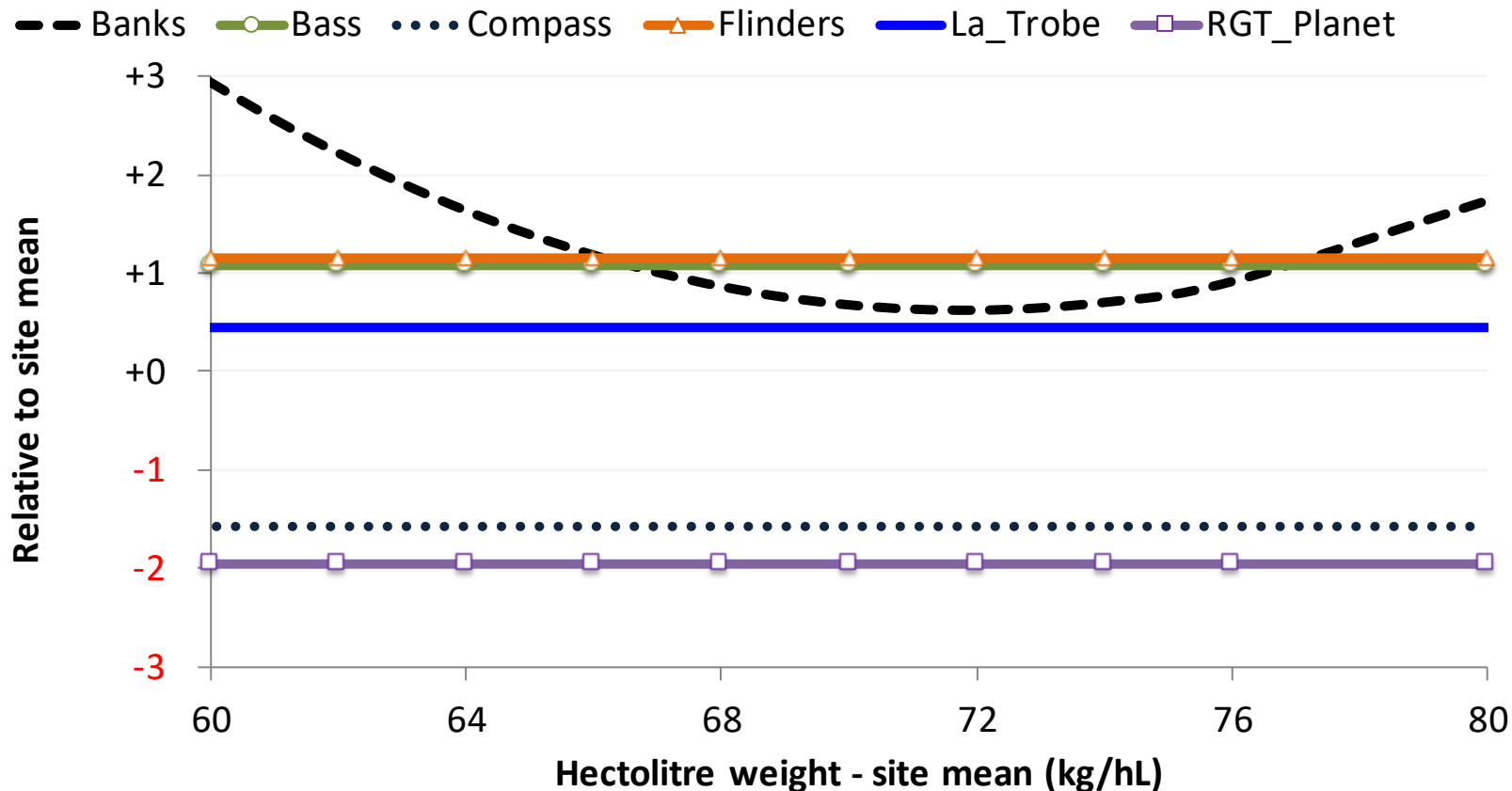
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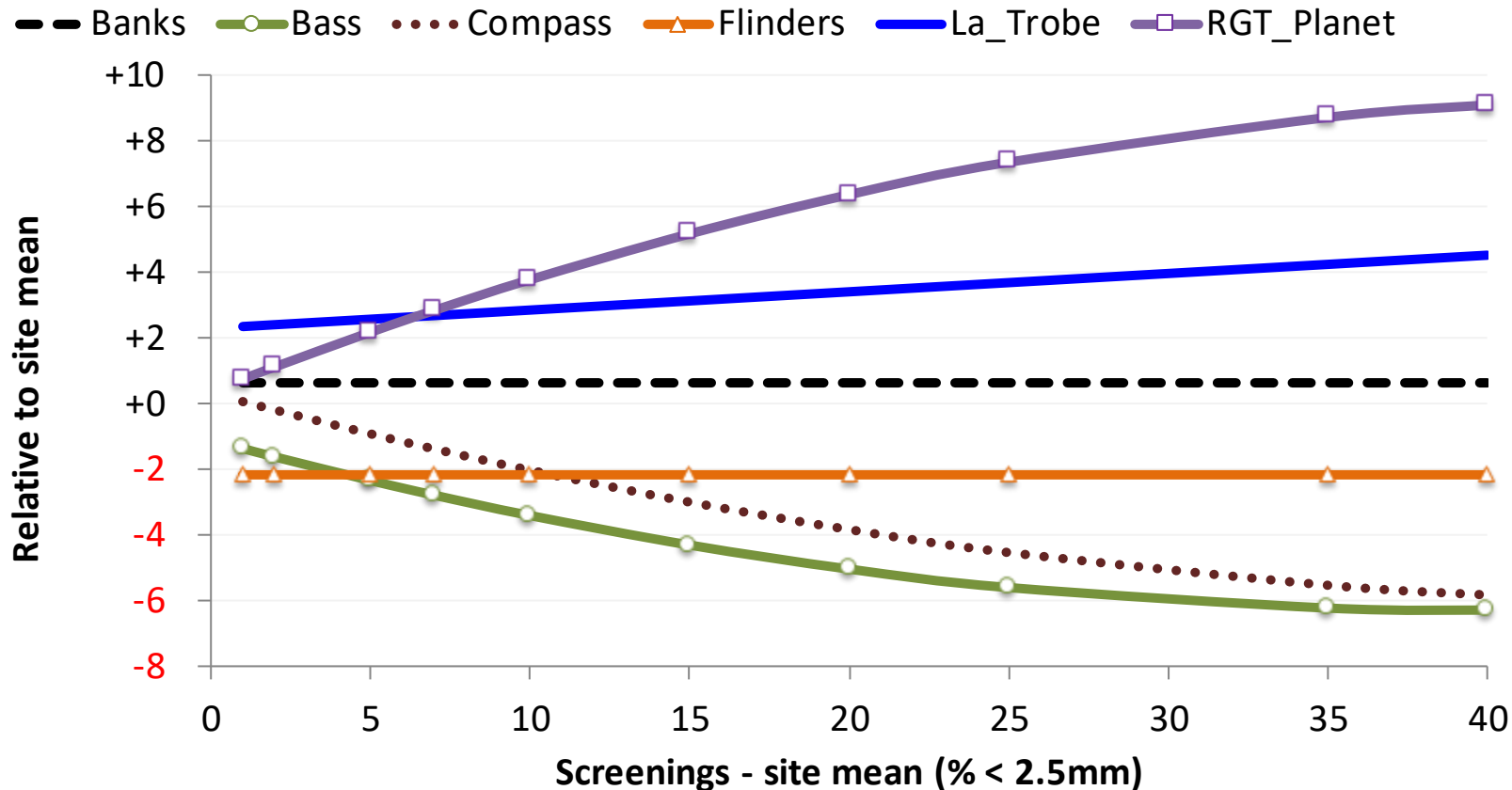
Banks & RGT Planet – grain yield



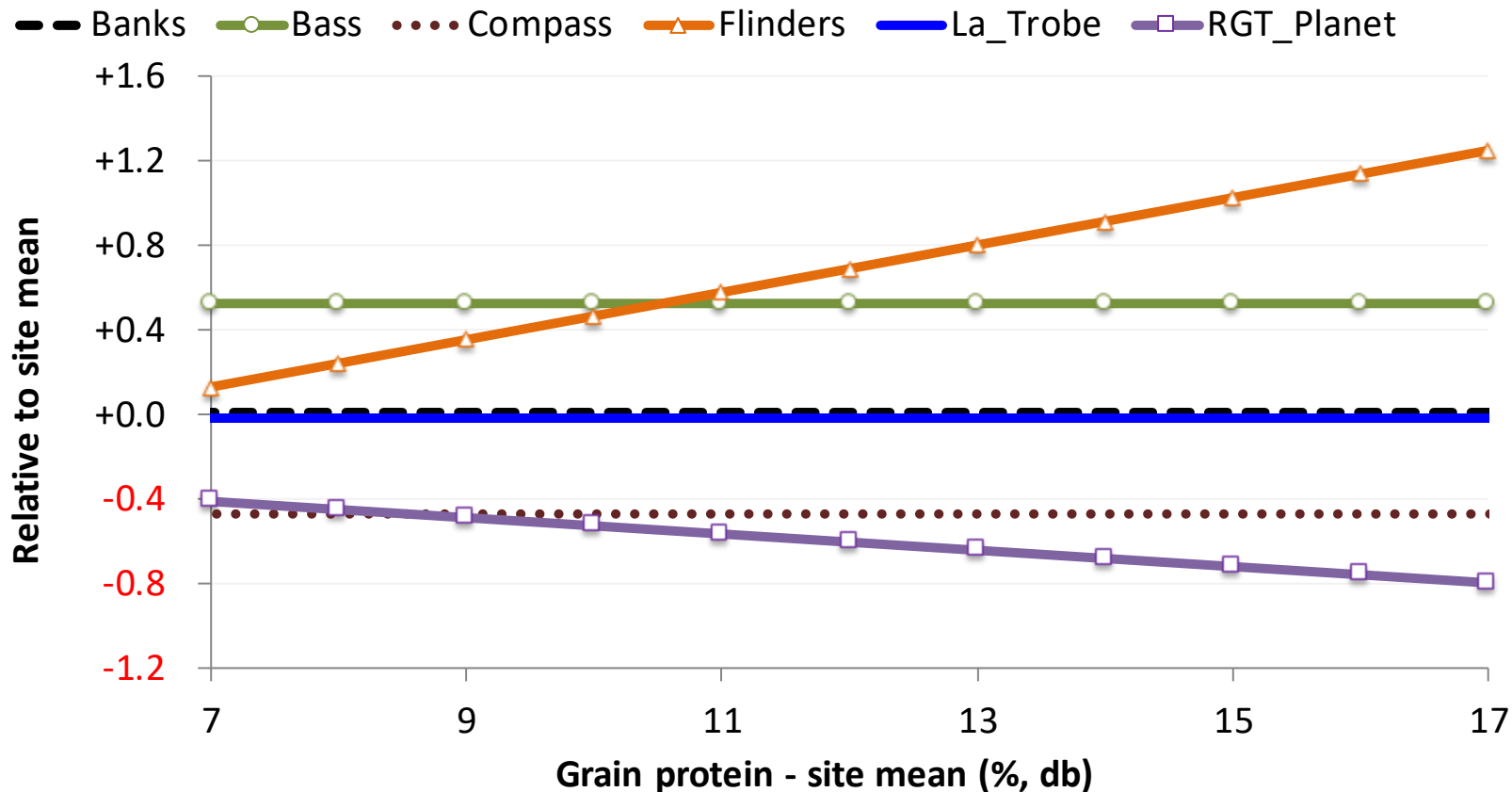
Banks & RGT Planet – hectolitre weight



Banks & RGT Planet – screenings



Banks & RGT Planet – grain protein



Banks & RGT Planet – grain brightness

