Wine Australia for Australian Wine

THE UNIVERSITY OF ADELAIDE AUSTRALIA

Cover crops can reduce the cost of under-vine weed control

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Under-vine Cover Cropping

Project Aims

- To reduce the need for repeated herbicide use in the under-vine zone
  - herbicide resistance; future of glyphosate?
- To improve under-vine soil health
- To grow plants under-vine which are beneficial to the grapevine, potentially leading to improved yields and/or quality
- To improve vineyard profitability and sustainability

Under-vine zone: Industry std. herbicide control

Why spray and when is a weed a weed?

- Aesthetics, garden mentality, “the vibe”
  - Nice, neat & tidy, military rows, work ethic ...
- Amenity (eg caltrop, innocent weed, jacks)
  - Dogs, pickers, boots, tyres
- Height (eg prickly lettuce, fleabane ….)
  - drip lines, foliage, accidental harvest
- **Competition for moisture**

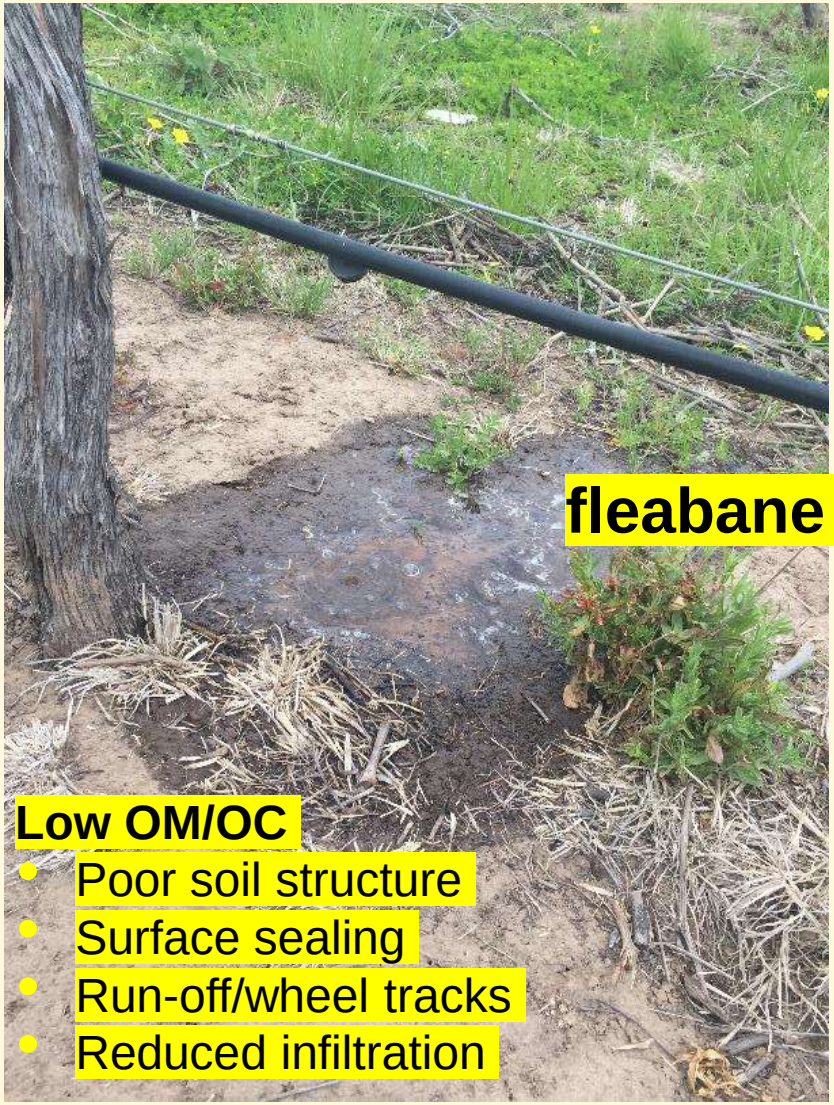
Under-vine soils

B. Hughes, PIRSA (2014), Adelaide Hills Wine Region

Issue ***(study of 13 sites, most spraying under-vine)***	**Extent**	**Possible Solutions**
• Low and falling organic matter/carbon under-vine *(nb. zone of greatest conc. vine roots)* compared with mid-row • Leading to poor under-vine soil structure (incl. surface sealing, reduced infiltration, increased runoff)	Wide-spread, sprayed sites ..	Add composts inc. mid-row DM and slash into under-vine zone grow pastures under vine row

Nuriootpa R.C. (26/9/17)

Herbicide control



Medic residues

Many variable traits of cover-crops

- Life cycle: annual vs. perennial?
  - annuals: early/mid/late maturing?
  - perennials: active growth/summer dormancy?
- Type: grass vs. legume?
- Growth habit: prostrate vs. upright
- Are they host for pests eg LBAM, earwigs?
- Vigour/competitiveness: low vs. high DM?
- Role of mixtures eg grass + legume?
- Site specific; pH, avg. rainfall ……

Project under-vine treatments/crops

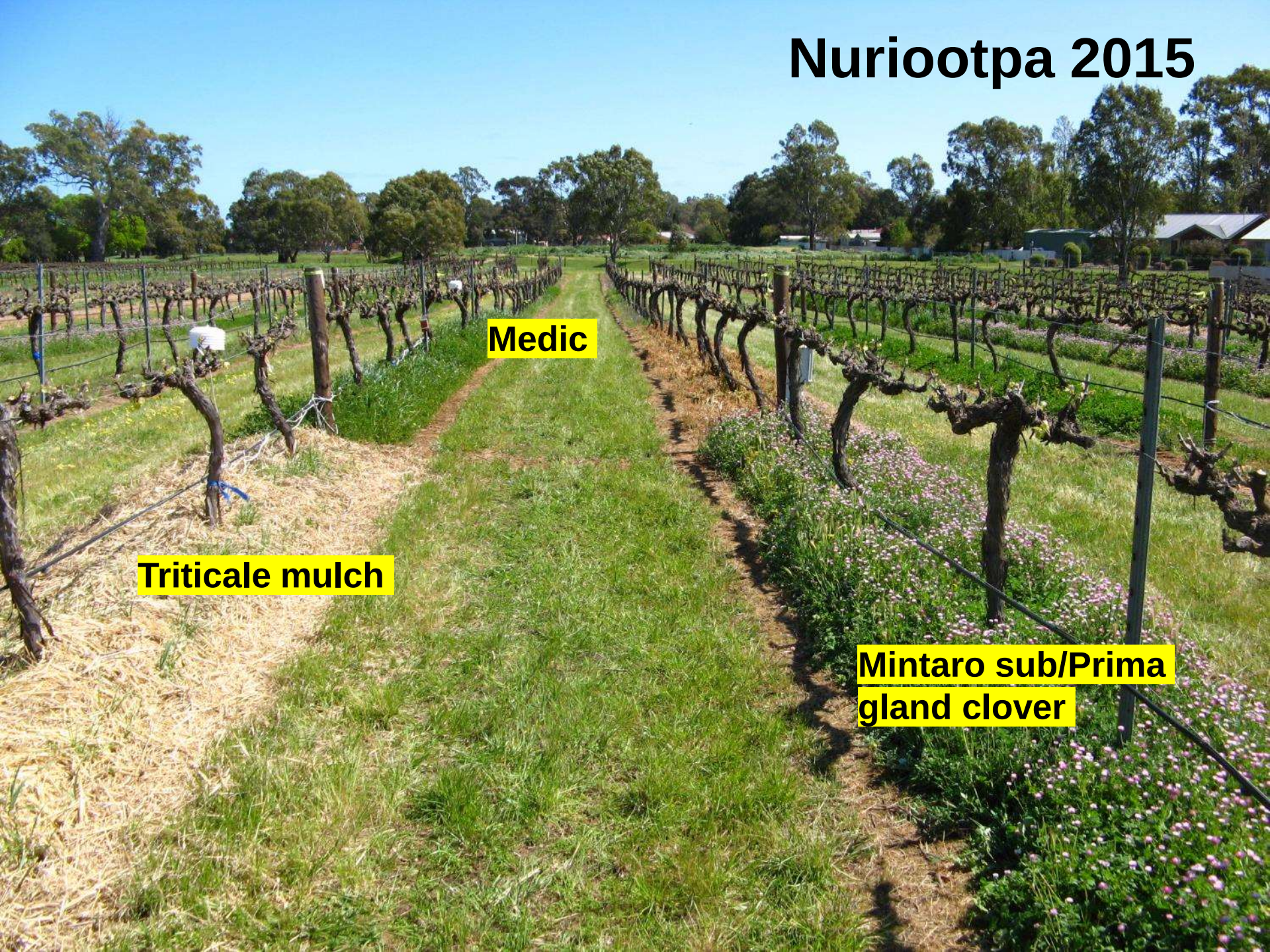
10 trt's: plant/variety/sp.	Plant type/comment	SR (kg/ha)
1. Triticale mulch	Control	~ 50 t/ha
2. Kasbah cocksfoot	Perennial grass; summer dormant**?!**	8
3. Wallaby grass (*Rytidosperma geniculata)*	Perennial grass, native; evergreen	10
4. Rat-tail fescue (*Vulpia myuros*)	Annual grass; self-regenerating, short	10
5. Cavalier burr medic & Bindaroo button medic	Annual pasture legumes; self-regen', early maturity	20/20

U'vine cover-crops (cont'd)

Plant/variety/sp.	Plant type/comment	SR (kg/ha)
6. Angel strand medic & Sultan barrel medic	Annual pasture legumes; self-regen', early maturity	20/20
7. Scimitar burr medic & Safeguard annual ryegrass	Annual grass/pasture legume mix; self-regen', soft-seeded medic	20/30
8. Sheep fescue & Palestine strawberry clover	Perennial grass/pasture legume mix;	20/20
9. Mintaro subclover & Prima gland clover	Annual pasture legume mix; self-regenerating, RLEM resistant	20/7
10. Herbicide control	Glyphosate	NA

How was it sown?

- Sown Autumn 2014
- Taege disc seeder
- Single row, ~ 20cm either side of vines
- ~ 1cm depth, chains
- Plot ~ 18m row, 3 panels x 3 vines
- Legumes inoculated
- Insecticide applied (RLEM/LF/Sitona
- 2014 was dry – some resown in 2015
- Compacted topsoil, mounded – tricky


Nuriootpa 2015
Medic
Triticale mulch
Mintaro sub/Prima
gland clover

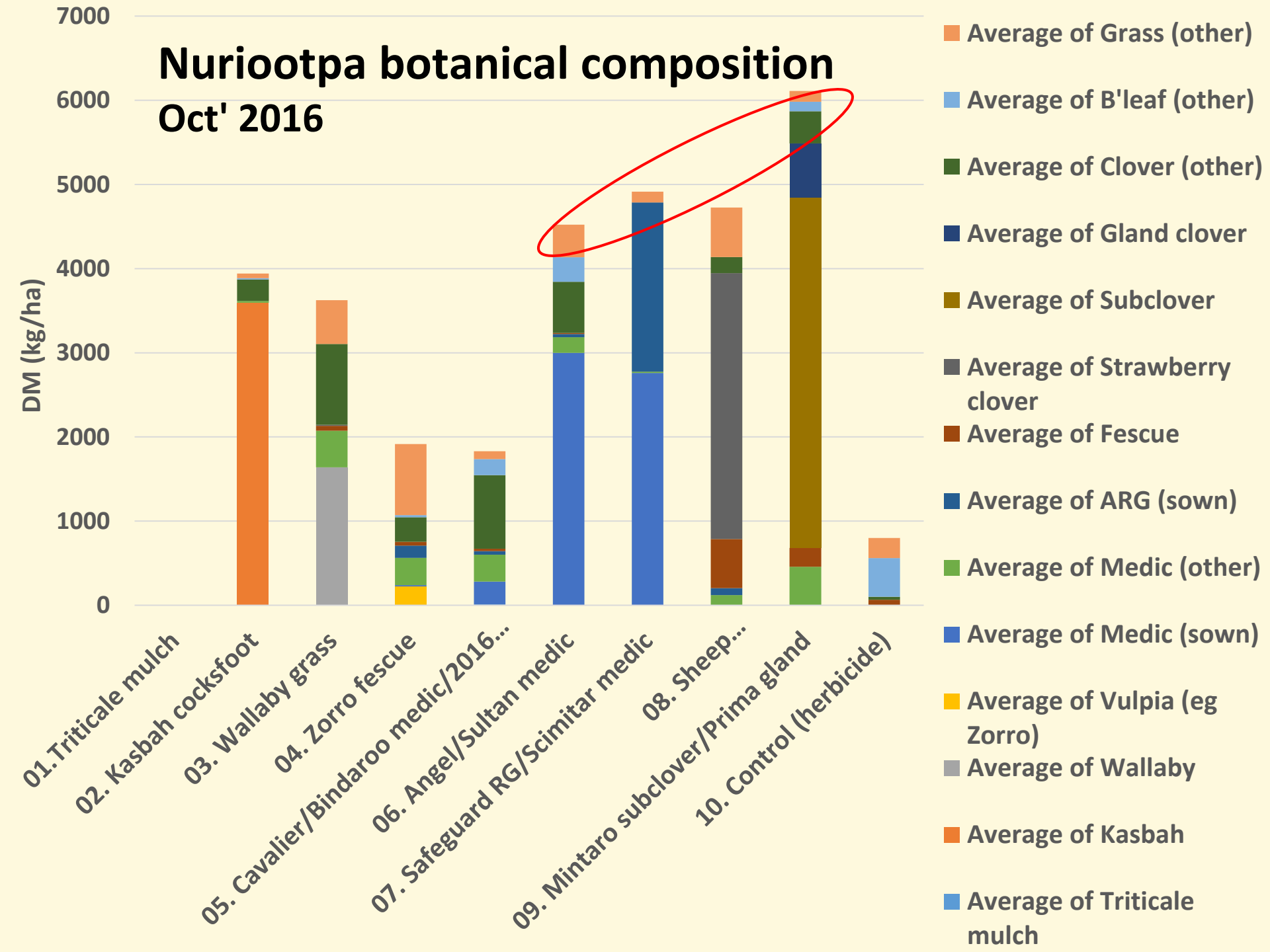

Wallaby grass
Clare
20th Sept. 2016

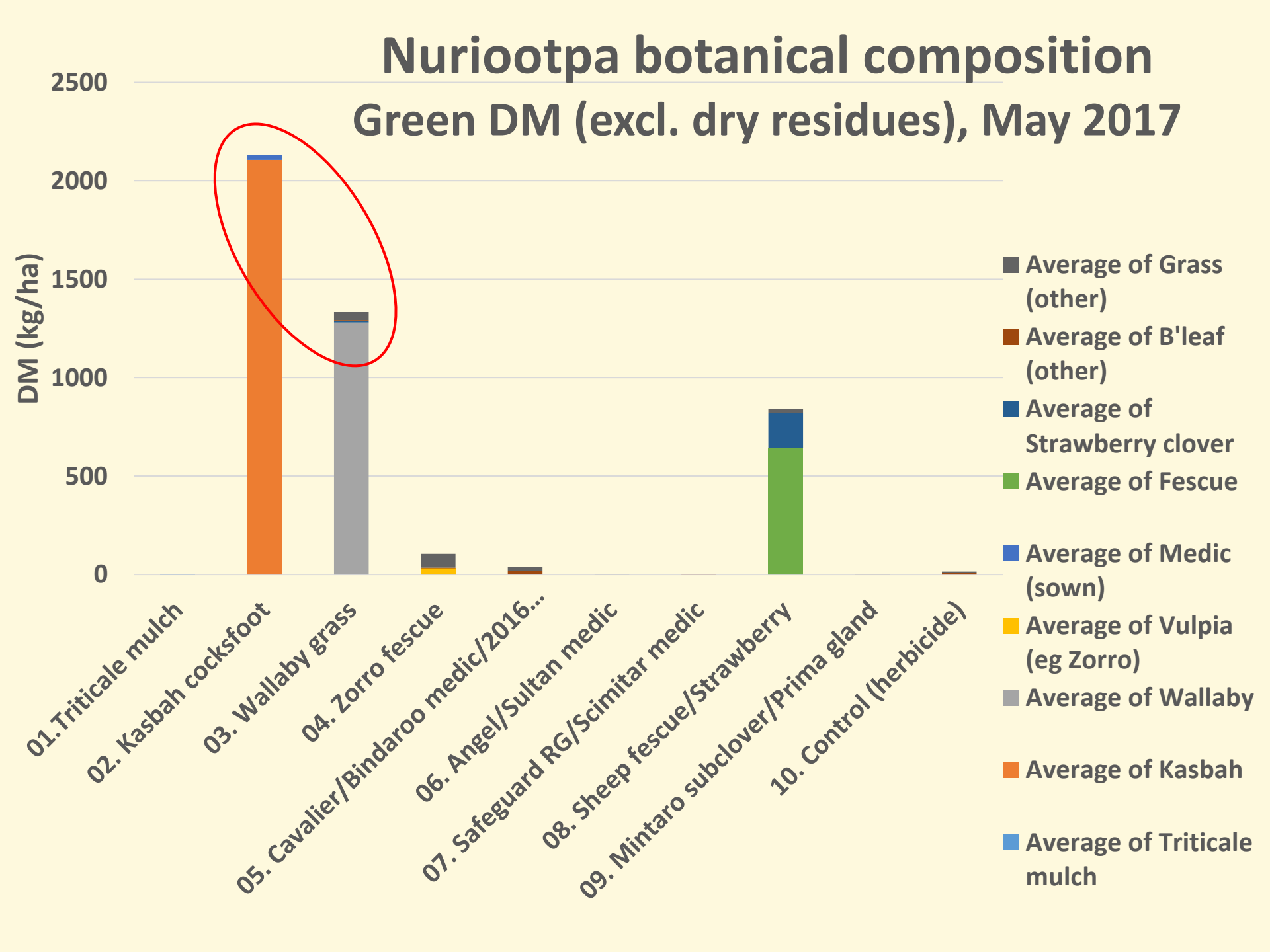

Kasbah cocksfoot
• height?
Nuriootpa 2016

What did we measure?

- Cover-crops
  - Botanical composition, DM growth, …
- Soils
  - Nutrients, moisture, compaction
  - Microflora/fauna: worms, mycorrhizae …..
  - Allelopathy
- Grapevines
  - Vegetative: leaf canopy/LAI, cane weights, petiole N
  - Grapes: 50 berry wt, bunch #/wt, total yield, YAN, sugars/acids, wine quality

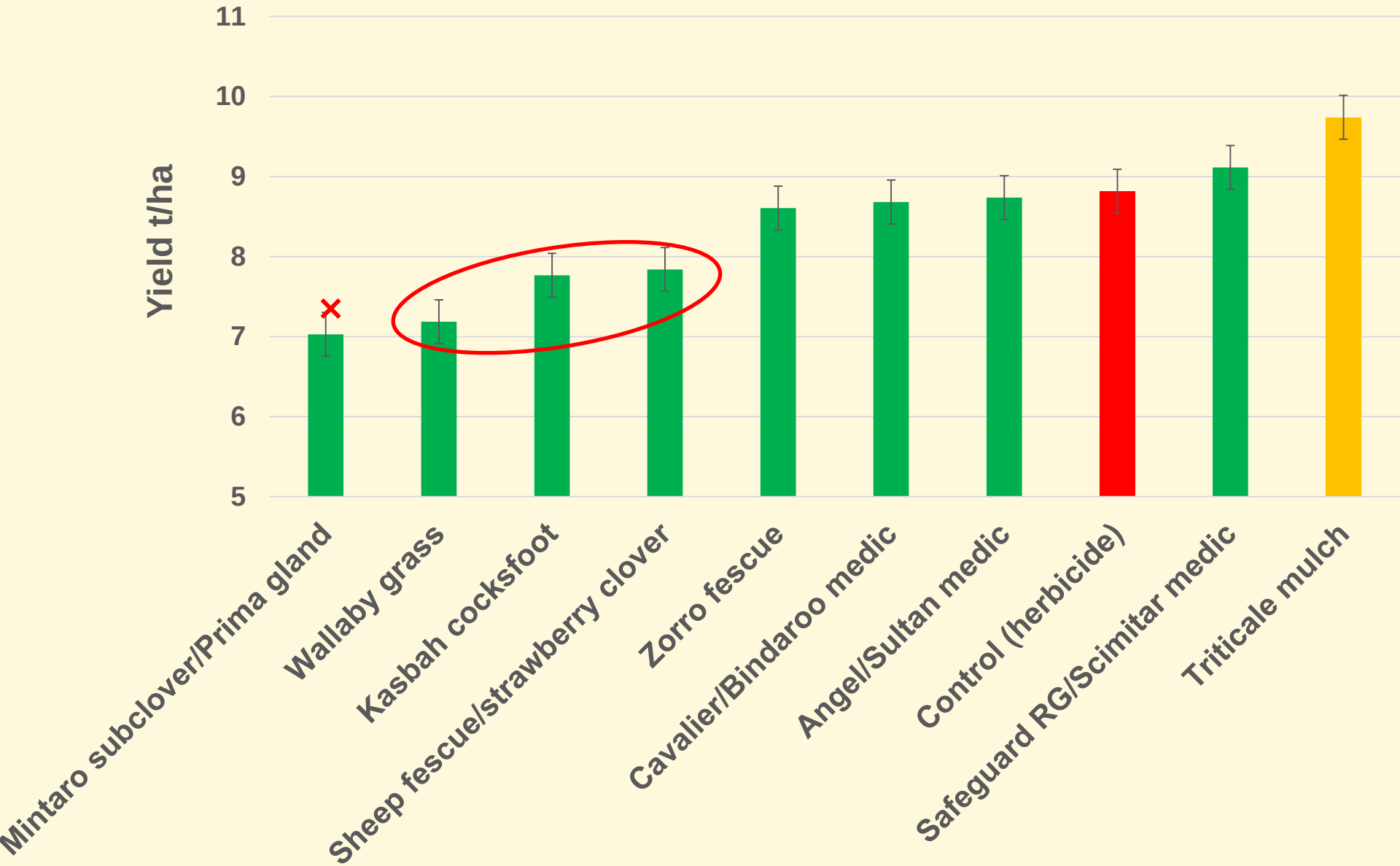
“Botanal - a comprehensive sampling and computing procedure for estimating pasture yield and composition”
Tothill et al (1996) CSIRO


Nuriootpa botanical composition
Oct' 2016
DM (kg/ha)
7000
6000
5000
4000
3000
2000
1000
0
01.Triticale mulch
02. Kasbah cocksfoot
03. Wallaby grass
04. Zorro fescue
05. Cavalier/Bindaroo medic/2016...
06. Angel/Sultan medic
07. Safeguard RG/Scimitar medic
08. Sheep...
09. Mintaro subclover/Prima gland
10. Control (herbicide)
Average of Grass (other)
Average of B'leaf (other)
Average of Clover (other)
Average of Gland clover
Average of Subclover
Average of Strawberry clover
Average of Fescue
Average of ARG (sown)
Average of Medic (other)
Average of Medic (sown)
Average of Vulpia (eg Zorro)
Average of Wallaby
Average of Kasbah
Average of Triticale mulch


Nuriootpa botanical composition
Green DM (excl. dry residues), May 2017
DM (kg/ha)
2500
2000
1500
1000
500
0
01.Triticale mulch
02. Kasbah cocksfoot
03. Wallaby grass
04. Zorro fescue
05. Cavalier/Bindaroo medic/2016...
06. Angel/Sultan medic
07. Safeguard RG/Scimitar medic
08. Sheep fescue/Strawberry
09. Mintaro subclover/Prima gland
10. Control (herbicide)
Average of Grass (other)
Average of B'leaf (other)
Average of Strawberry clover
Average of Fescue
Average of Medic (sown)
Average of Vulpia (eg Zorro)
Average of Wallaby
Average of Kasbah
Average of Triticale mulch

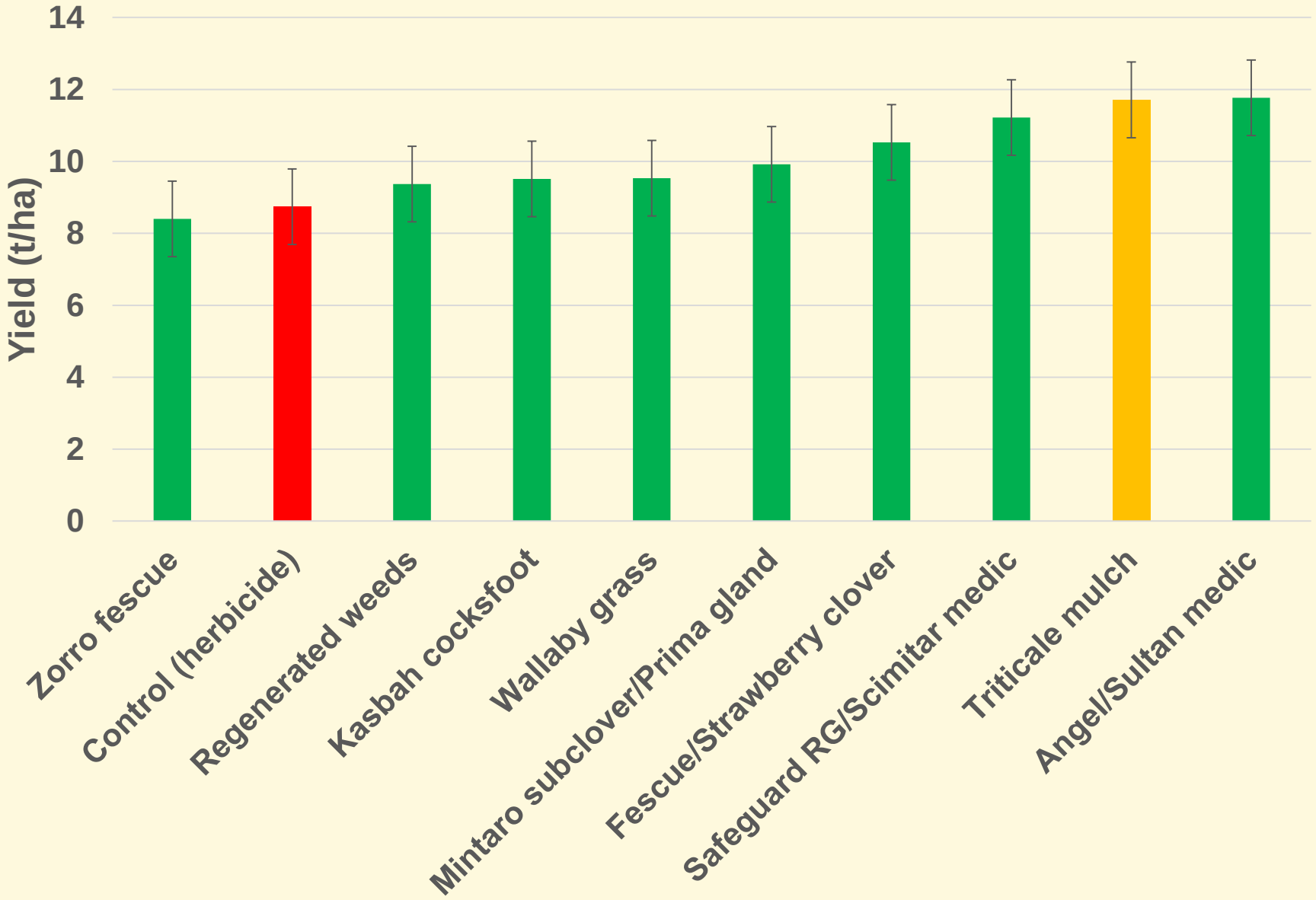
Nuriootpa harvest yield 2016

(nb. v. dry spring/summer)



Nuriootpa harvest yield 2017

(nb. wetter spring/summer)



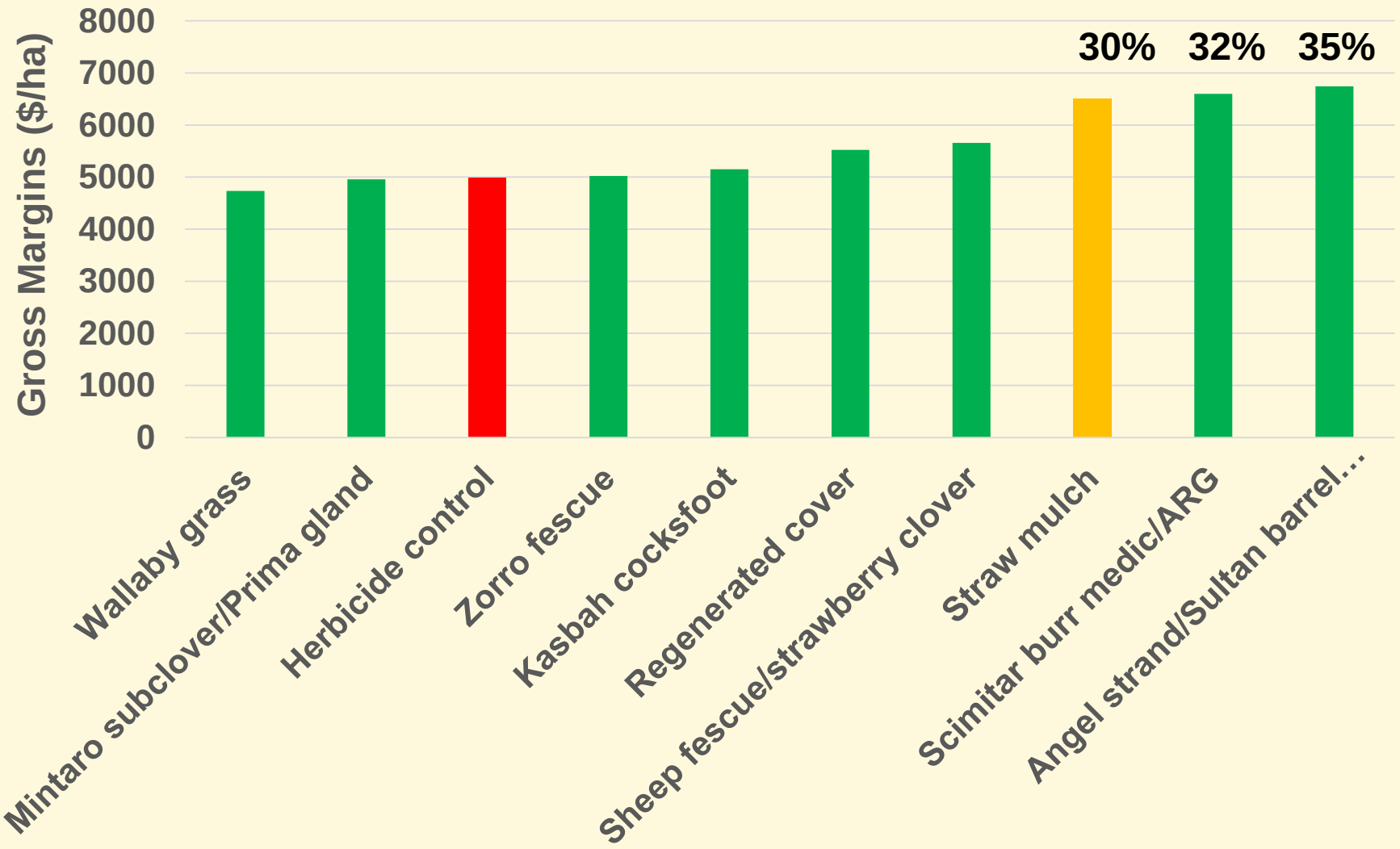
Nuriootpa annual costs ($/ha)

Tom Nordblom et al (62 AARES Conf., 2018)

12 years district yields/prices => 2400 simulated harvests

Under-vine costs	$/ha	Other vineyard	$/ha
Straw mulch ($3000/4 yrs)	750	Fungicide & application	470
Herbicide x ~ 5 applications	333	Mowing mid-rows	150
Cover-crops (5 yrs) NB Wallaby grass	40-80 175!	Fertiliser (MAP soluble)	32
		Pruning/hedging	1,339
		Irrigation (0.8 Ml)	560
		Harvesting	800
Avg. total costs if using herbicide ($/ha)			**~ 3,700**

Nuriootpa: simulated gross margins using known vineyard costs and yields from 2016 & 2017 vintages

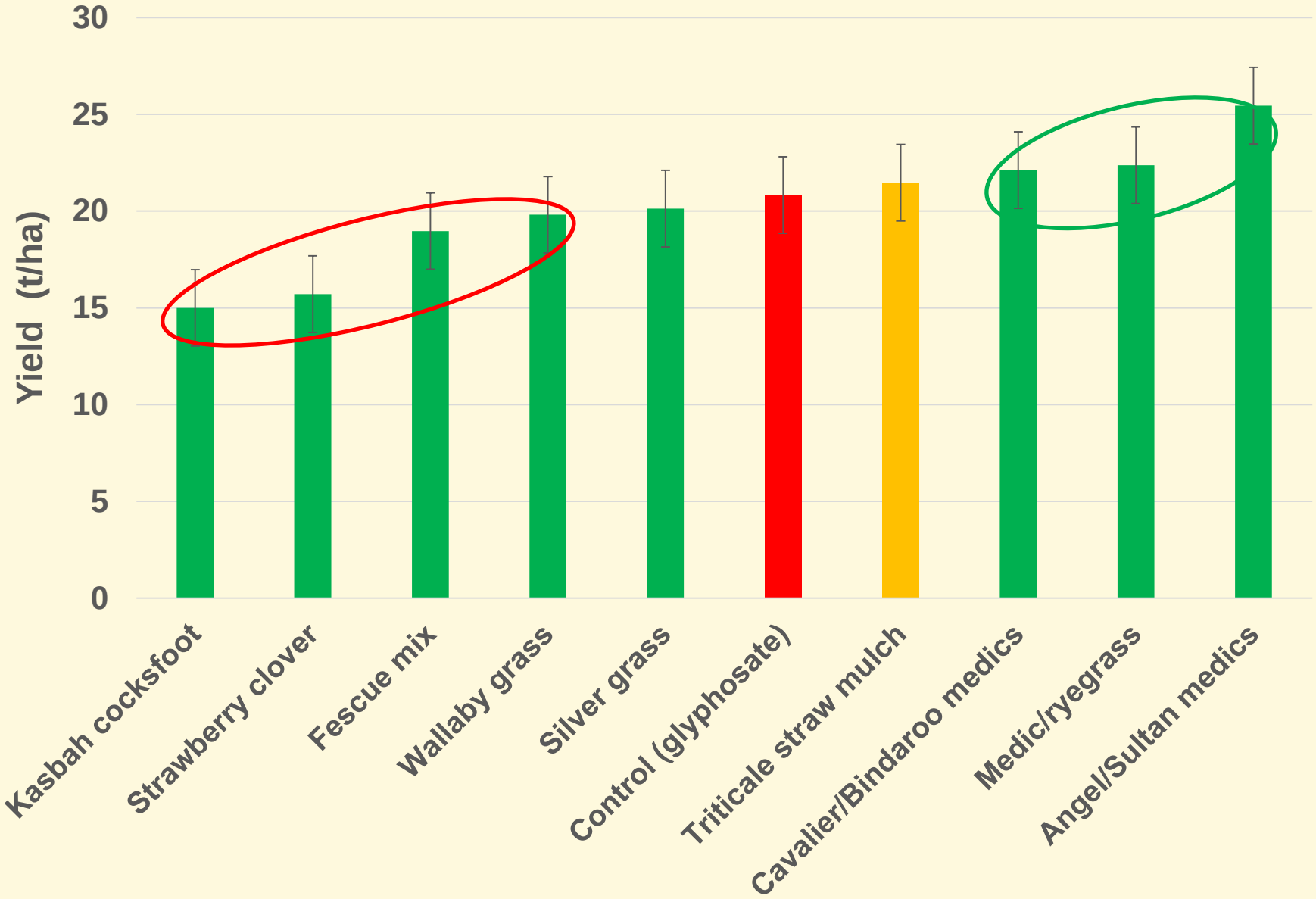


General observations

- NB 2 years data only
  - Needs ongoing site & data collection to validate results
- Yield the biggest GM driver – moisture availability
- Perennials
  - Good weed suppression; slow to establish; reliable (?)
  - Reduced yields (eg wallaby, cocksfoot, fescue & strawberry clover, Microlaena); summer dormancy?
- Annuals
  - Faster but fickle w.r.t. regeneration, insects,
  - Better matched to vine growth cycle

Langhorne Creek Harvest, 2016

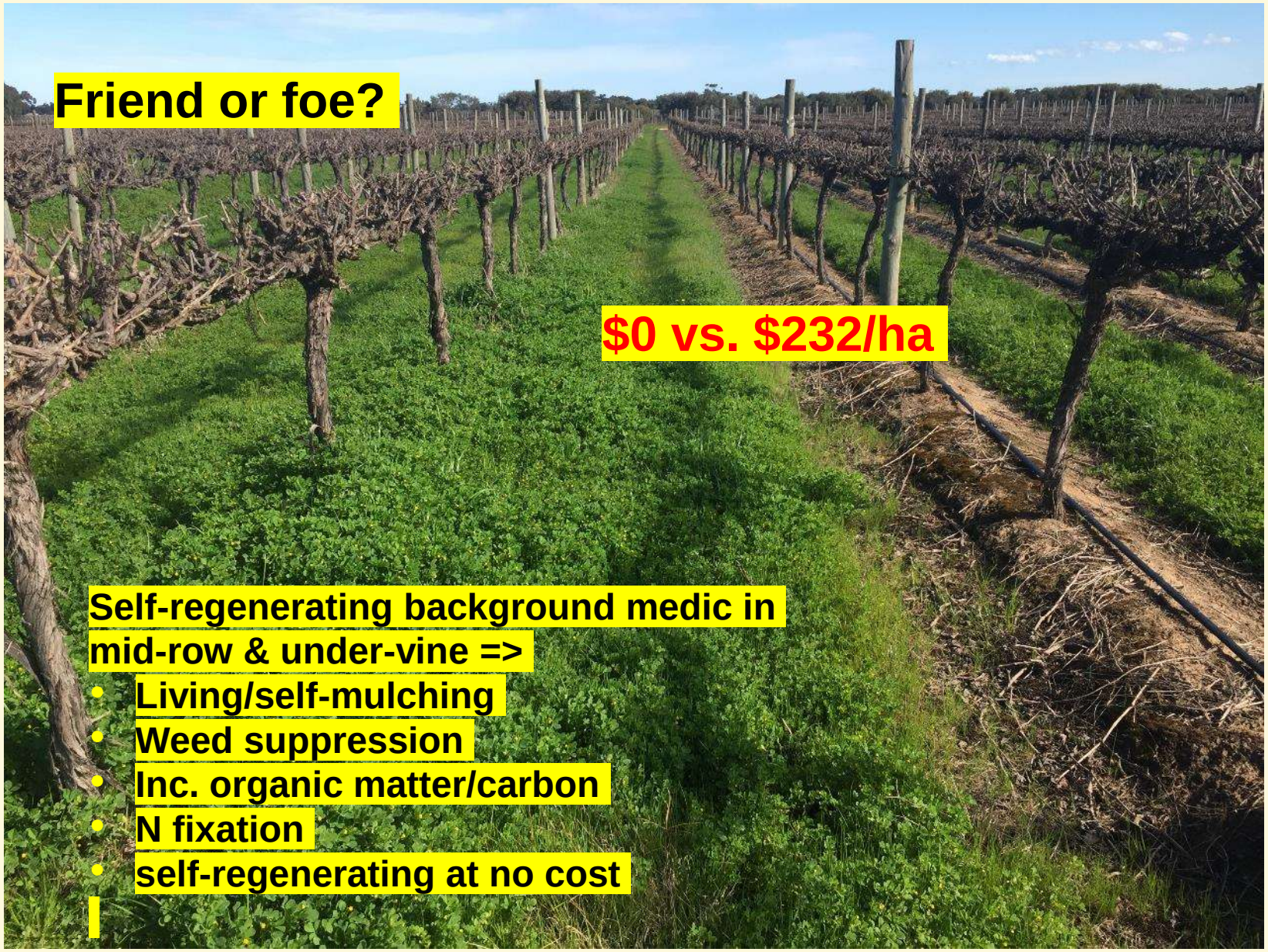
(nb. v. dry spring/summer)



Conclusions

- Cover crops can reduce the ~~**cost of**~~ **need for** under-vine weed control
- Growing desirable species under-vine can:
  - improve vine yield (and grape/wine quality)
  - reduce costs/increase gross margins
  - and may inc. microbial diversity & activity; soil organic matter/carbon; improve soil structure & infiltration
- Much more to learn in the next 3 years eg.
  - soil/water/vine relationships
  - the role of allelopathy; mycorrhizae ……
  - grazing and mowing options for perennials?

Langhorne Creek Sept 2017



Trial sites/co-operators/variety

- Nuriootpa Research Centre (SARDI); Shiraz
- Oxford Landing (Yalumba); Merlot
- Eden Valley (Eden Hall); Shiraz
- Langhorne Creek (CMV Farms); Cabernet Sauvignon
  - & additional satellite sites in Clare, Coonawarra, McLaren Vale, Adelaide Hills.

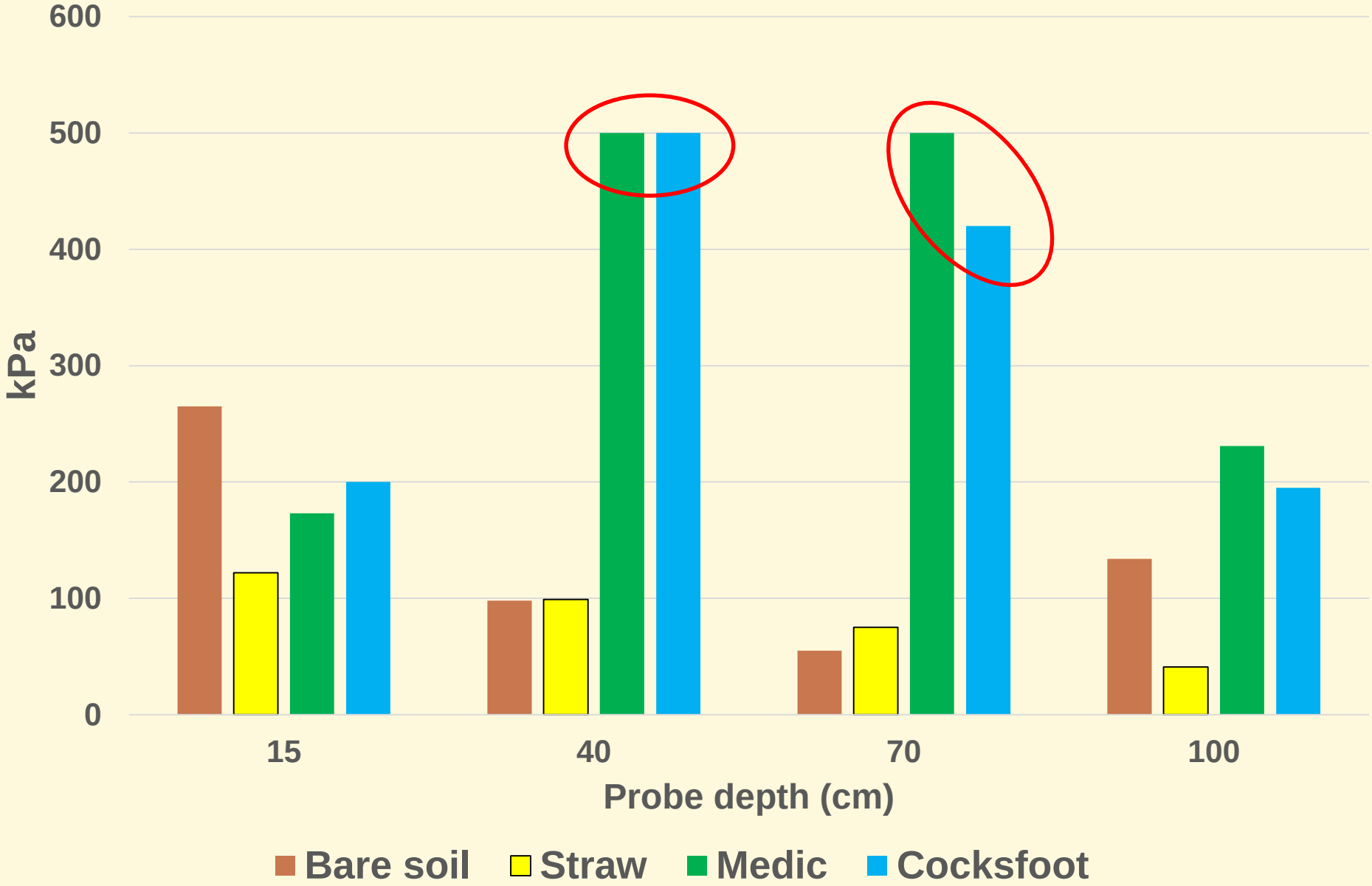
Wine score: Chris's Nuriootpa Shiraz 2016

Barossa Vine Improvement Society (26 panel members)

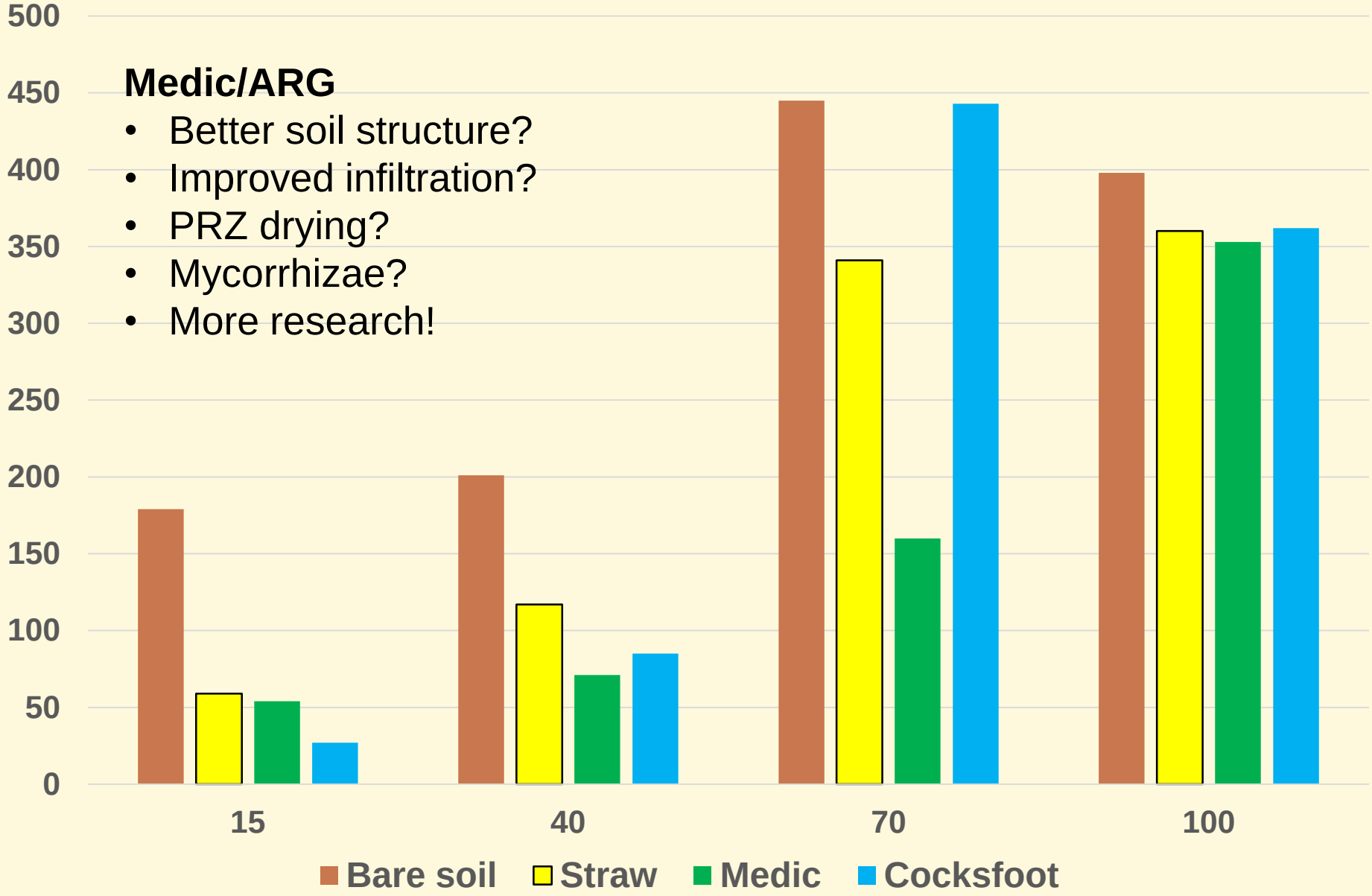
- Expt. Wine batches
- 7 selected trts
- 20 point scale
- no 95 Halliday points but
- ….. Gawler show medal

Effect of reduced yield?

Nuriootpa 2016: soil moisture tension at flowering



Nuriootpa 2017: soil moisture tension at harvest

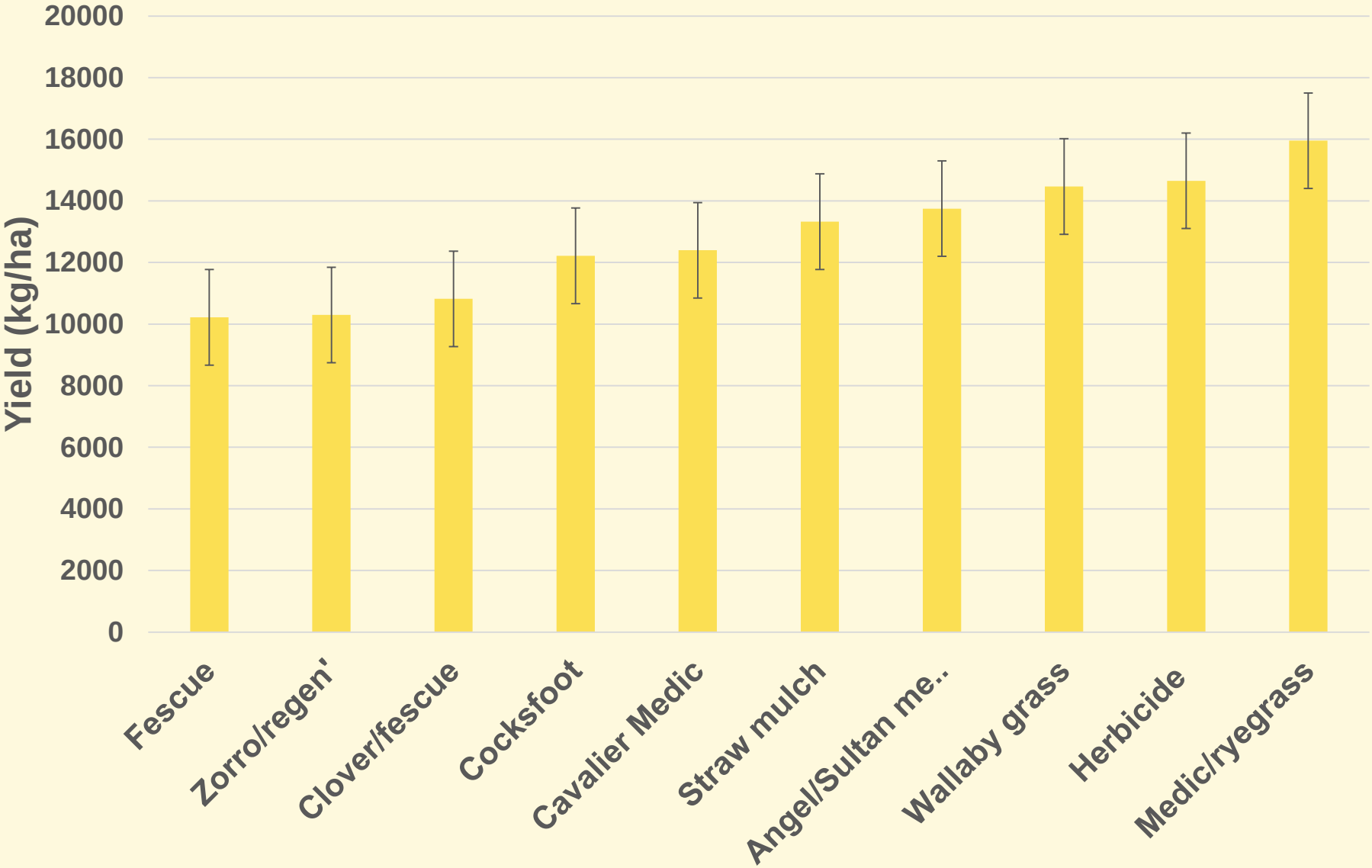


Medic/ARG

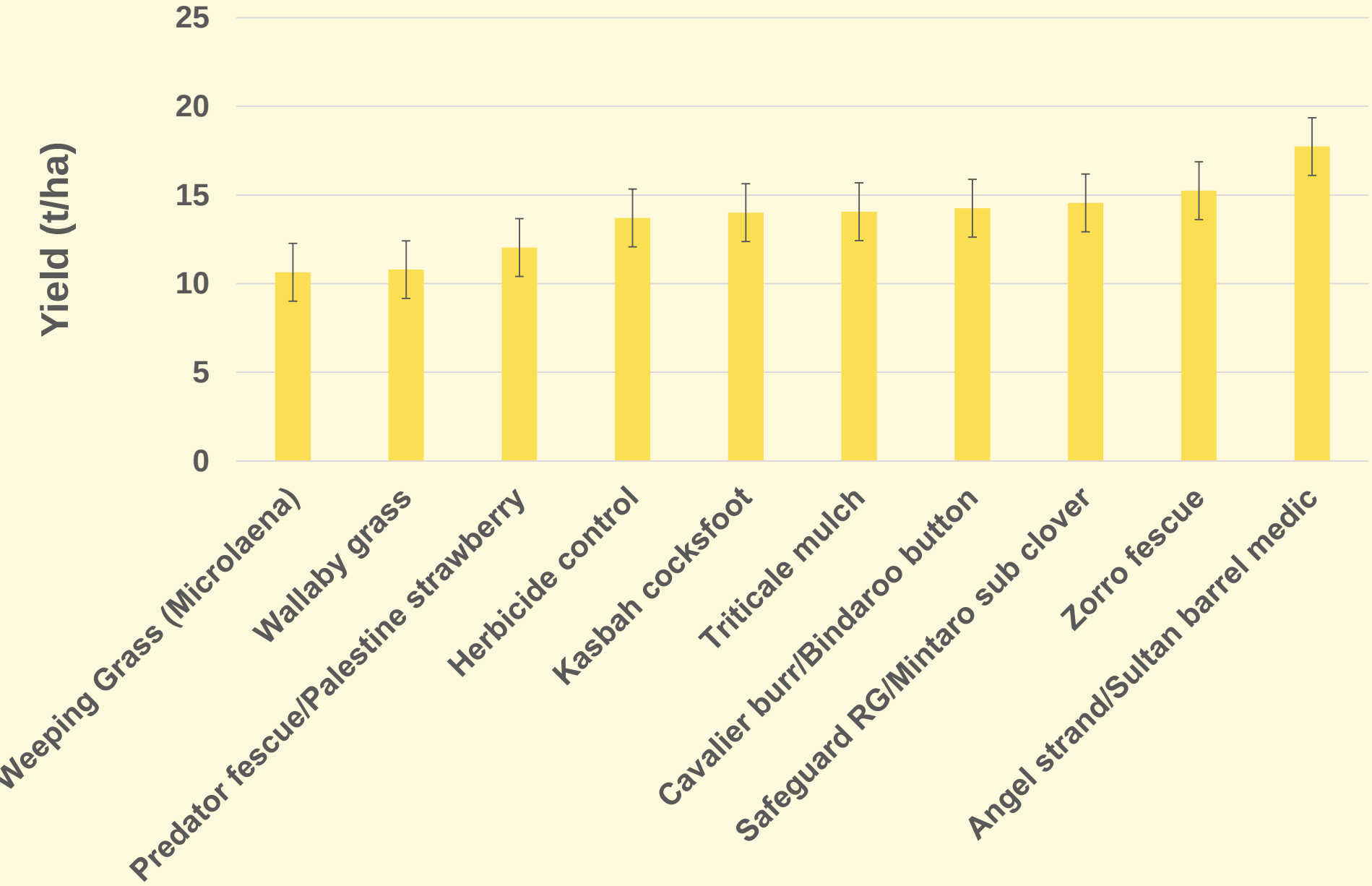
- Better soil structure?
- Improved infiltration?
- PRZ drying?
- Mycorrhizae?
- More research!

Langhorne Creek Harvest, 2017

(nb. wetter spring/summer)

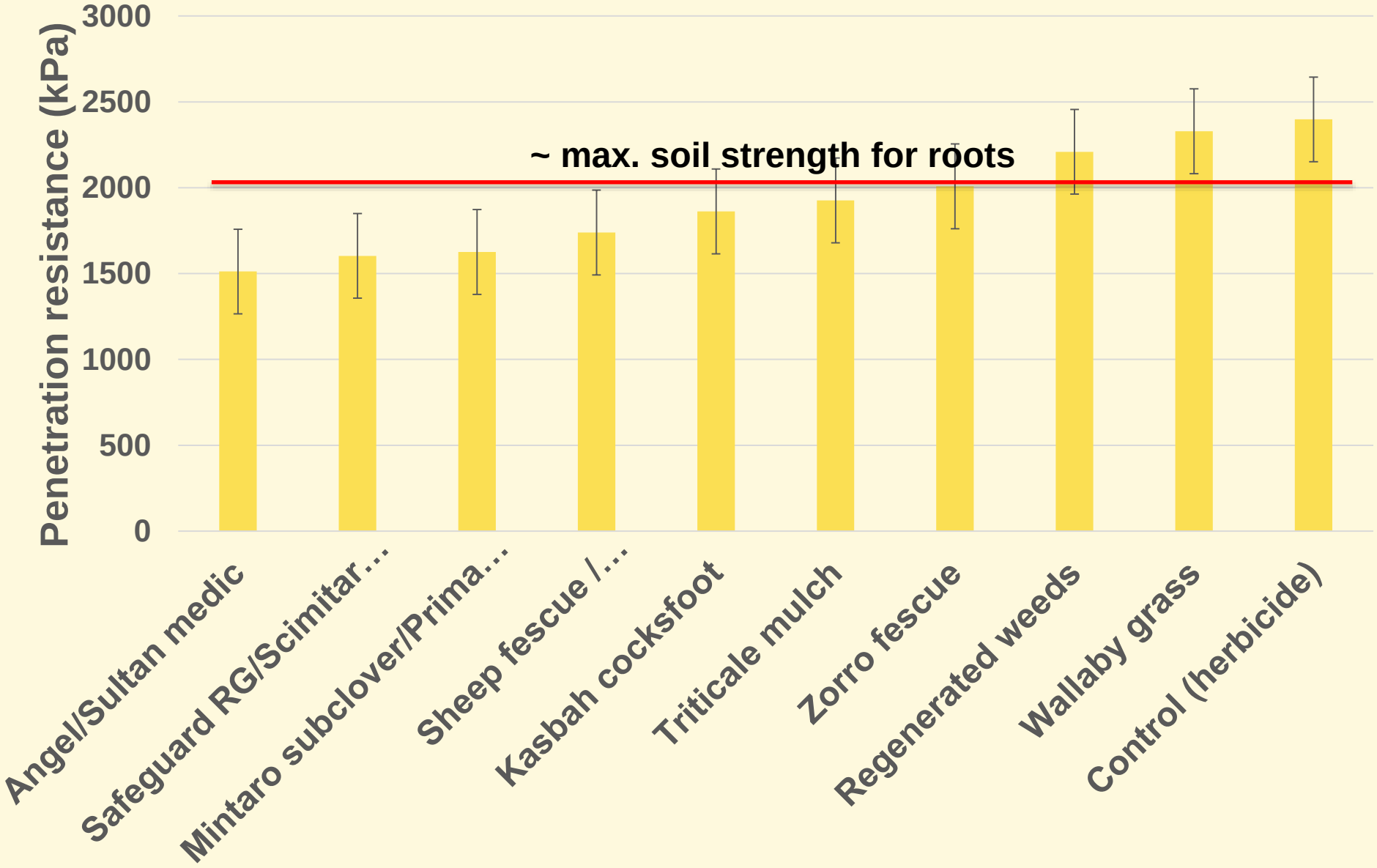


Eden Valley Harvest 2017



Penetration Resistance 10-20 cm

Nuriootpa 2016



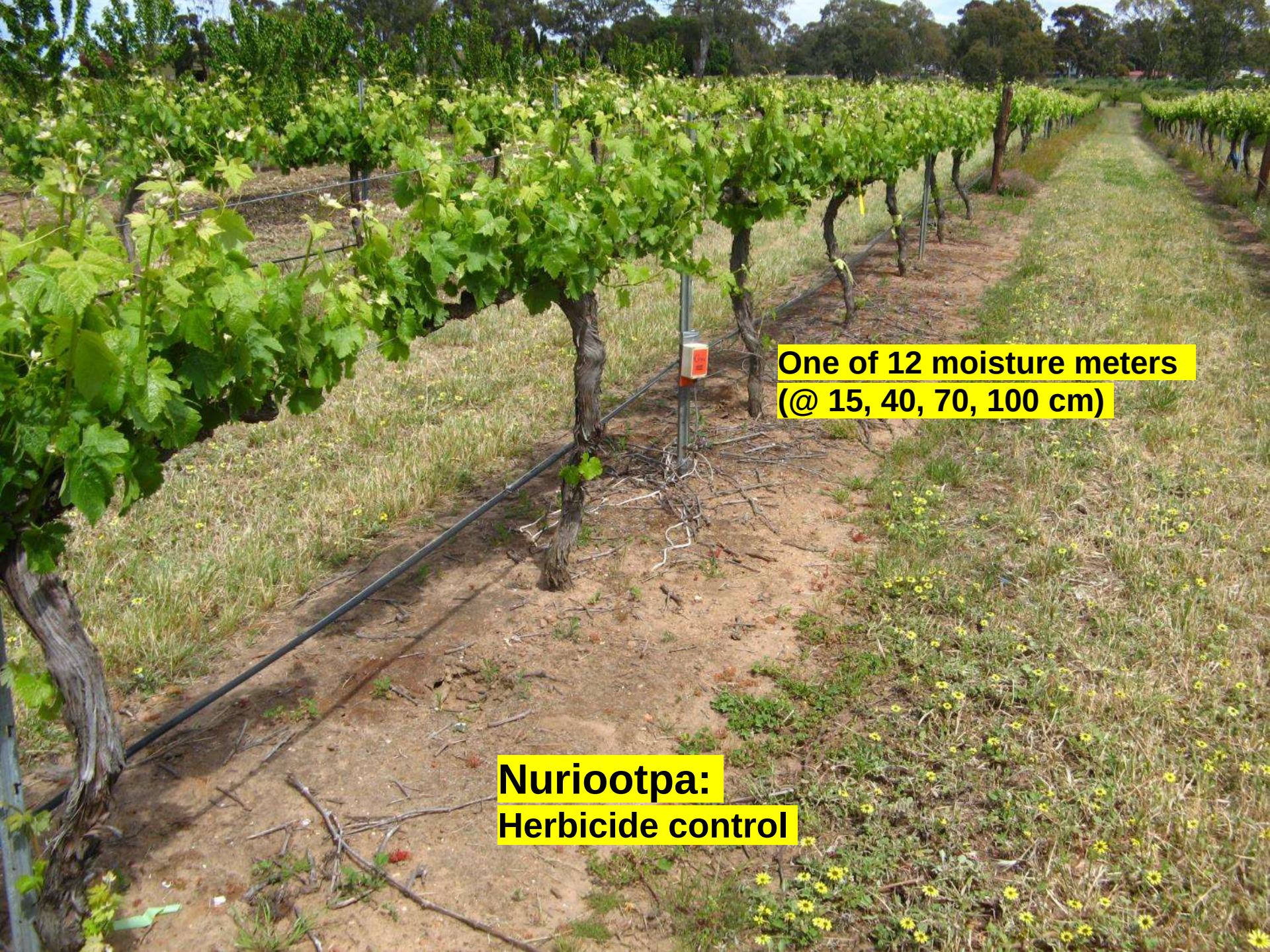
Langhorne Creek Sept. 2017

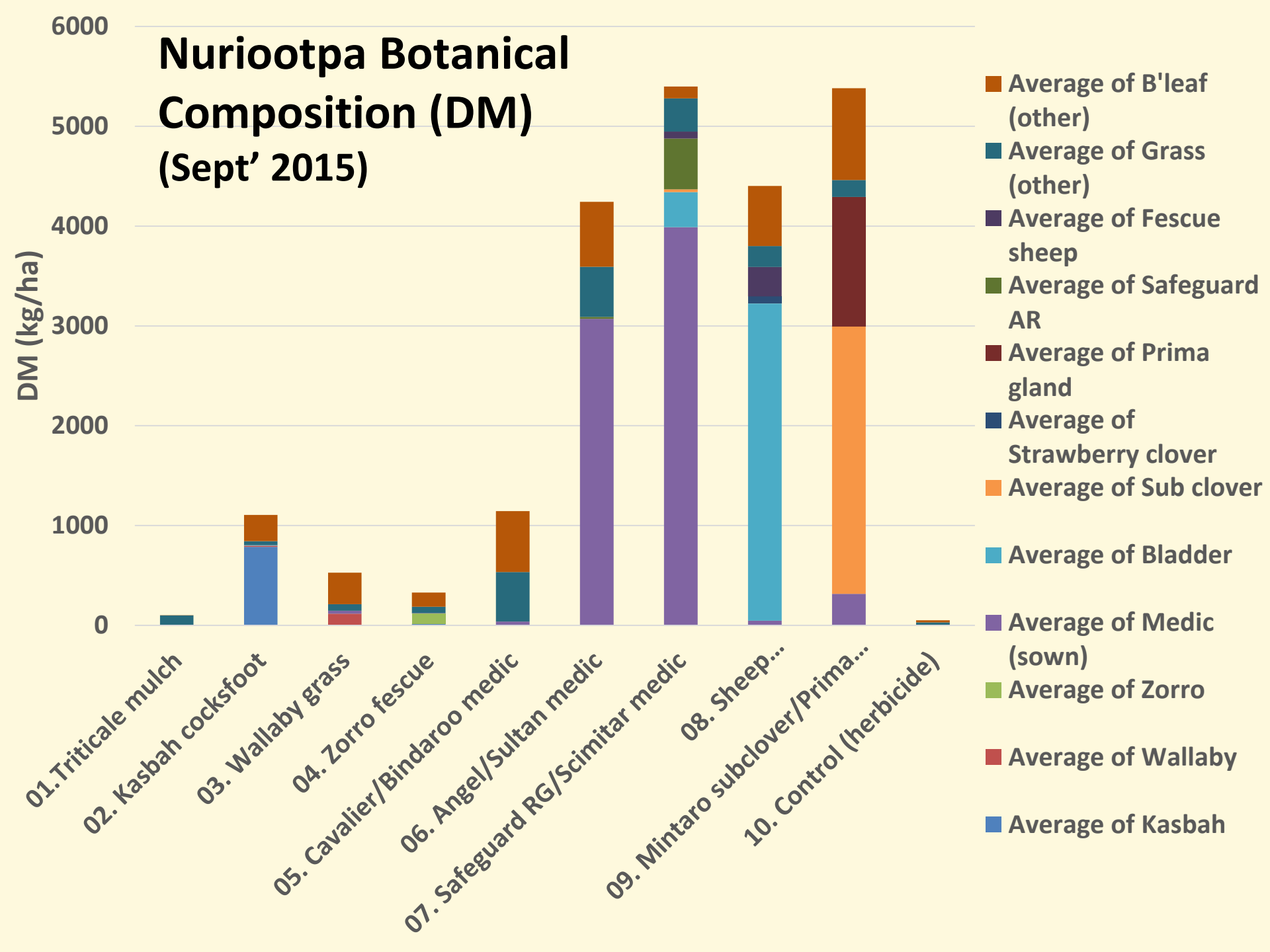

Nuriootpa 2016
Mintaro regen’
but v. little Prima

Vineyard subsoils

the case for cover crops?

- In duplex soils (Barossa, Sunraysia, MIA), sub-soil structure is generally poor, and cannot decline much further (Murray *et al*, 2010)
  - Infiltration rates (< 1 mm/hr) and air-filled porosity were low, penetration resistance was high
  - Unfavourable to root growth and respiration at field capacity and drier
- Poor microbial activity (Barossa, Rawnsley 2010)


One of 12 moisture meters
(@ 15, 40, 70, 100 cm)
Nuriootpa:
Herbicide control


Nuriootpa Botanical Composition (DM)
(Sept' 2015)
DM (kg/ha)
6000
5000
4000
3000
2000
1000
0
01.Triticale mulch
02. Kasbah cocksfoot
03. Wallaby grass
04. Zorro fescue
05. Cavalier/Bindaroo medic
06. Angel/Sultan medic
07. Safeguard RG/Scimitar medic
08. Sheep...
09. Mintaro subclover/Prima...
10. Control (herbicide)
Average of B'leaf (other)
Average of Grass (other)
Average of Fescue sheep
Average of Safeguard AR
Average of Prima gland
Average of Strawberry clover
Average of Sub clover
Average of Bladder
Average of Medic (sown)
Average of Zorro
Average of Wallaby
Average of Kasbah


Industry standard 2
- Straw mulch

“Botanal
- A comprehensive sampling and computing procedure for estimating pasture yield and composition”

- JC Tothill et al (1996), CSIRO Division of Tropical Crops and Pastures
  - Dry-weight-rank method: 1, 70%; 2, 21%; 3, 9%.
  - Visual score: std. reference quadrats scored for DM (eg 1-10), cut to calibrate visual scores.
  - Groundcover; % green DM
  - XLS based program