



Phalaris cultivars

Monaro Farming Systems Winter Field Day
June 10 2016

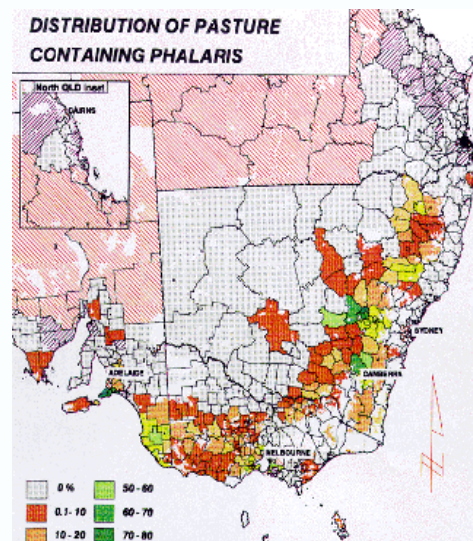
Richard Culvenor

CSIRO Canberra

Outline

1. Introduction
2. Cultivar types
3. Two recent cultivars bred for persistence factors
 - Holdfast GT (Grazing tolerance)
 - Advanced AT (Acid soil tolerance)
4. Canberra genotype x management study

Phalaris aquatica in Australia

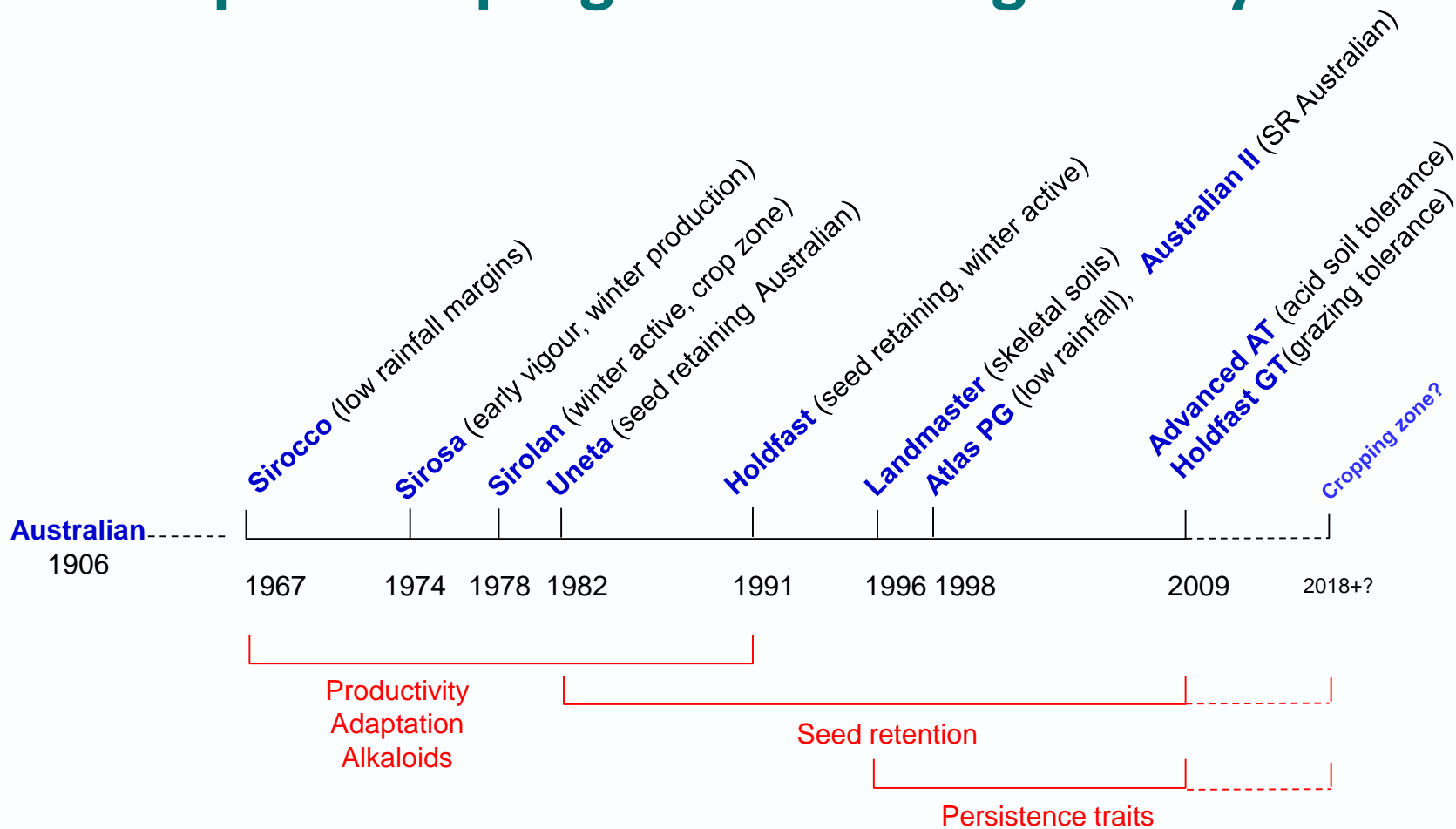


- Proven deep-rooted perennial grass for sheep and beef industries of southern Australia
- Sown on 2+ M ha Australia-wide (2011 survey)
Domestic seed market ~400 t/yr
- Good autumn-winter-spring production, partially dormant in summer
- Excellent drought survival
- Role in sustainability
- Few pests and diseases
- Occasionally toxic to livestock

Dormant buds for summer survival



CSIRO phalaris program breeding history



Advances: seedling vigour, autumn-winter yield, lower alkaloids, harvestable seed & seed quality, reduced establishment costs, adaptation to dry areas, adaptation to skeletal and acidic soils

Grouping phalaris cultivars

Winter activity



Seed retention



Summer dormancy



Al, acid soil tolerance

Phalaris cultivars in Australia

	Semi-winter dormant	Winter-active type		
	Australian type	General purpose	Marginal soils (acid, shallow, low fertility)	Drier margins
Older cultivars (pre-2005)	Australian Uneta* Australian II* Grazier*, etc <u>Maru</u>	Siroso Holdfast*	Landmaster *	Sirocco Sirolan Atlas PG*
Since 2005	Fosterville	Holdfast GT* Lawson* Stockman?	Advanced AT*	New cropping zone cultivar?*

* Seed-retaining cultivar

Semi-winter dormant cultivar: Australian, Uneta, Australian II, Fosterville, ...

Reputation for high persistence

Tolerant of heavy continuous grazing

Smaller seedlings, less productive in autumn/winter than winter-active cultivars

More spreading

Higher content of tryptamine alkaloids

General purpose winter-active cultivar: Sirosa, Holdfast, Holdfast GT, Lawson



Best used in well-fertilized, highly productive pastures

Best managed rotationally/strategic rests for optimum productivity and persistence

BUT

Holdfast GT much more tolerant of high continuous grazing pressure

Winter-active cultivars for marginal and acidic soils:

Landmaster, Advanced AT

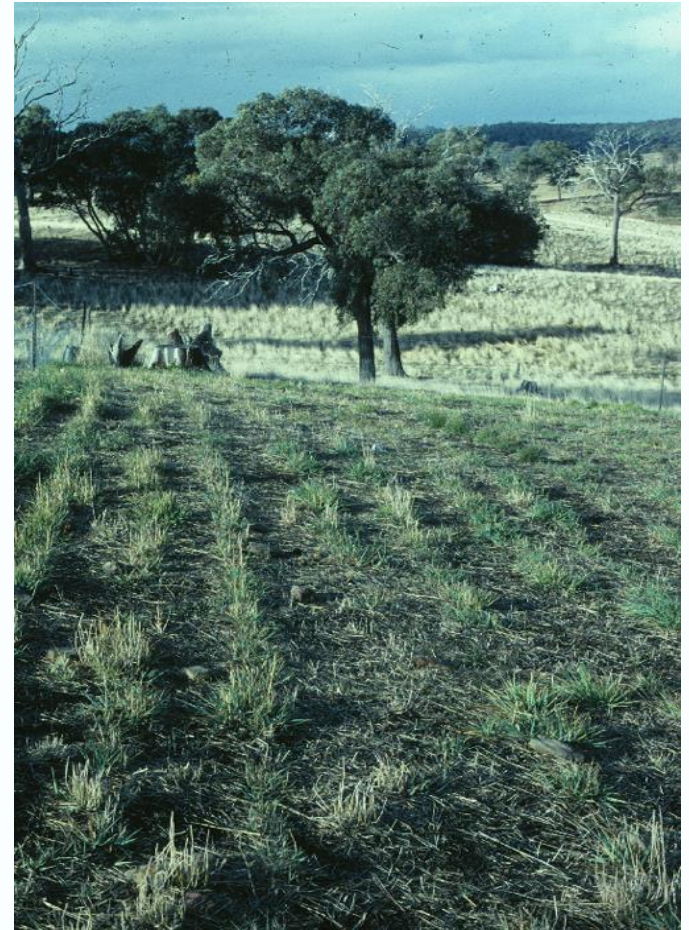
Landmaster

Bred for shallow, fairly acidic and infertile soils on mid and upper slopes where recharge occurring

Advanced AT

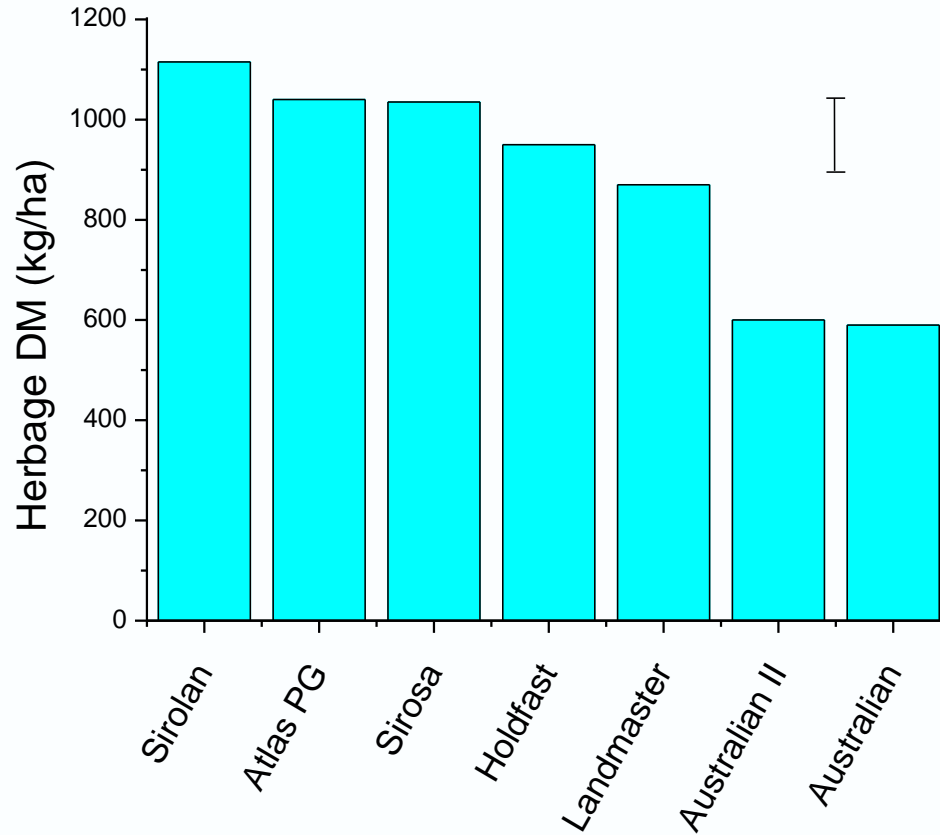
Most Al-tolerant phalaris cultivar for strongly acid soils

Best managed rotationally/strategic rests for optimum productivity and persistence



Winter yield comparison

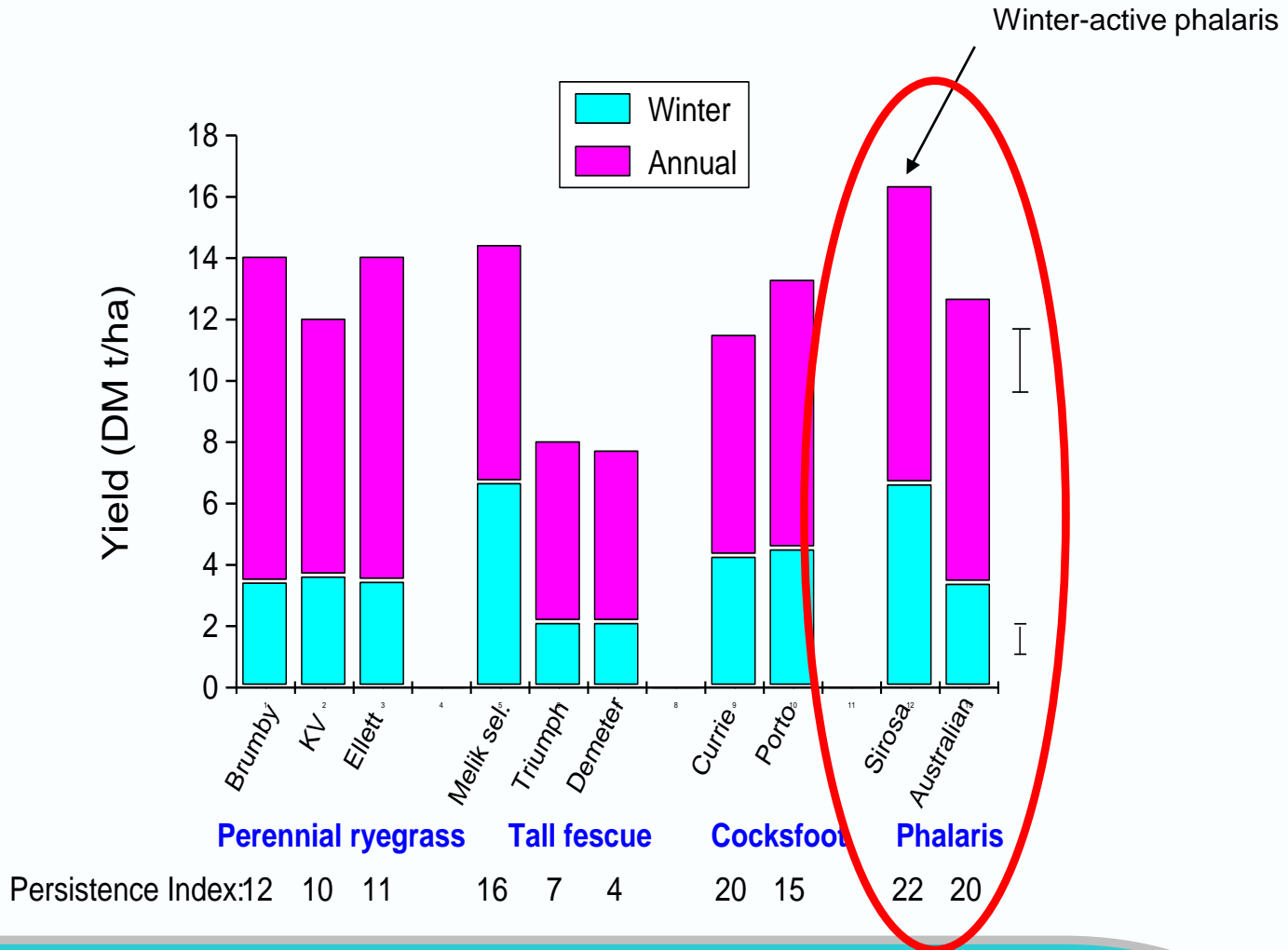
Swards in September of Year 2
(Mean of sites at Tamworth, Yass, Hamilton)



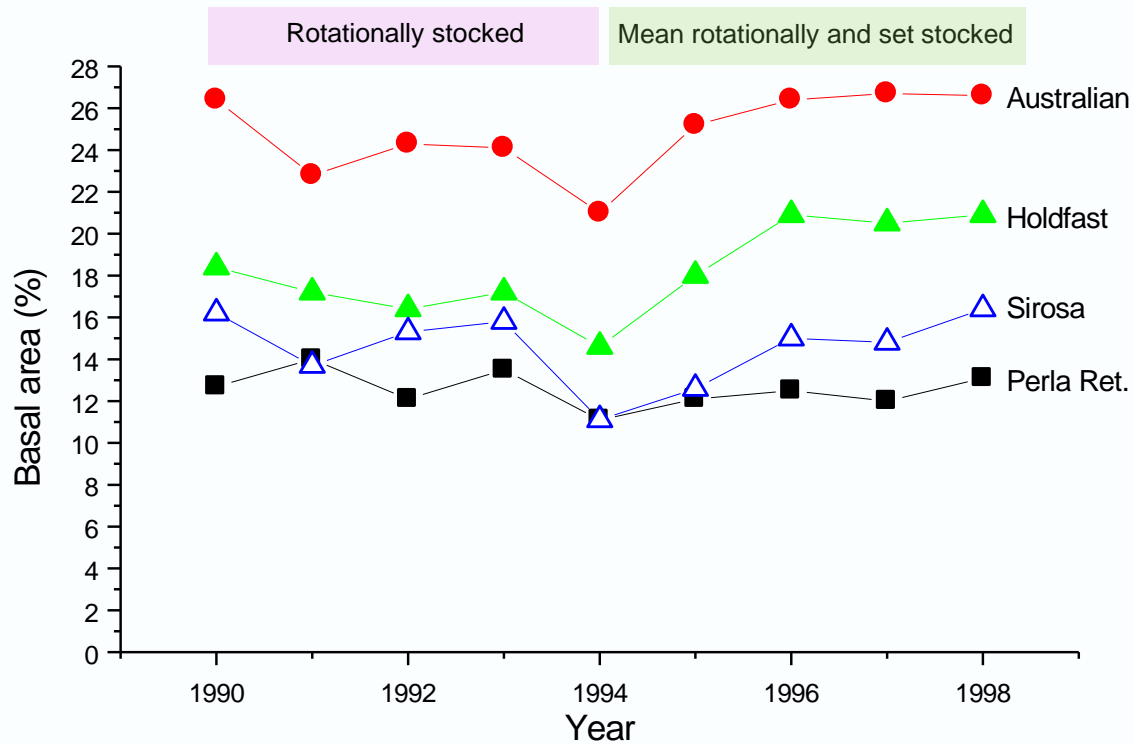
Yield comparison 1991-94

Balmoral, Western Victoria (615 mm)

Source: Anderson et al. 1999



Higher spreading ability of Australian Canberra grazing trial 1990-98



AUSTRALIAN 1420 kg/ha phal, 1850 kg/ha total DM



ADVANCED AT
1960 kg/ha phalaris,
2280 kg/ha total DM

Background to persistence issues

1. Pressure to intensify management

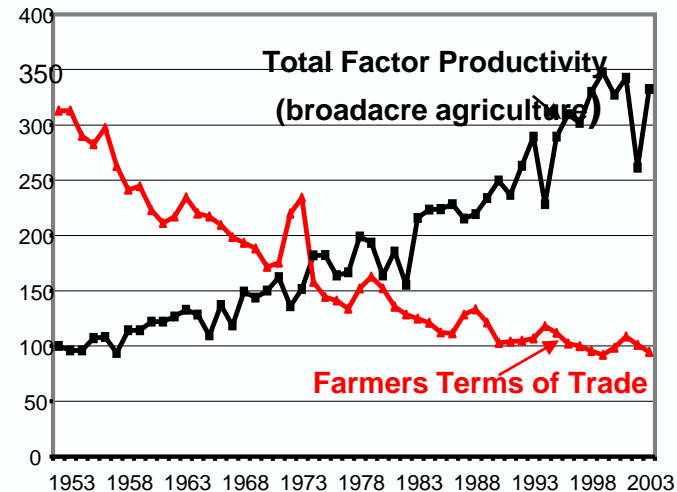
- profitable
- internationally competitive
- efficient use of land & pasture resources

2. Fertiliser, increased stocking rates

- **Pressure on persistence of perennial grasses**

3. Concern for >25 years over persistence of perennials

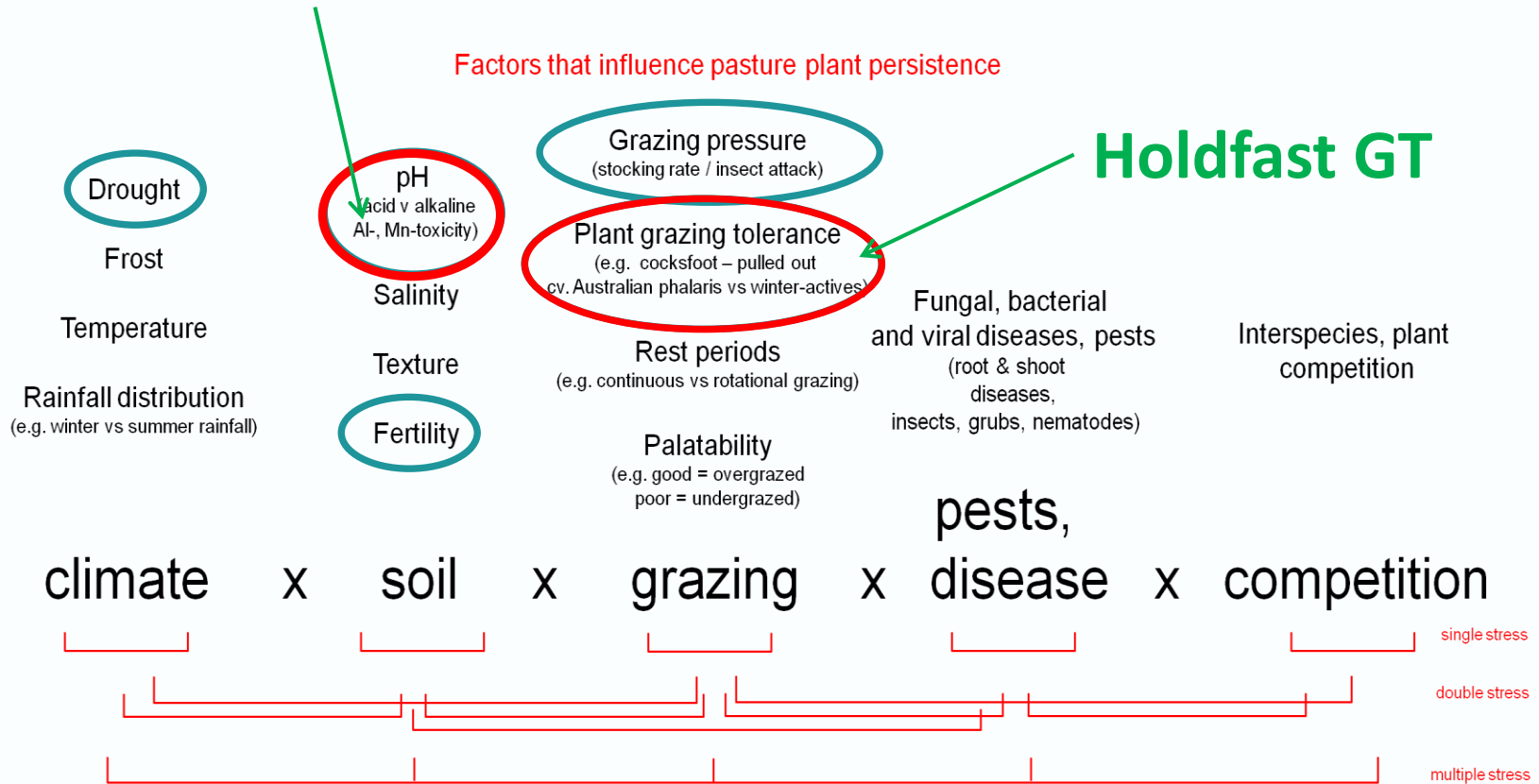
- MLA Key programs
- Feedbase Investment Plan



Derived from ABARE data (Source: Mullen, 2007)

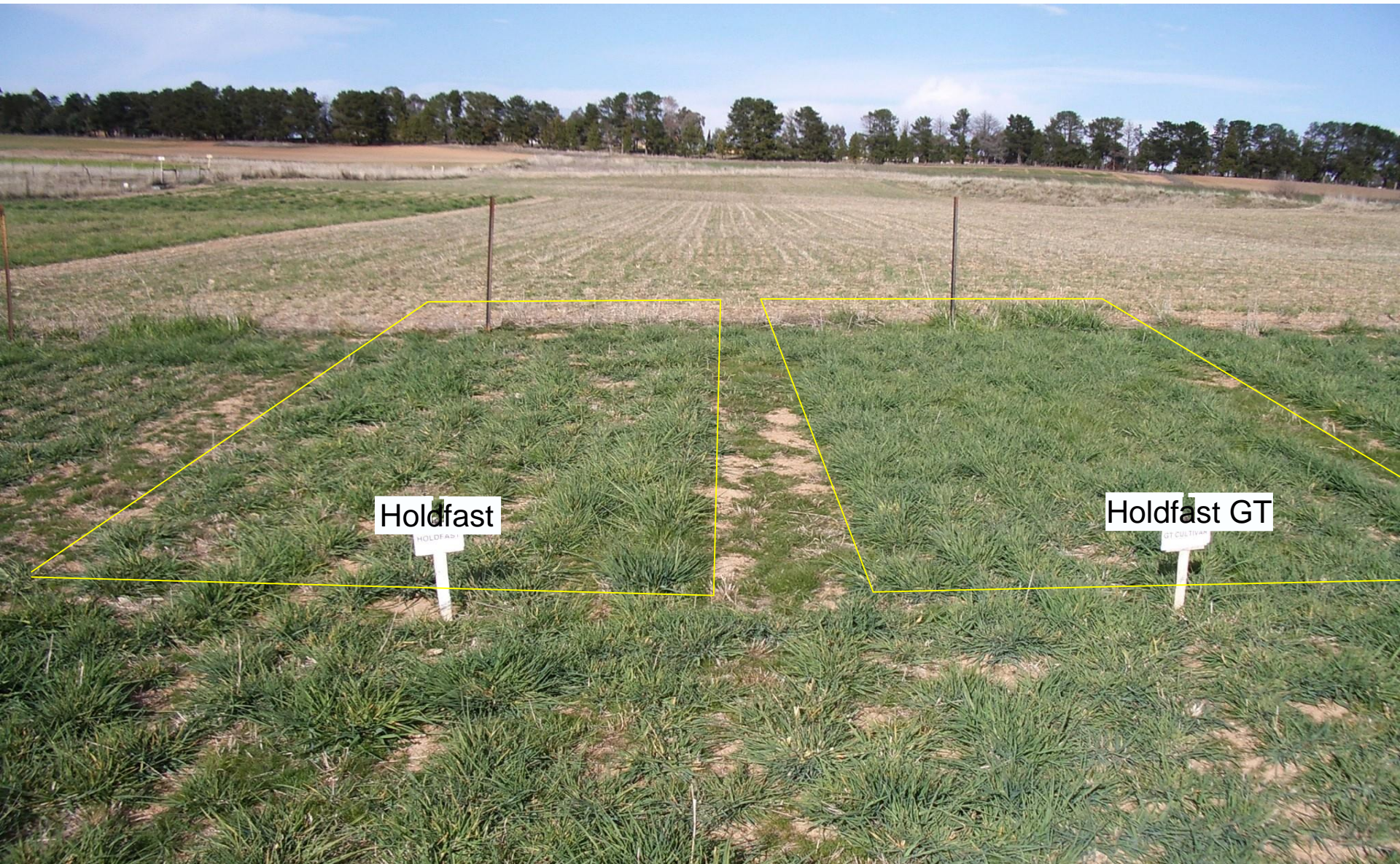
Stresses affecting persistence

Advanced AT

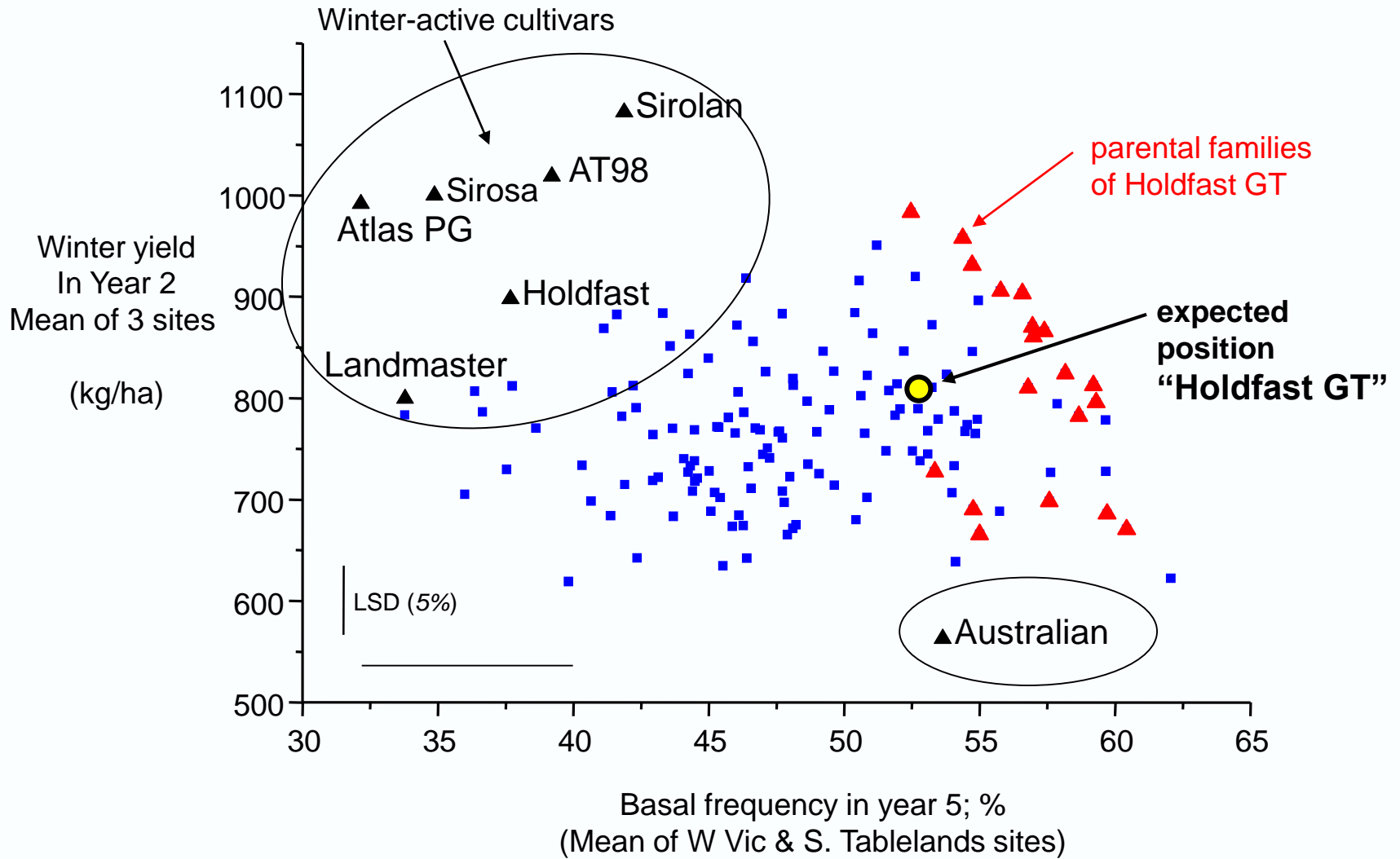


Holdfast GT

A winter-active cultivar with improved persistence under grazing



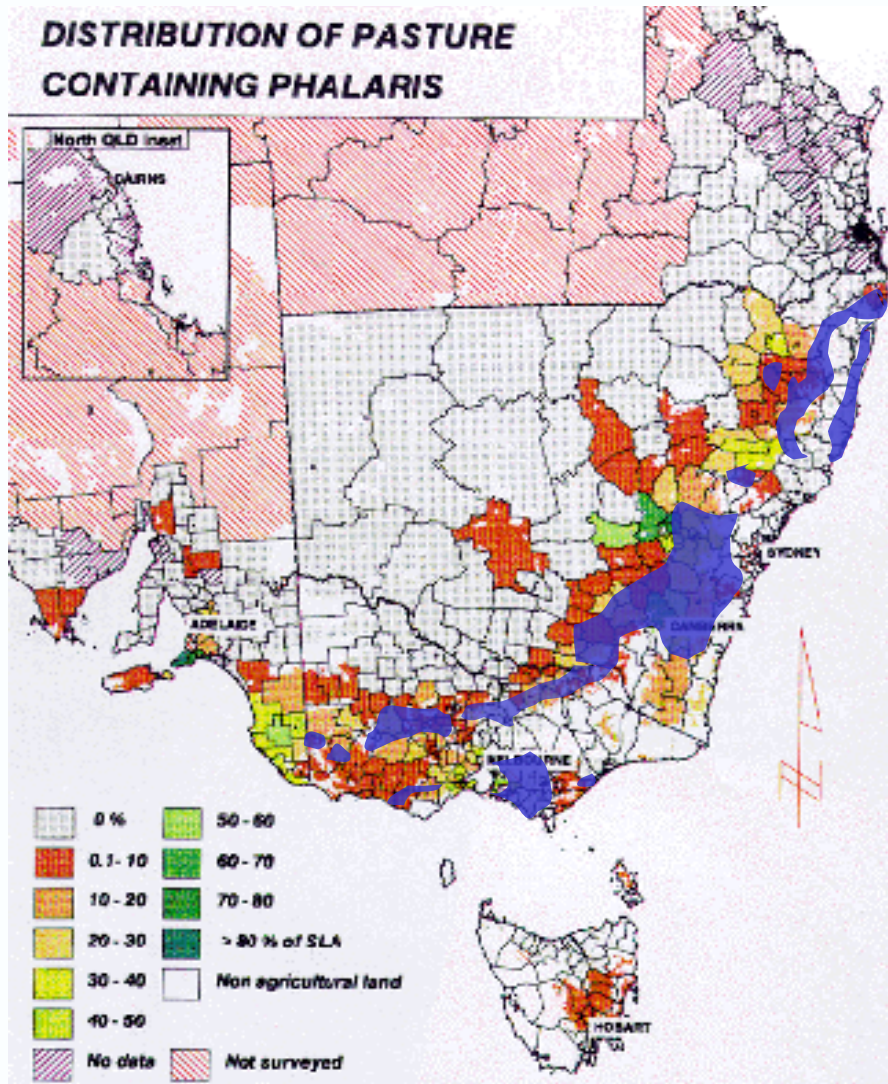
Winter Activity vs. Persistence under grazing pressure



Improved acid soil tolerance – Advanced AT



Soil acidity and phalaris



Soil $pH_{Ca} < 4.5$
common

Progress in breeding for Al tolerance

Phalaris aquatica × *arundinacea*
× *aquatica*

Sirosa
(1974)



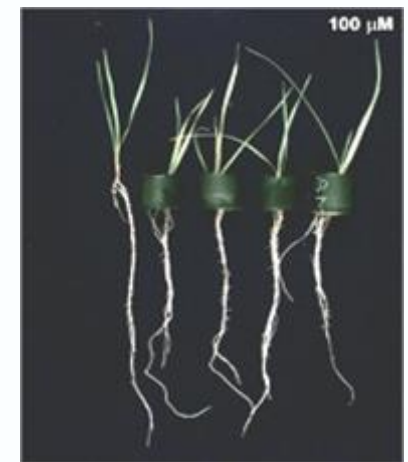
Holdfast
(1990)



Landmaster
(1996)



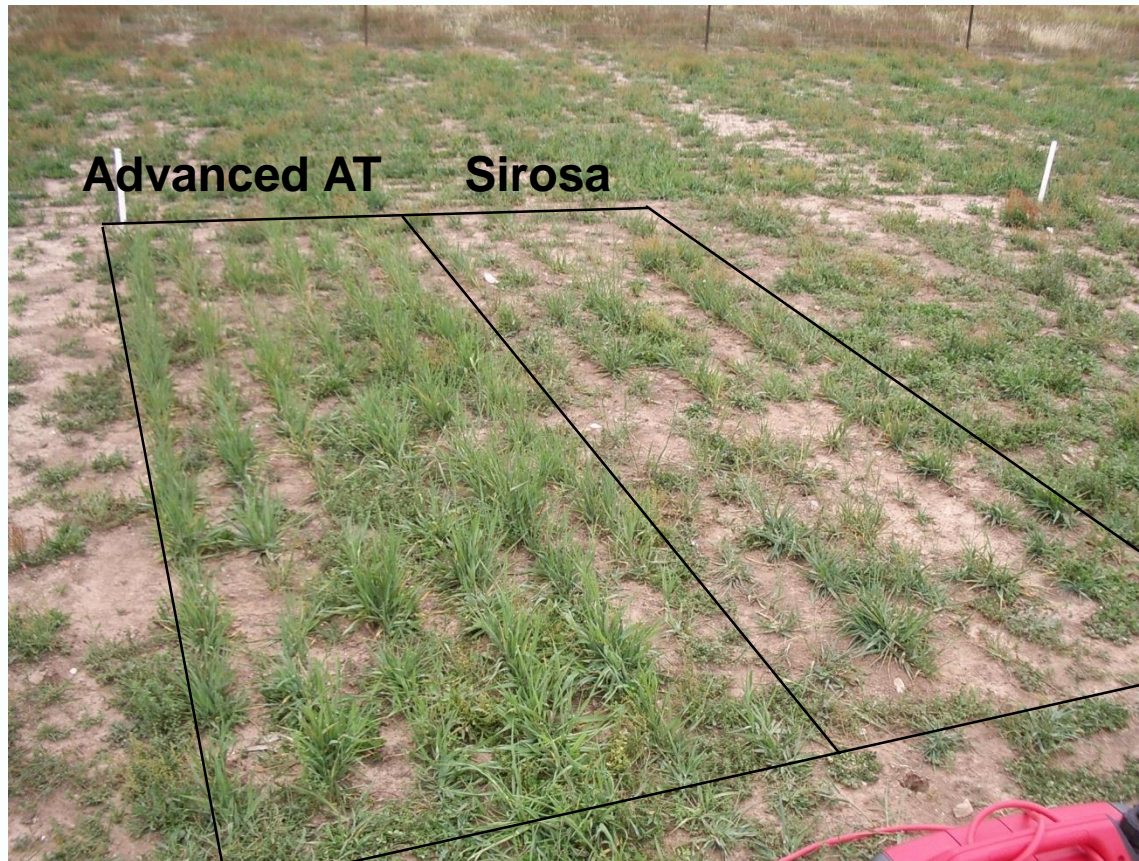
AT98
(source of the
new AT cultivar)



Tolerance of 100 μM Al in nutrient solution

Establishment

Seedling growth, Rye Park

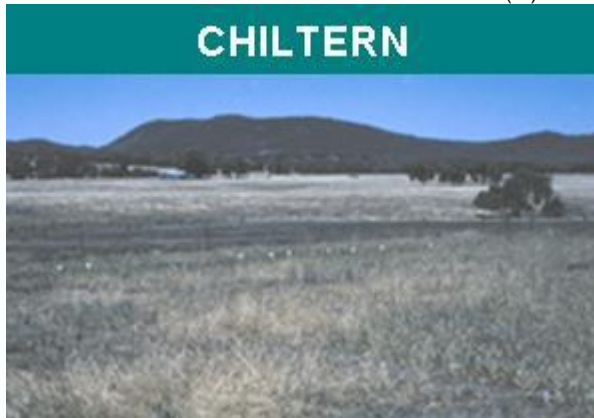
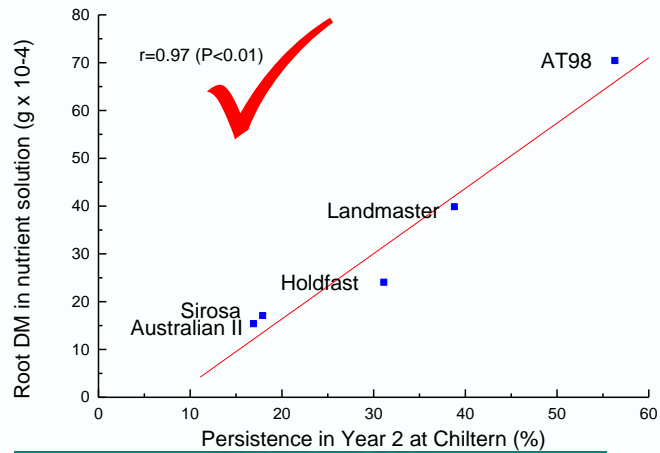


Soil

0-10: pH_{Ca} 3.9, Exch. Al 26%

10-30cm: pH_{Ca} 4.0, Exch. Al 35%

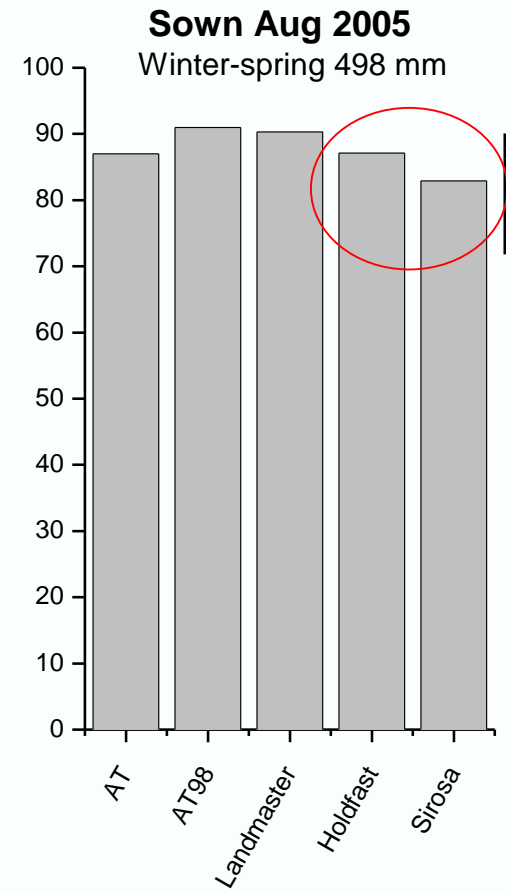
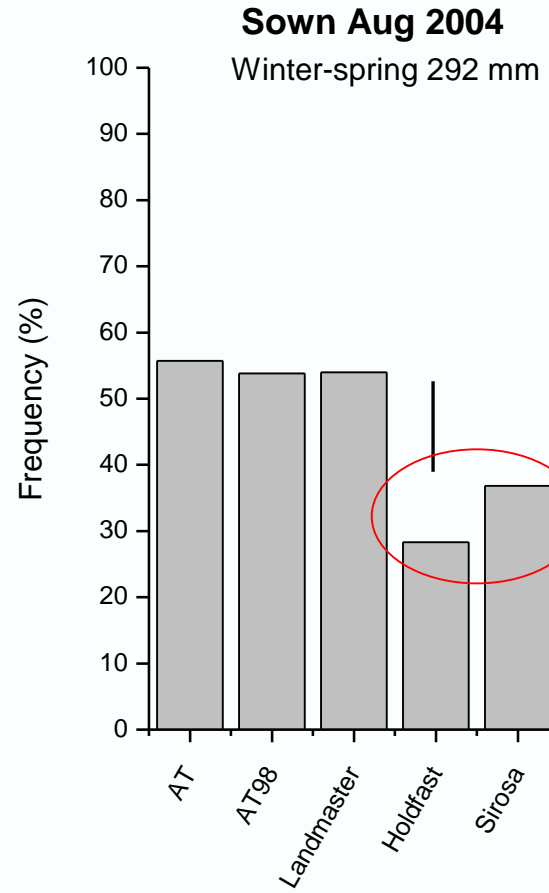
Benefit of AI tolerance at establishment



Acid soil tolerance x moisture interaction

Dick's Ck (2nd year basal frequency)

Soil 0-40 cm: pH_{Ca} 4.1, Exch. Al 43%



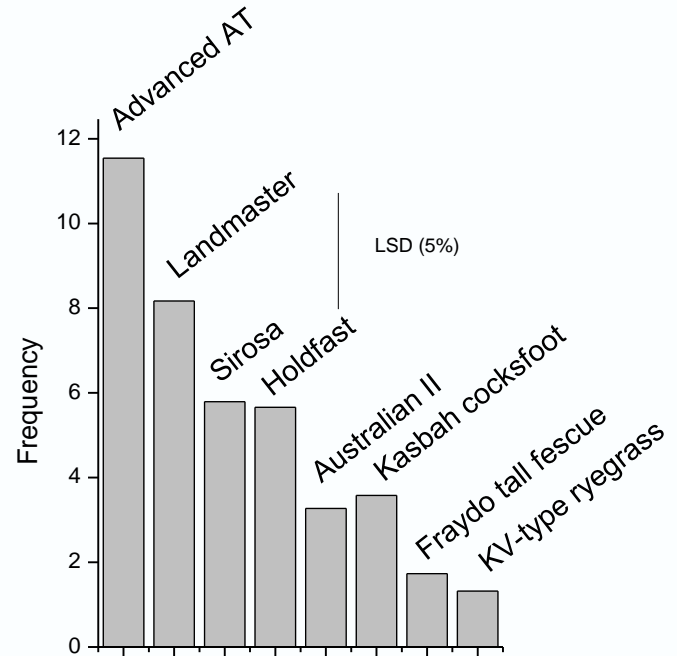
Effect of drought

Aug. 2006-sown trials in 2007 (mean of 4 sites)



Site	pH _{Ca}	Exch. Al %
1	4.0-4.3	21-52
2	4.1-4.1	17-46
3	4.0-4.1	38-58
4	4.2-4.6	12-22

Frequency in autumn of 2nd year



Advanced AT trials: conclusions

Higher Al tolerance in Advanced AT of most benefit in assuring establishment in acid soils in response to moisture availability

Landmaster has useful Al tolerance but Advanced AT superior

- when establishing under drought
- in soils with layers of $\text{pH} < 4.2$ and 30-50% exch. Al in the top 50 cm

Parallel effects on longer-term persistence generally smaller than at establishment

*Note: Advanced AT is very erect and should be rotationally grazed for good persistence

Role of genetics and management:

Canberra 2009-2013



Structure of experiment

Genotype:

x

16 phalaris genotypes
(differing in growth habit, growth pattern, stress tolerance)

×

Environment:

x

soil fertility & drought
(low P / high P)

×

Management:

{ grazing management
(rotational vs. continuous at high and low P)
grazing pressure
(13.5 vs 18 dse/ha at high P)

Long-term P × stocking rate experiment

Dr Richard Simpson

Timeline:

Pre-treatment phase

2007: sown May (+100 kg/ha single super on low P plots)

2008: grazed intermittently, fertility treatments maintained

Experimental phase

2009: mid-June grazing treatments commenced

2013: early June grazing treatments ended

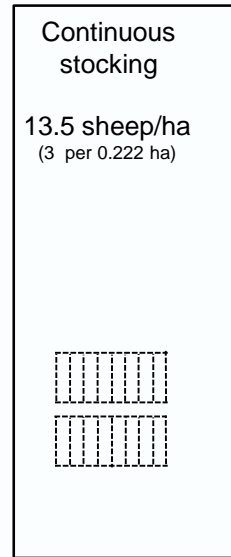
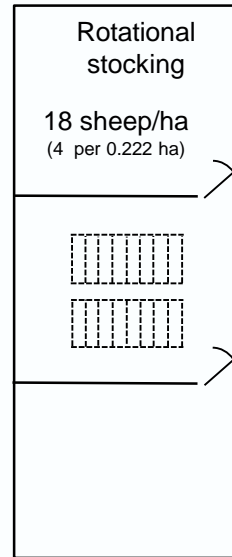
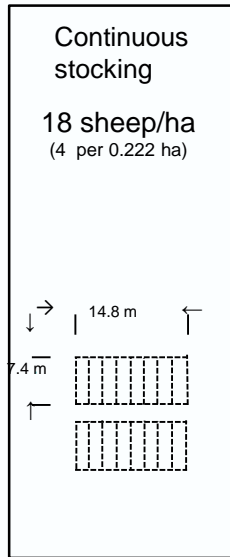
Recovery phase (grazing exclusion)

Jun-Aug 2013 assess winter production

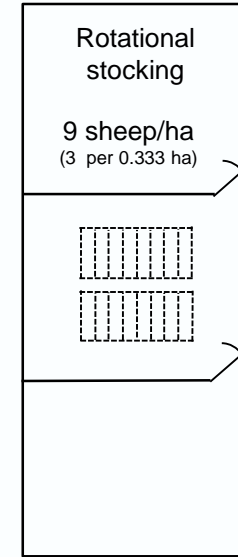
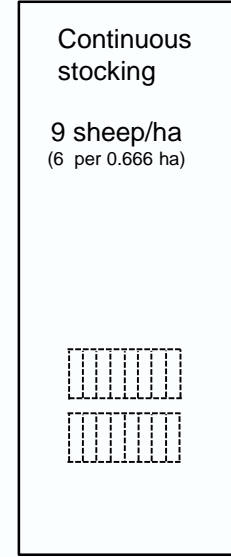
Sep-Oct 2013 assess spring production

Management treatments

High P Olsen 22



Low P (no super) Olsen 4



Soil pH_{Ca} 0-20cm 4.2-4.6

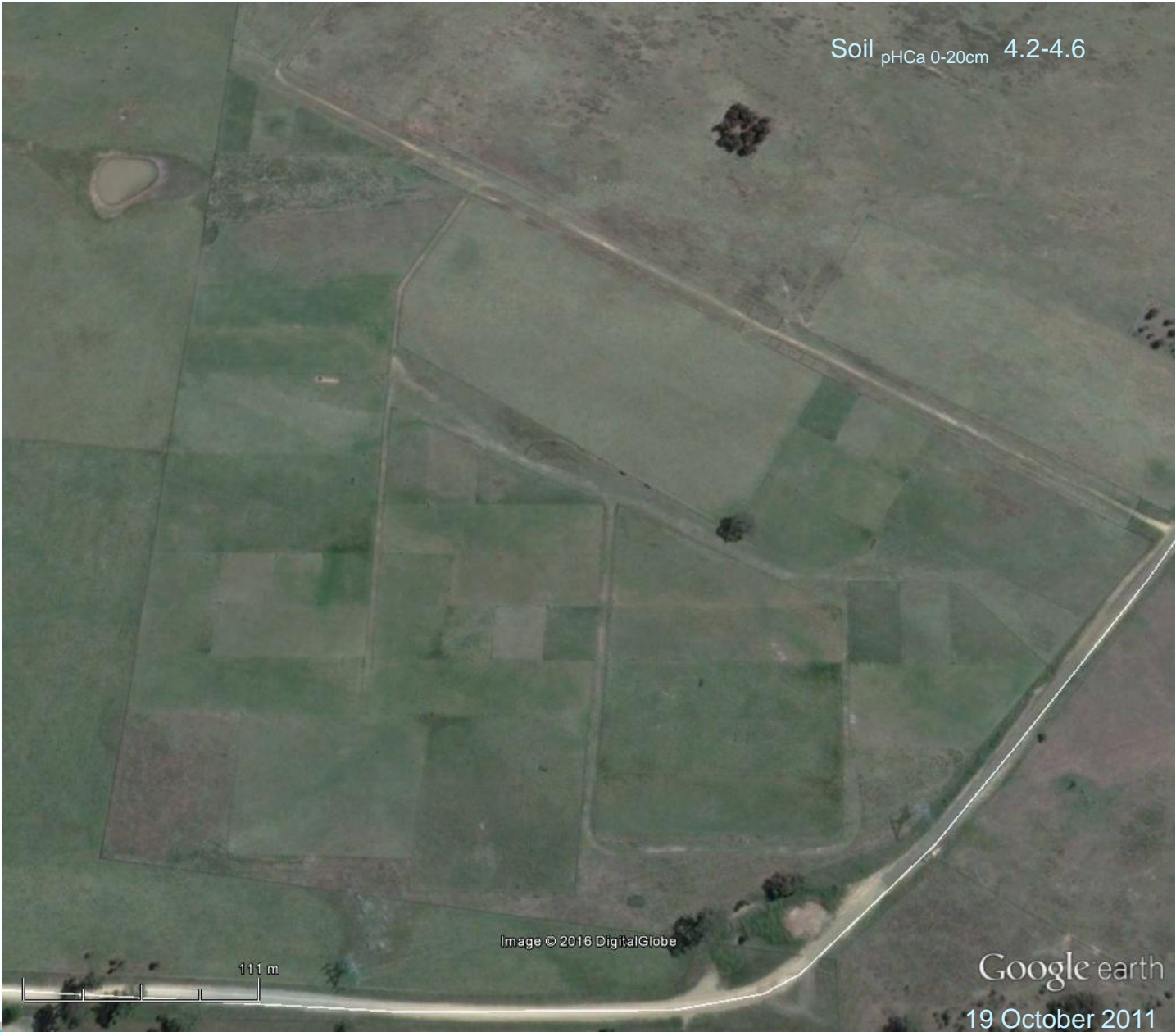


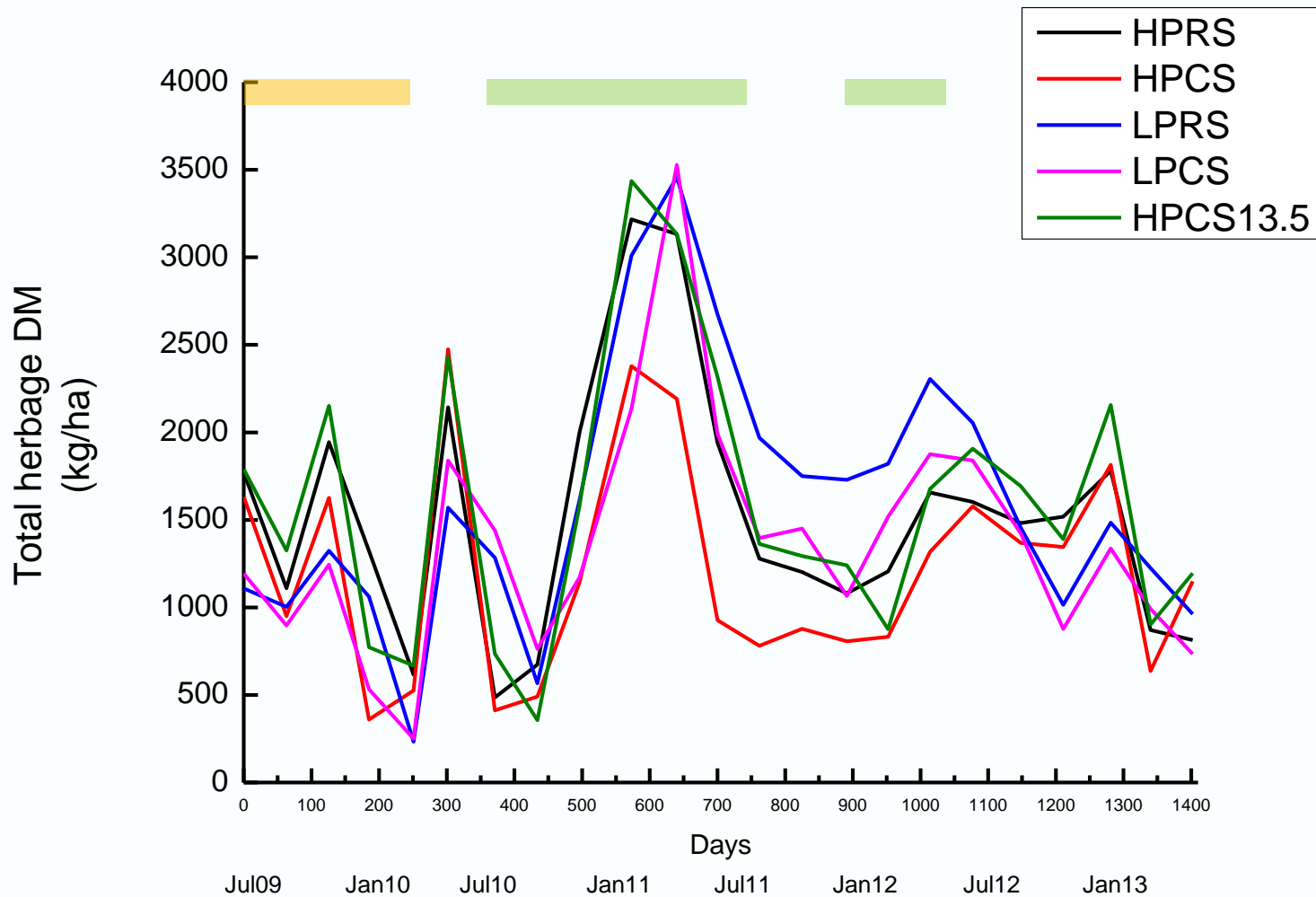
Image © 2016 DigitalGlobe

111 m

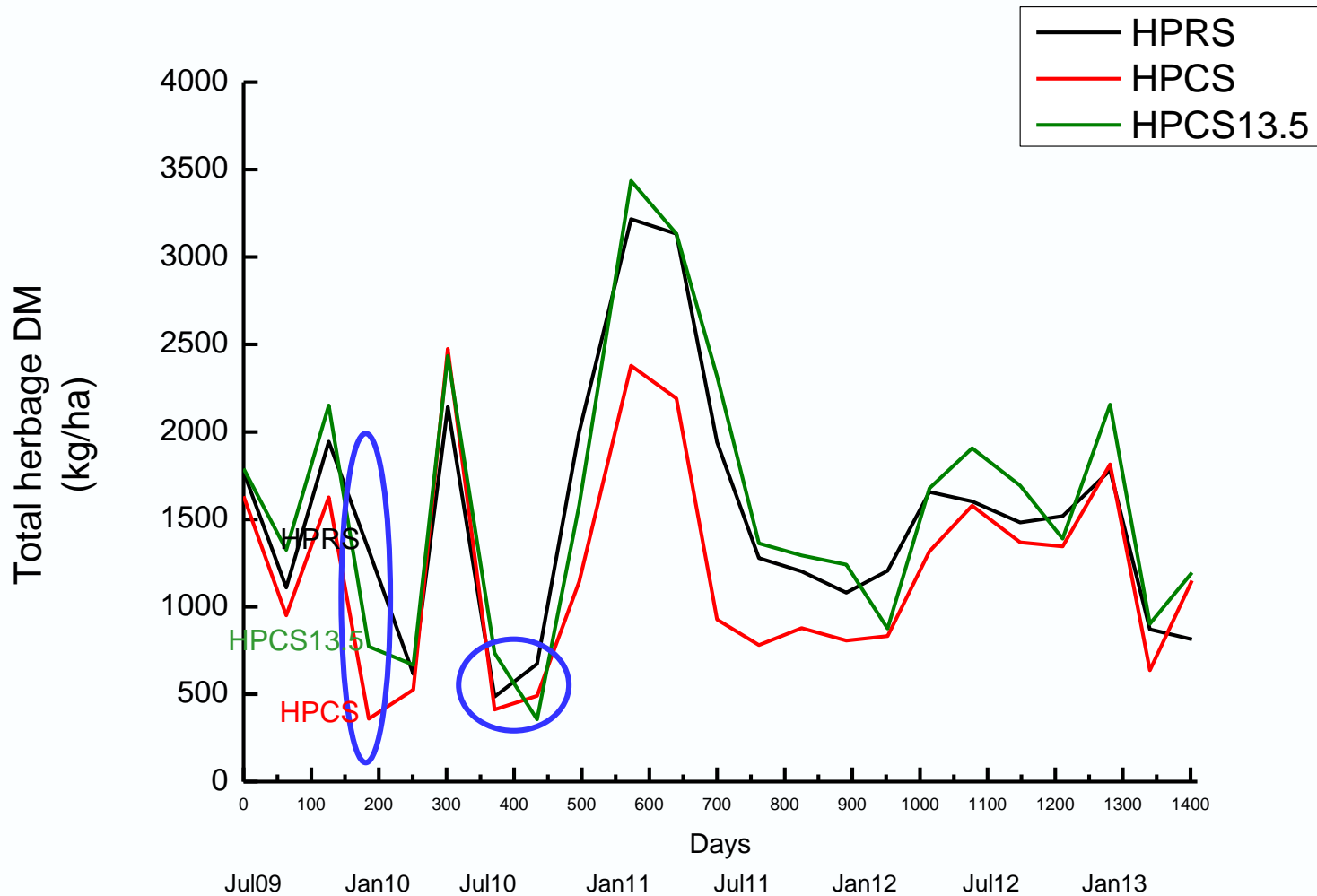
Google earth
19 October 2011



Total herbage DM

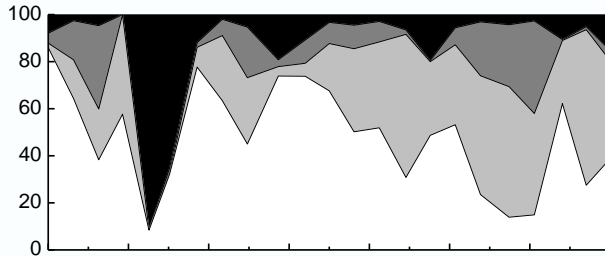


Total herbage DM – High P

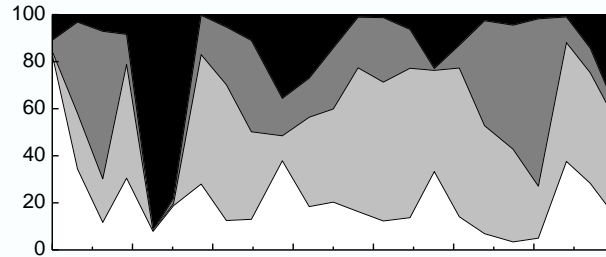


Botanical composition

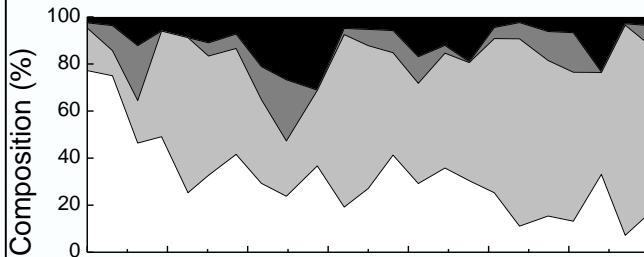
High P
Rotational
18/ha



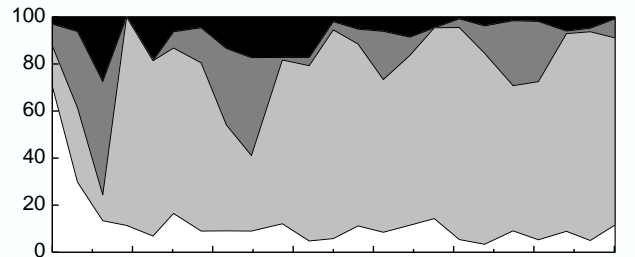
High P
Continuous
18/ha



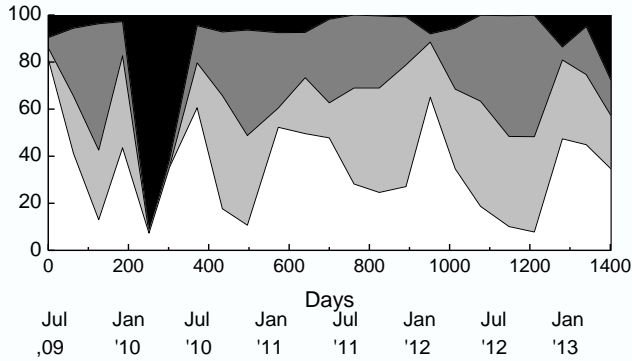
Low P
Rotational
9/ha



Low P
Continuous
9/ha



High P
Continuous
13.5/ha

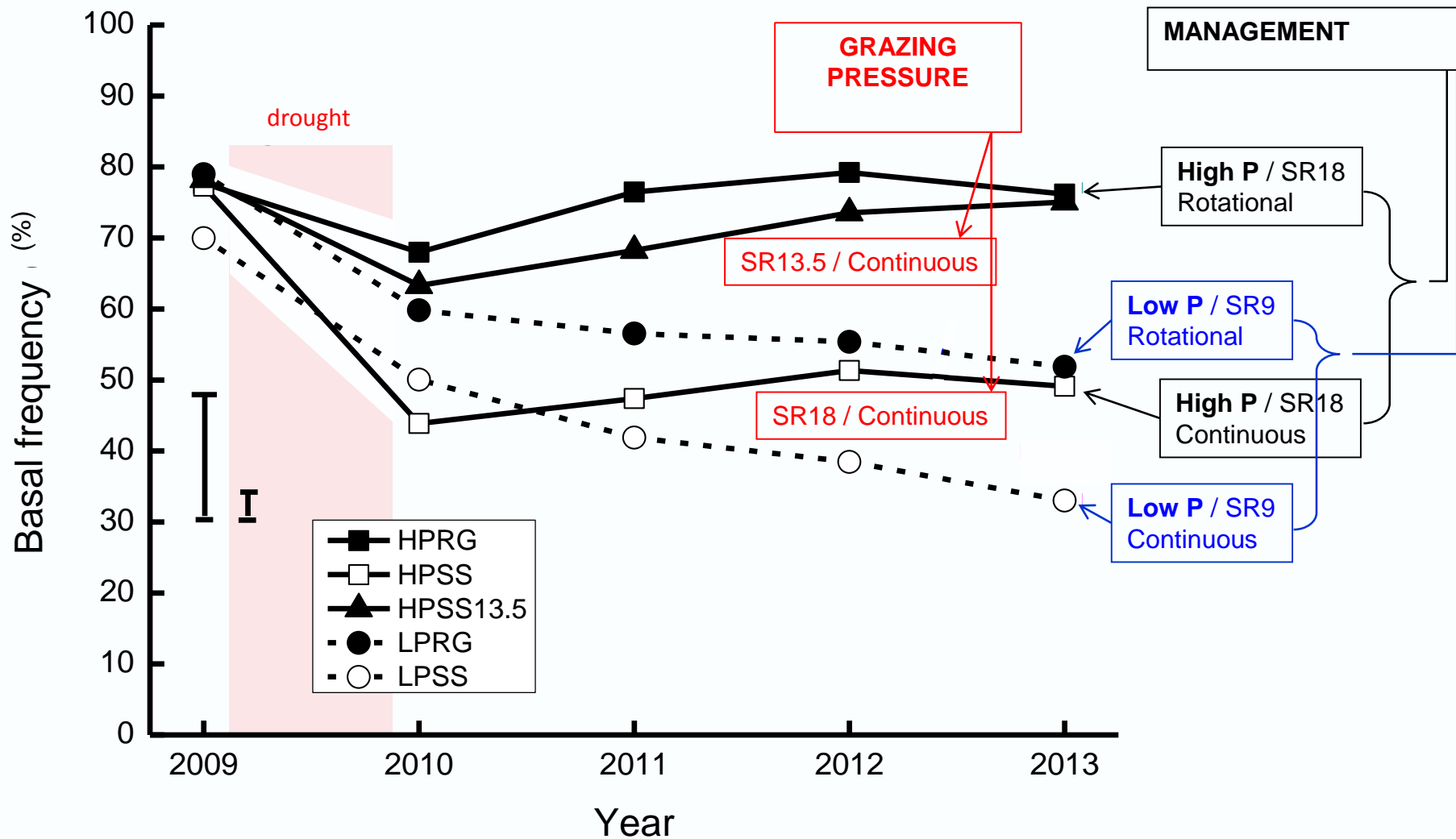


Days
Jul '09 Jan '10 Jul '10 Jan '11 Jul '11 Jan '12 Jul '12 Jan '13

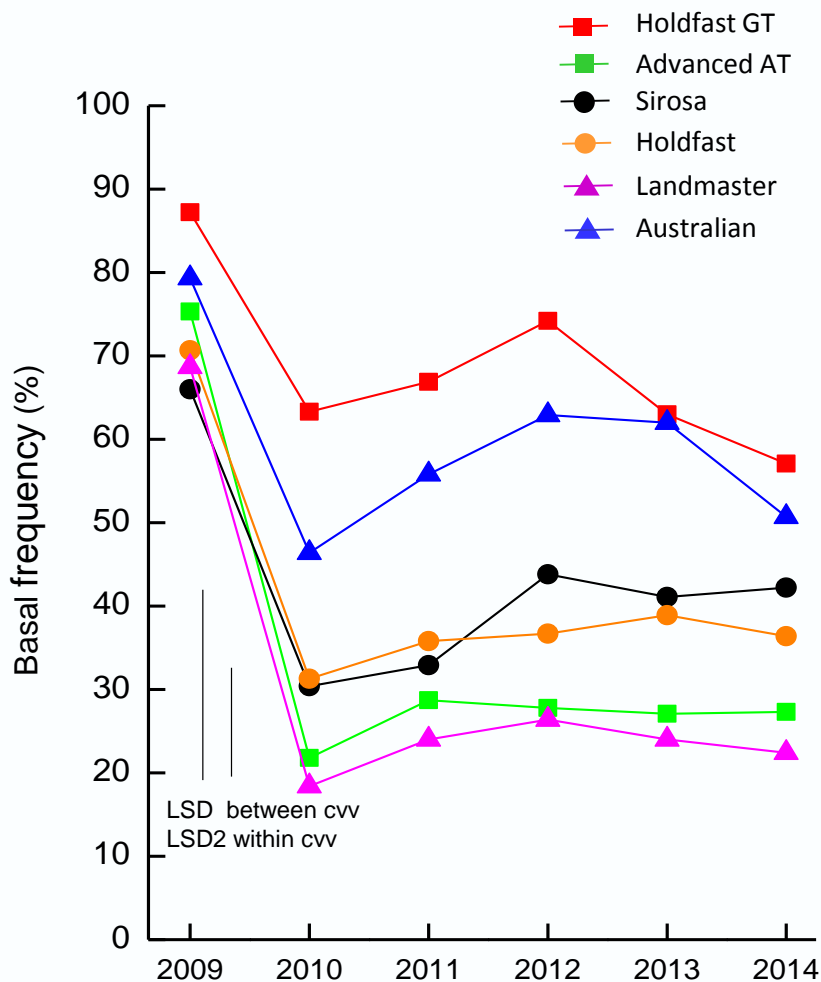
- Broadleaf weeds
- Clover
- Other grass
- Phalaris

Grazing management effects

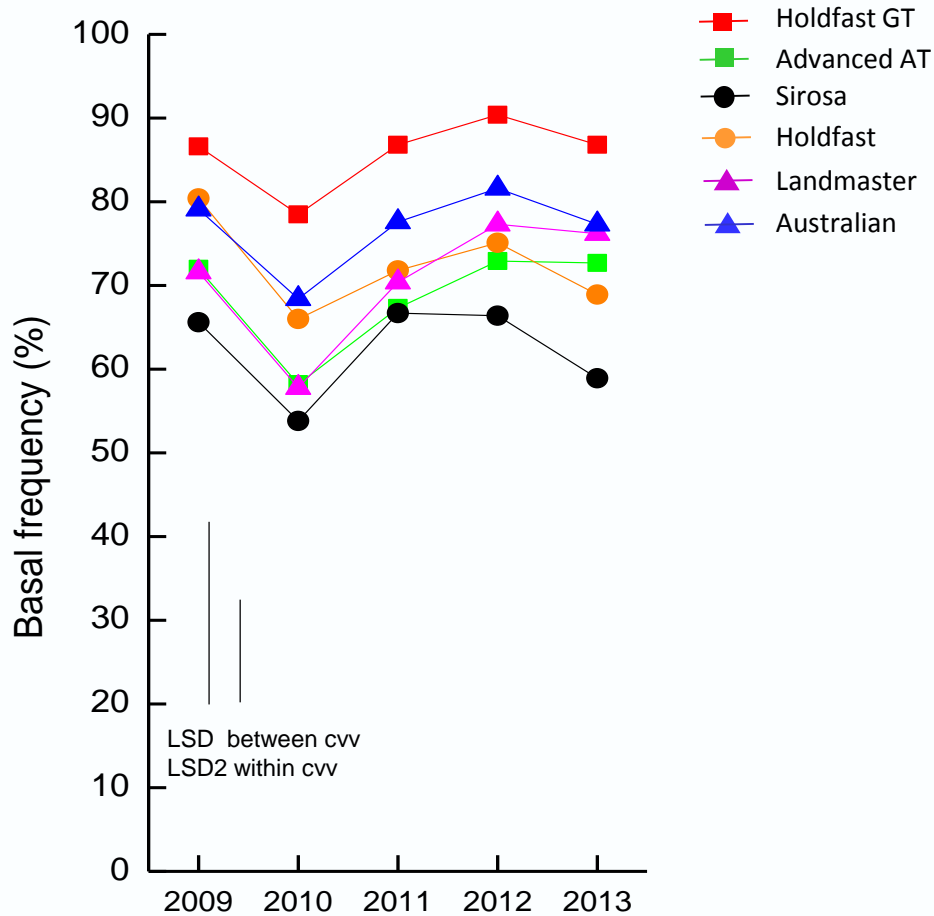
(average all phalaris lines)



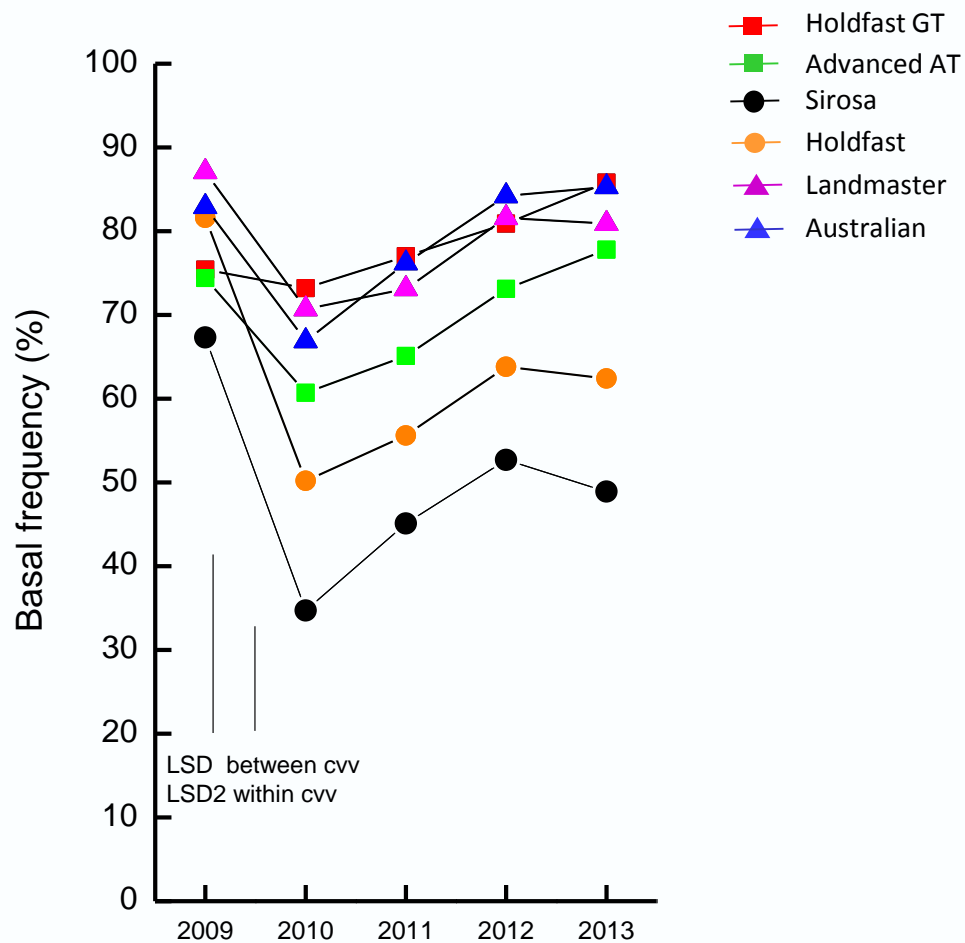
High P, 18 sheep/ha, continuous stocking



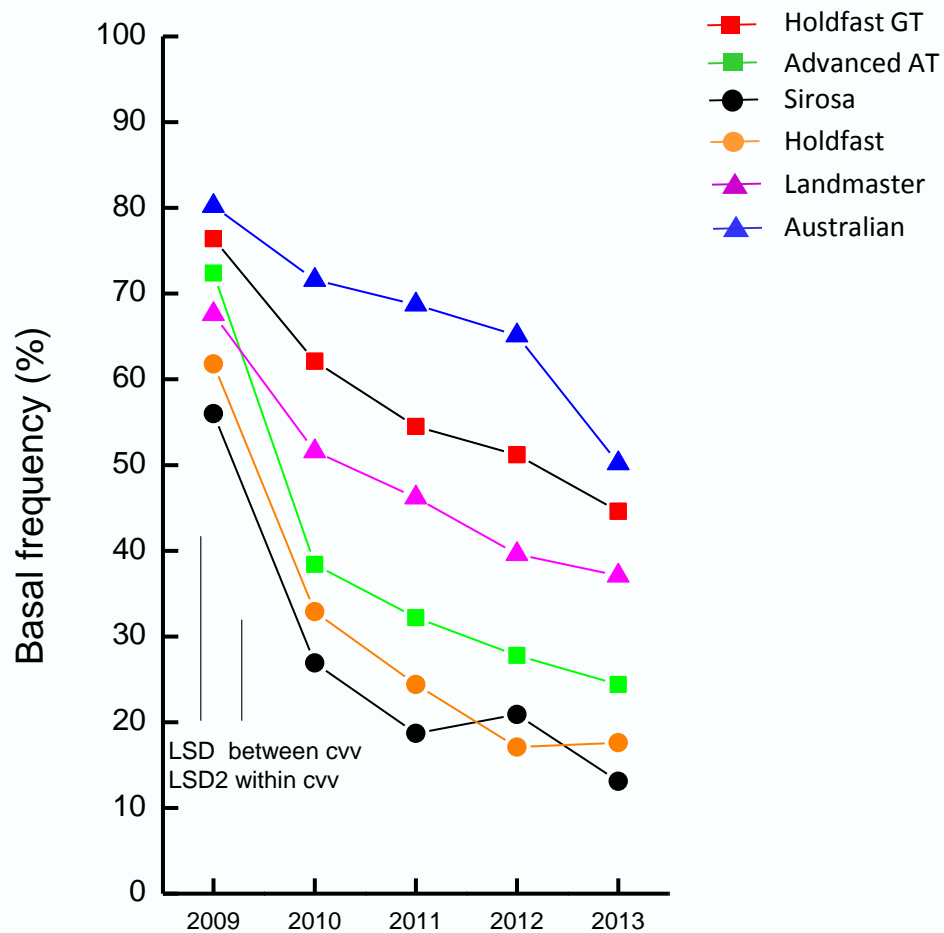
High P, 18 sheep/ha, rotational stocking



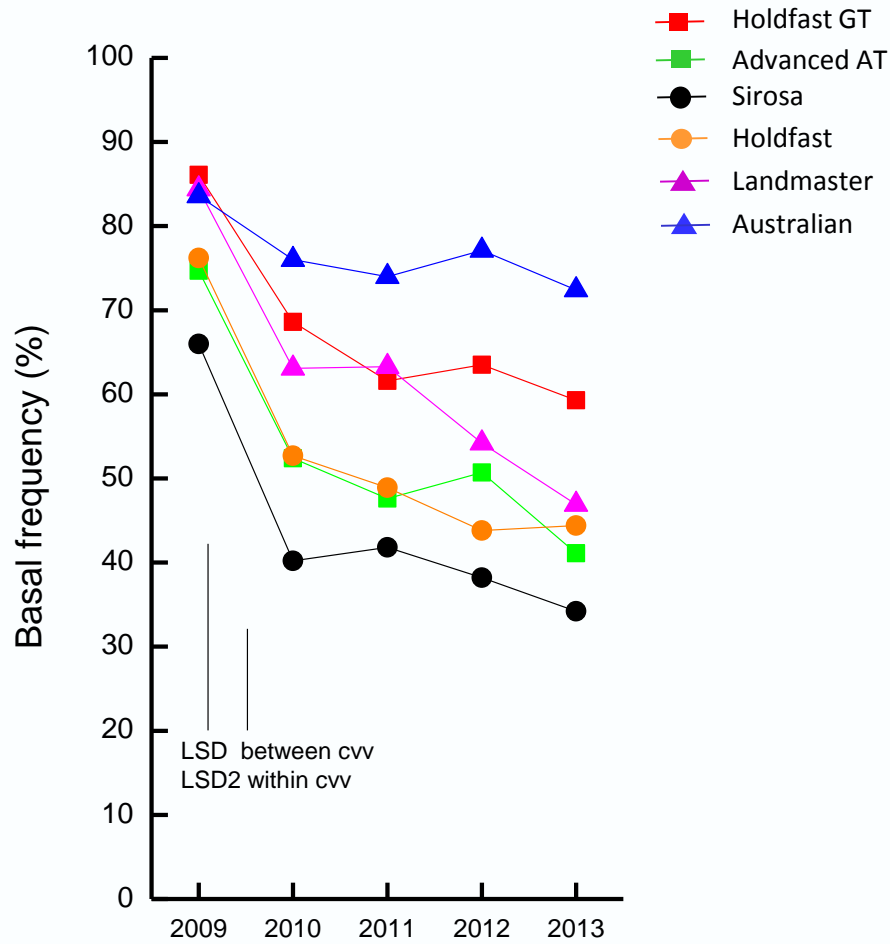
High P, 13.5 sheep/ha, continuous stocking



Low P, 9 sheep/ha, continuous stocking



Low P, 9 sheep/ha, rotational stocking



Recovery period (exclusion from grazing)

Aim: To observe the growth potential of surviving phalaris
after 4 years of treatment

- combines survival and vigour

Winter: 7 June to 28 August

Spring: 2 September to 30 October

Recovery period – winter

General views

High P
Rotational
18/ha



High P
Continuous
13.5/ha



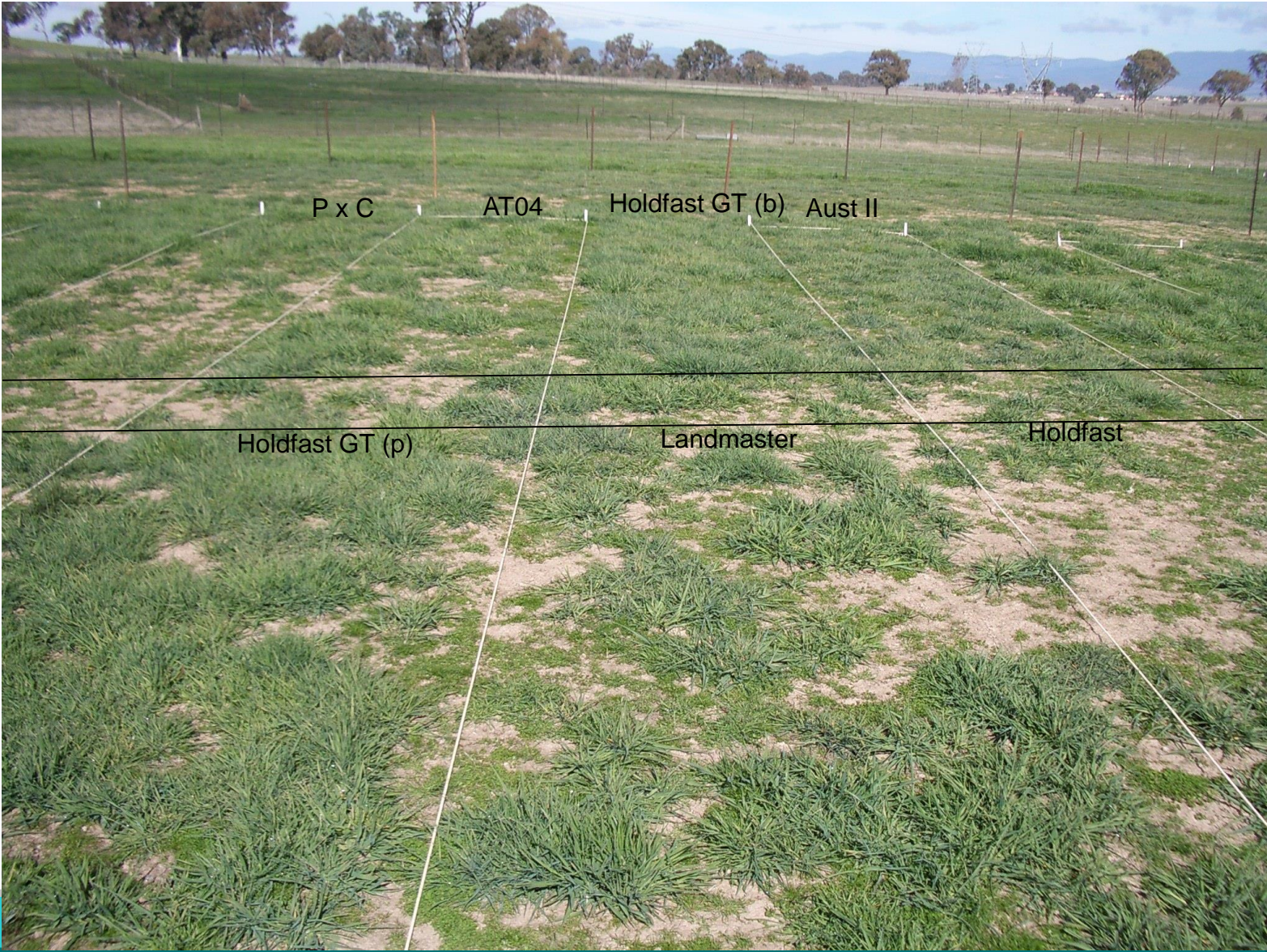
Low P
Rotational
9/ha



Low P
Continuous
9/ha



Recovery: High P, 18 sheep/ha, continuous stocking



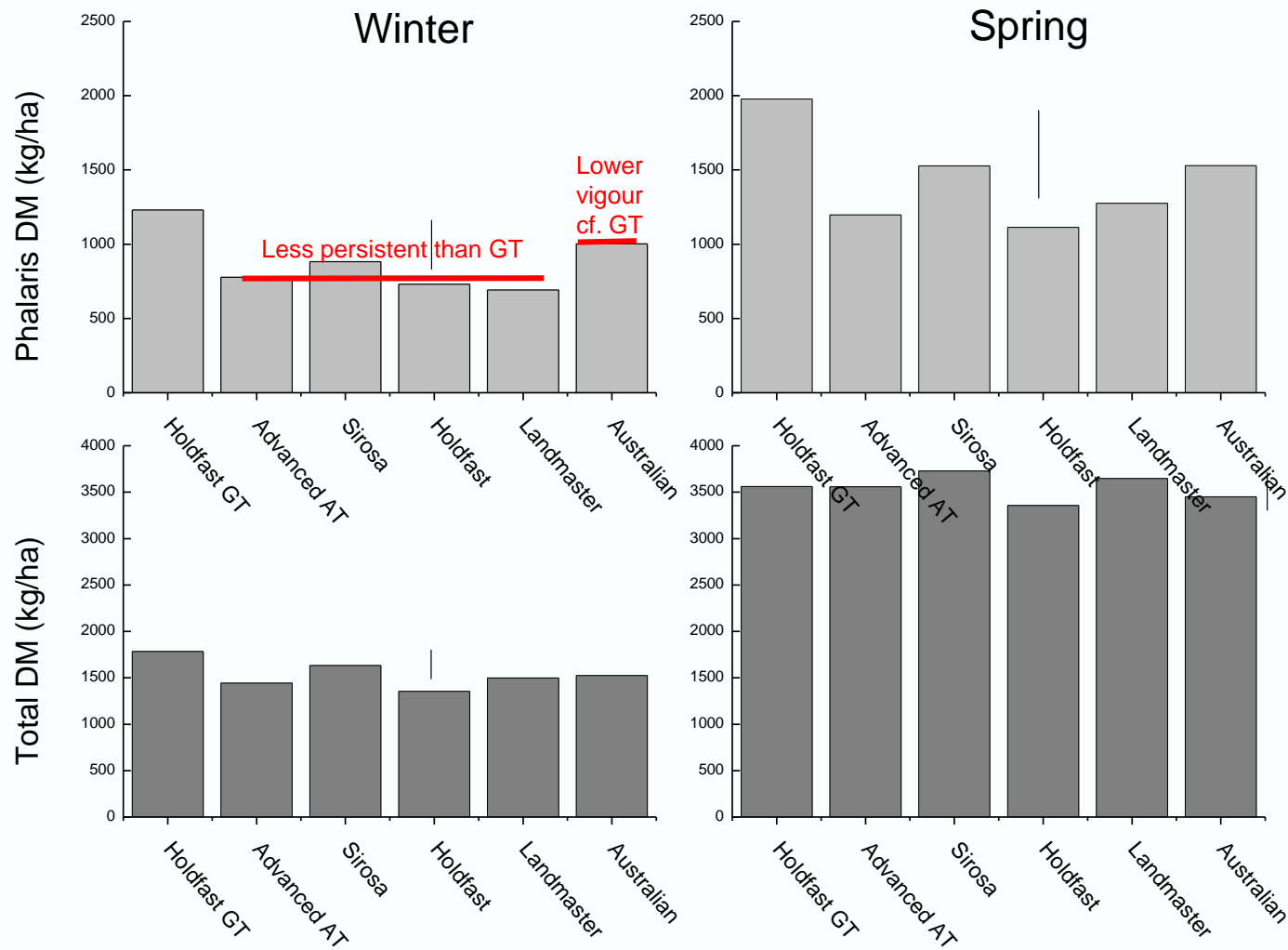
Recovery period

Fertility treatment effects

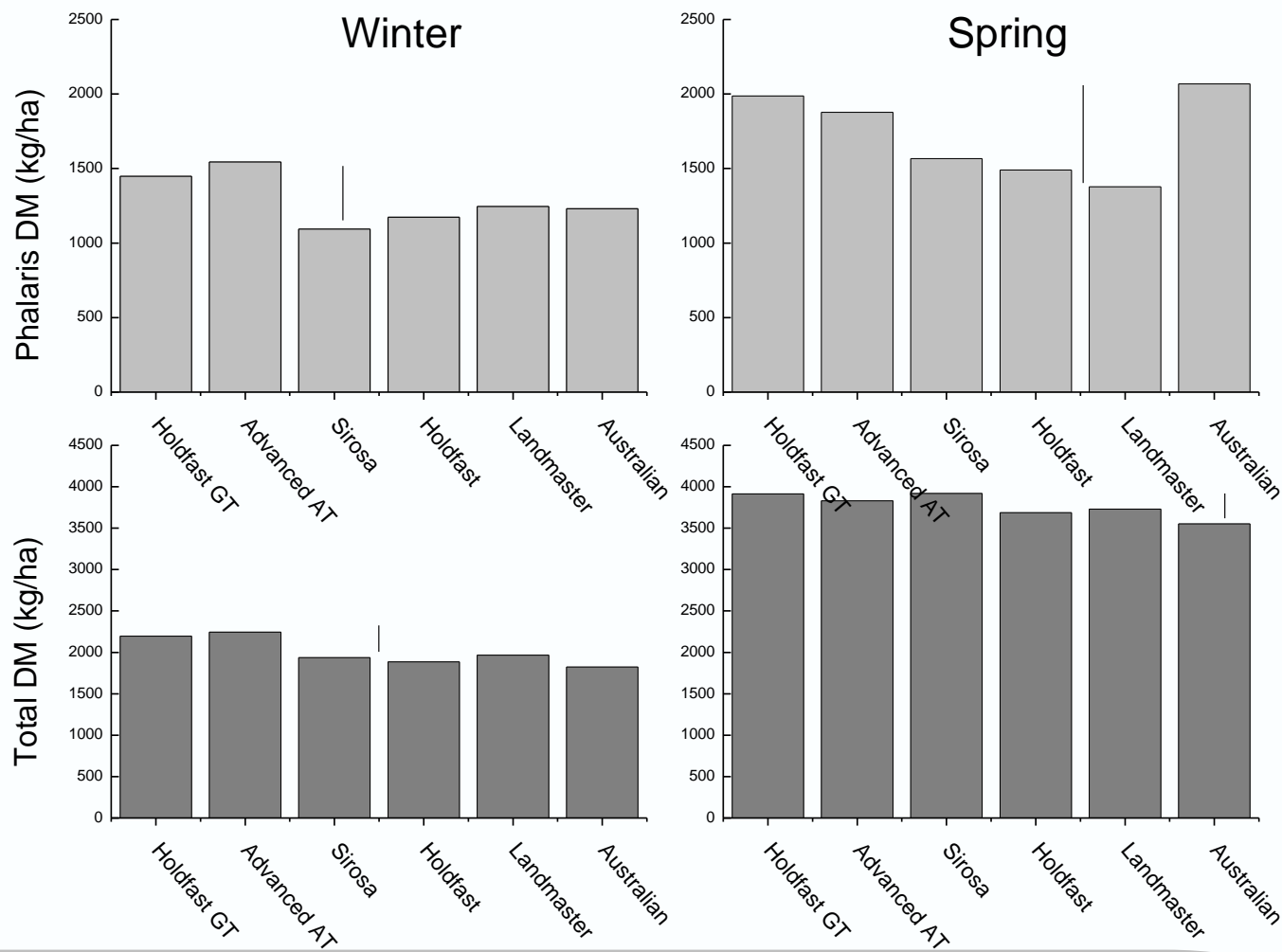
Winter + Spring

Treatment	DM kg/ha	
	Phalaris	Total
High P	2740	5040
Low P	750	2700
<i>lsd (P=0.05)</i>	<i>188</i>	<i>121</i>

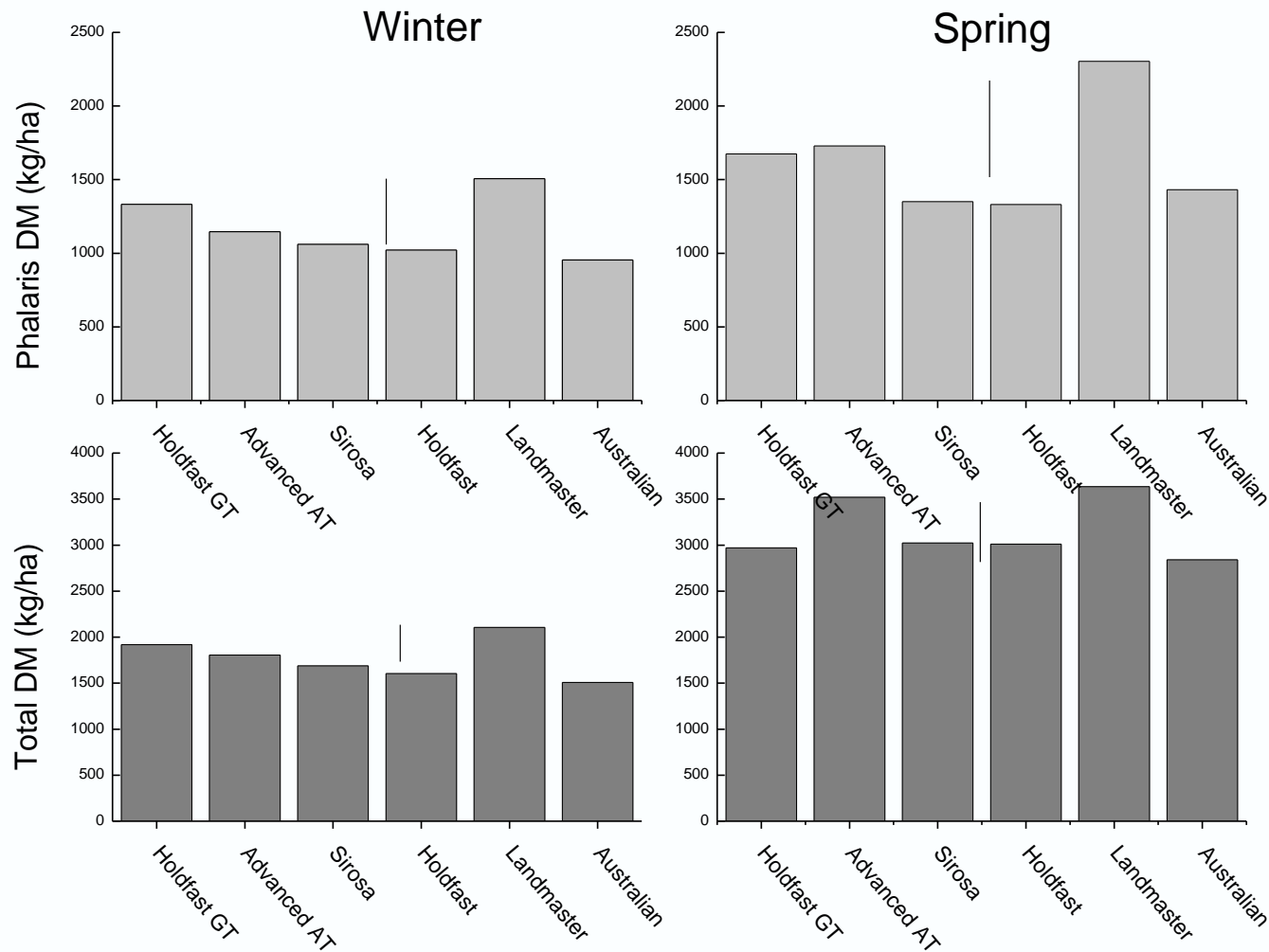
Recovery: High P, 18 sheep/ha, continuous stocking



Recovery: High P, 13.5 sheep/ha, continuous stocking



Recovery: High P, 18 sheep/ha, rotational stocking



Summary

- Phalaris was more resilient after drought/overgrazing and much more productive at high than at low soil fertility
- Rotational stocking enhanced persistence during a period of drought and low herbage mass
- Reducing stocking rate under continuous stocking also protected phalaris persistence
- Holdfast GT was more tolerant of close continuous stocking than other winter-active cultivars
- The other winter-active cultivars clearly benefitted from rotational stocking at high grazing pressure
- Australian was best able to cope with grazing pressure under low soil fertility

Conclusions

- Perennial grass persistence is protected by Managing grazing.

OPTIONS: lower stocking rate (*high cost*)
or rotational stocking (*less convenience*)

- Genotypes that can resist Environmental and/or grazing stresses further protect perennial grass density when management options are limited.

e.g. in droughts when multiple stresses occur

- Long term persistence and continuing productivity is ensured by combining G and M

Thank you

