Western Cape Government

Agriculture

BETTER TOGETHER.

Pasture plant breeding in South Africa: Lessons from the past and future needs

Ammann SB[1,4], Smith A[2], Goodenough DCW[3]

[1] Current: Western Cape Department of Agriculture, Outeniqua Research Farm, George
[2] stats4science, P.O.Box 50505 Moreletta Village, 0087. South Africa
[3] ARC – Animal Production Institute, Cedara, PO Box 1055, Hilton 3245
[4] KZNDARD, Cedara, P/Bag X9059 Pietermaritzburg 3200

GSSA Congress 50, Pietermaritzburg

Pasture plant breeding in South Africa: past and future

The pasture plant breeding programme is located at

ARC Animal Production Institute, Cedara

Western Cape Government
Agriculture

Pasture plant breeding in South Africa: past and future

- **Pasture plant breeding in RSA dates back to 1888 in Stellenbosch, F Blersch**

- **From 1910 onwards: research stations established specifically for pasture breeding**

- **1959 a blueprint defined for RSA**
  - Cedara identified as principle forage improvement centre for eastern high RF region
  - 5 professional + 11 technical staff

Western Cape Government

ARC • LNR

Pasture plant breeding in South Africa: past and future

- **Cedara and Roodeplaat (Pretoria) developed into substantial programmes in the last 30 years contributing greatly to forage production in RSA**

  - **Produced 68 varieties with PBR of 11 species**
  - **Currently 48 on the market in RSA**

Western Cape Government

ARC • LNR

Pasture plant breeding in South Africa: past and future

Prinshof grass breeding station near Pretoria from 1923

Collection of 110 accessions of following species (Pole-Evans 1937, 1939):

Festuca arundinacea, Pennisetum clandestinum

Bromus
Dactylis
Phalaris

Cenchrus
Chloris
Digitaria
Setaria
Themeda

Trifolium repens
Trifolium pratense

Pasture plant breeding in South Africa: past and future

- Work was suspended during WW2
- 1951: ryegrass breeding started at Cedara
- Rietondale expanded for Highveld region
- Decided to stop breeding cross-pollinated species – takes 15 years for a variety
- Chose to focus on apomitic species only

Pasture plant breeding in South Africa: past and future

1959 blueprint for grass breeding developed

- **At a comprehensive meeting in 1959 decided on 23 grass and legume species.**
- **Very ambitious but staff and funding shortages.**
- **Reduced to:**
  - ***Chloris gayana***
  - ***Dactylis glomerata***
  - ***Lolium multiflorum & L. perenne***
  - ***Panicum maximum, P.coloratum, P.deustum***
  - ***Paspalum dilitatum, P.urvillei***

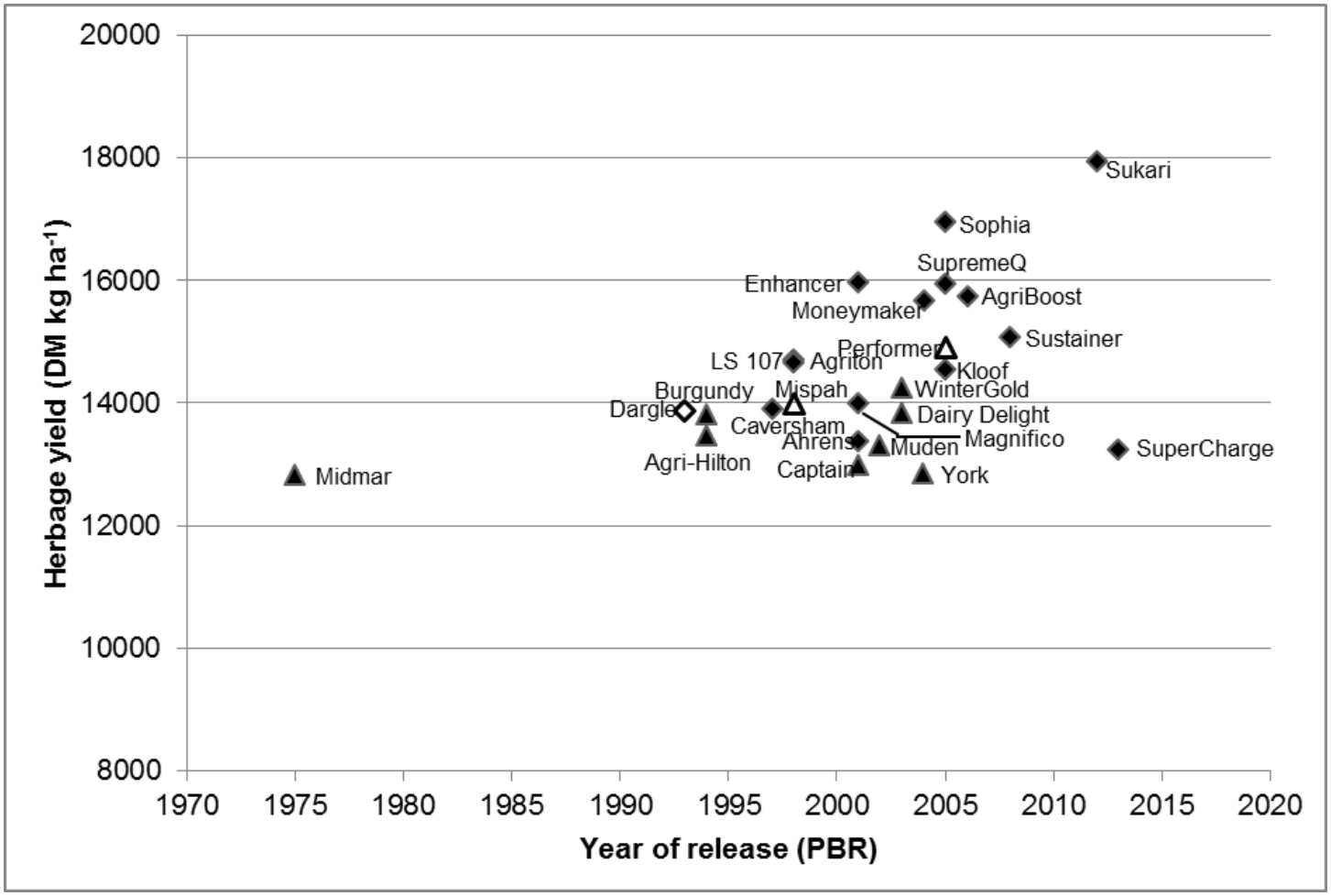
Pasture plant breeding in South Africa: past and future

Important lessons

- **1903-1956 progress lacking**
  - **Lack of continuity**
  - **Too fragmented – 7 different research stations**
- **1959 onwards**
  - **Only 2 research stations (Rietondale & Cedara)**
  - **Later Roodeplaat and Cedara**
- **Present**
  - **ARC Cedara only**

Lolium multiflorum breeding programme

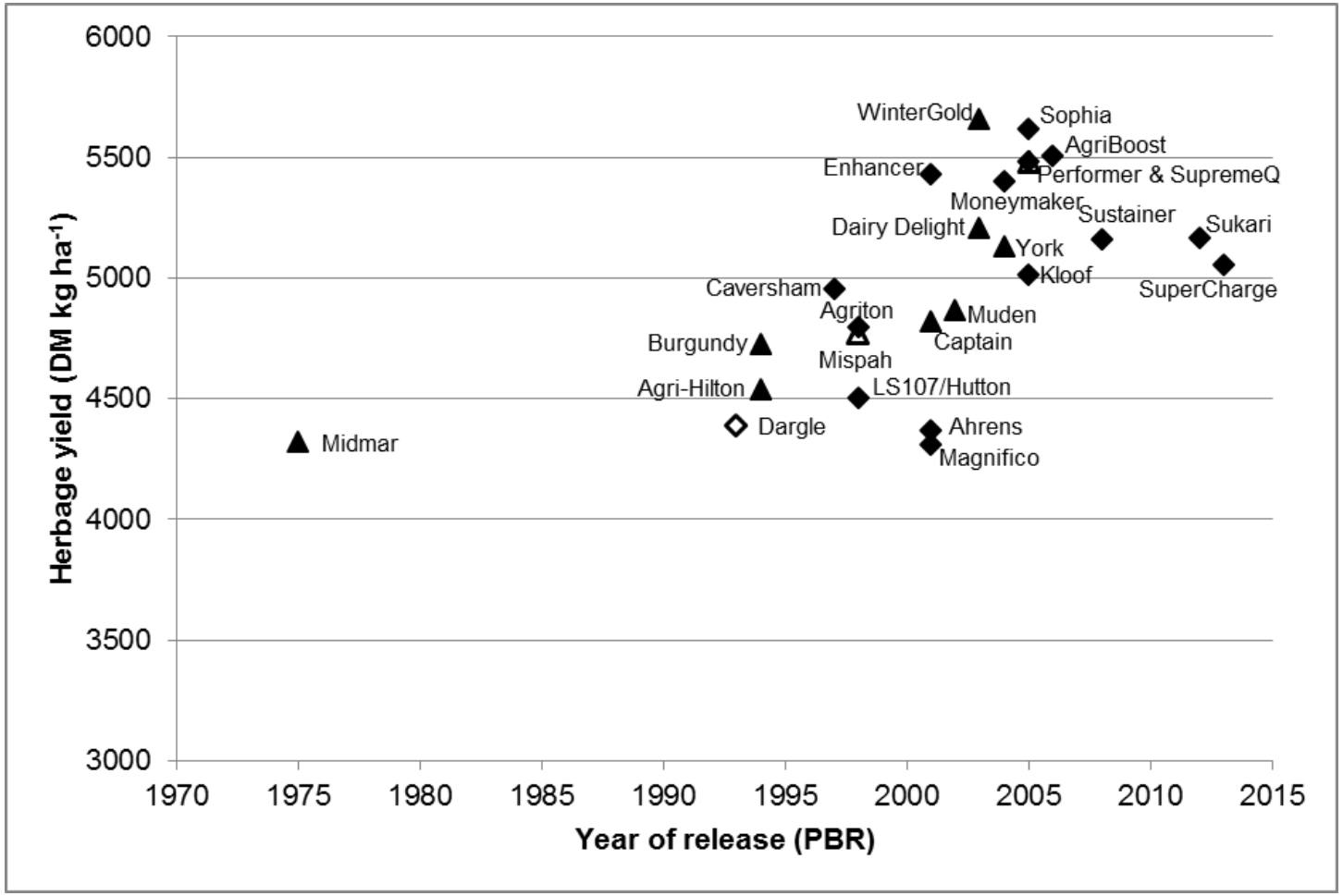
Figure 1: Mean total herbage yield



▲ Westerwolds ◆ Italian △ W/wolds with Italian component ◇ Italian with W/wolds component

Lolium multiflorum breeding programme

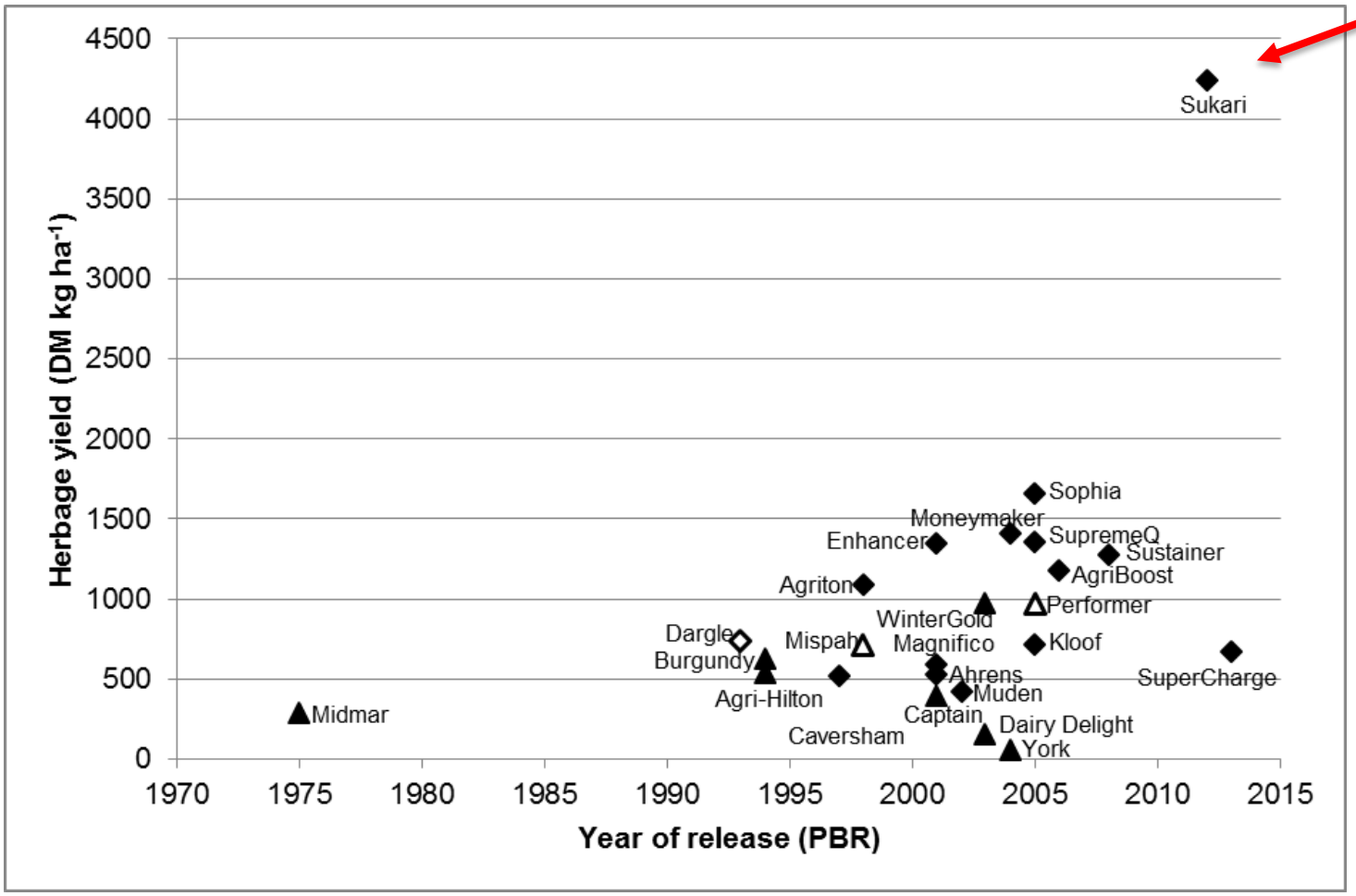
Figure: 2 Mean winter yield



▲ Westerwolds ◆ Italian △ W/wolds with Italian component ◇ Italian with W/wolds component

Lolium multiflorum breeding programme

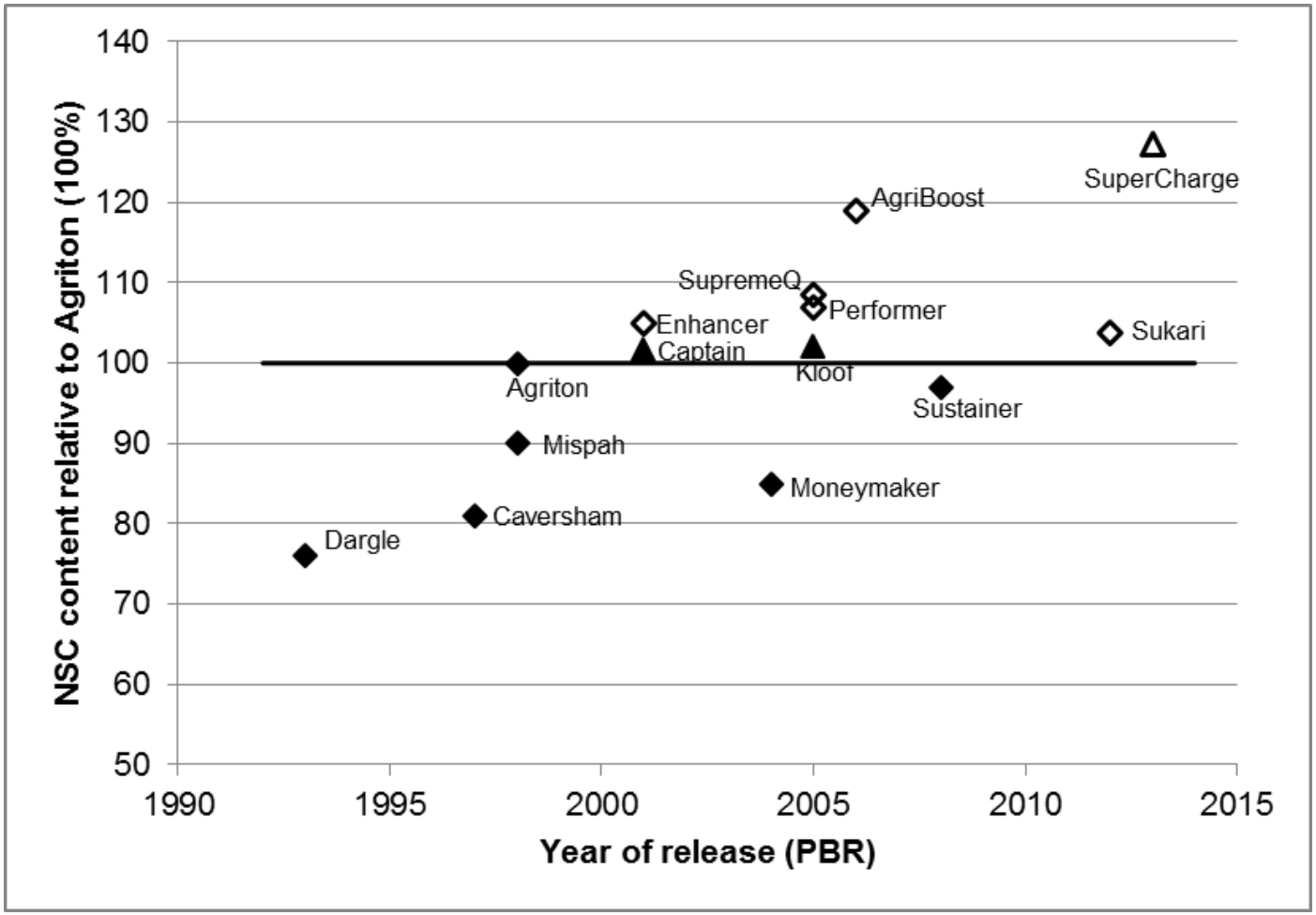
Figure 3: Mean summer yield



▲ Westerwolds ◆ Italian △ W/wolds with Italian component ◇ Italian with W/wolds component

Lolium multiflorum breeding programme

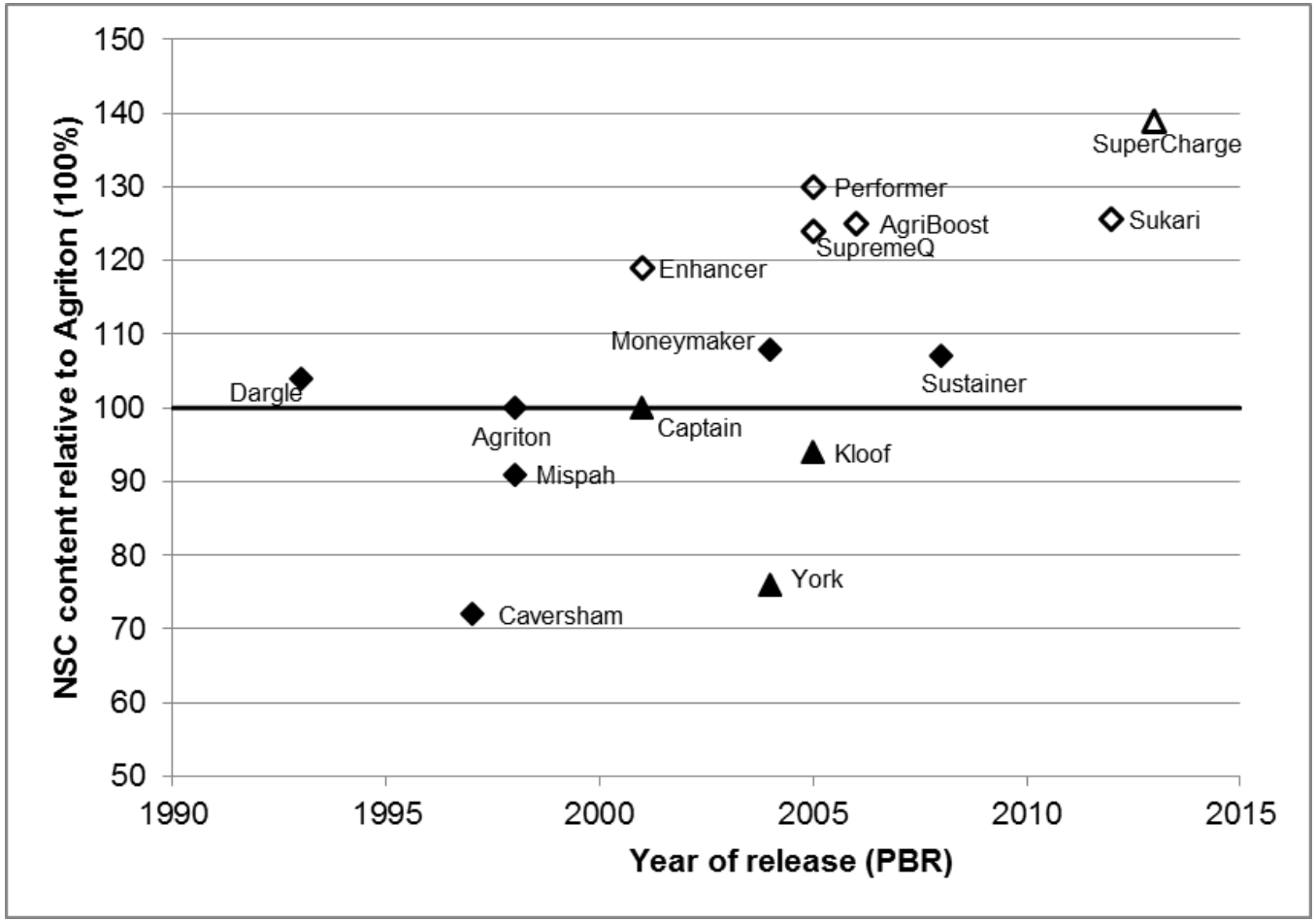
Figure 4: Mean autumn non-structural carbohydrate (NSC)



◆Diploid ▲Tetraploid ◇Diploid bred for high NSC △Tetraploid bred for high NSC

Lolium multiflorum breeding programme

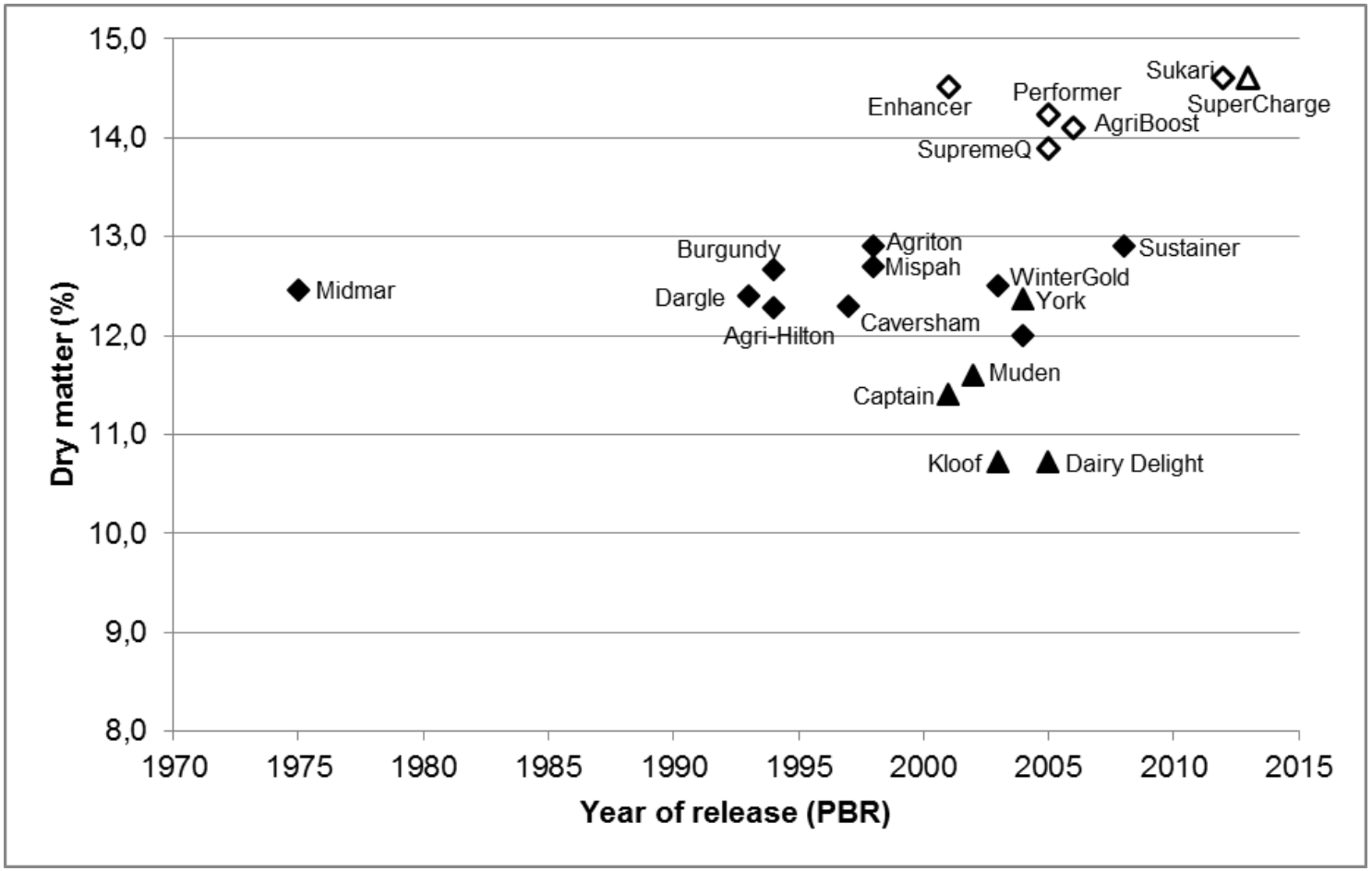
Figure 5: Mean winter non-structural carbohydrate (NSC)



◆ Diploid ▲Tetraploid ◇ Diploid bred for high NSC △ Tetraploid bred for high NSC

Lolium multiflorum breeding programme

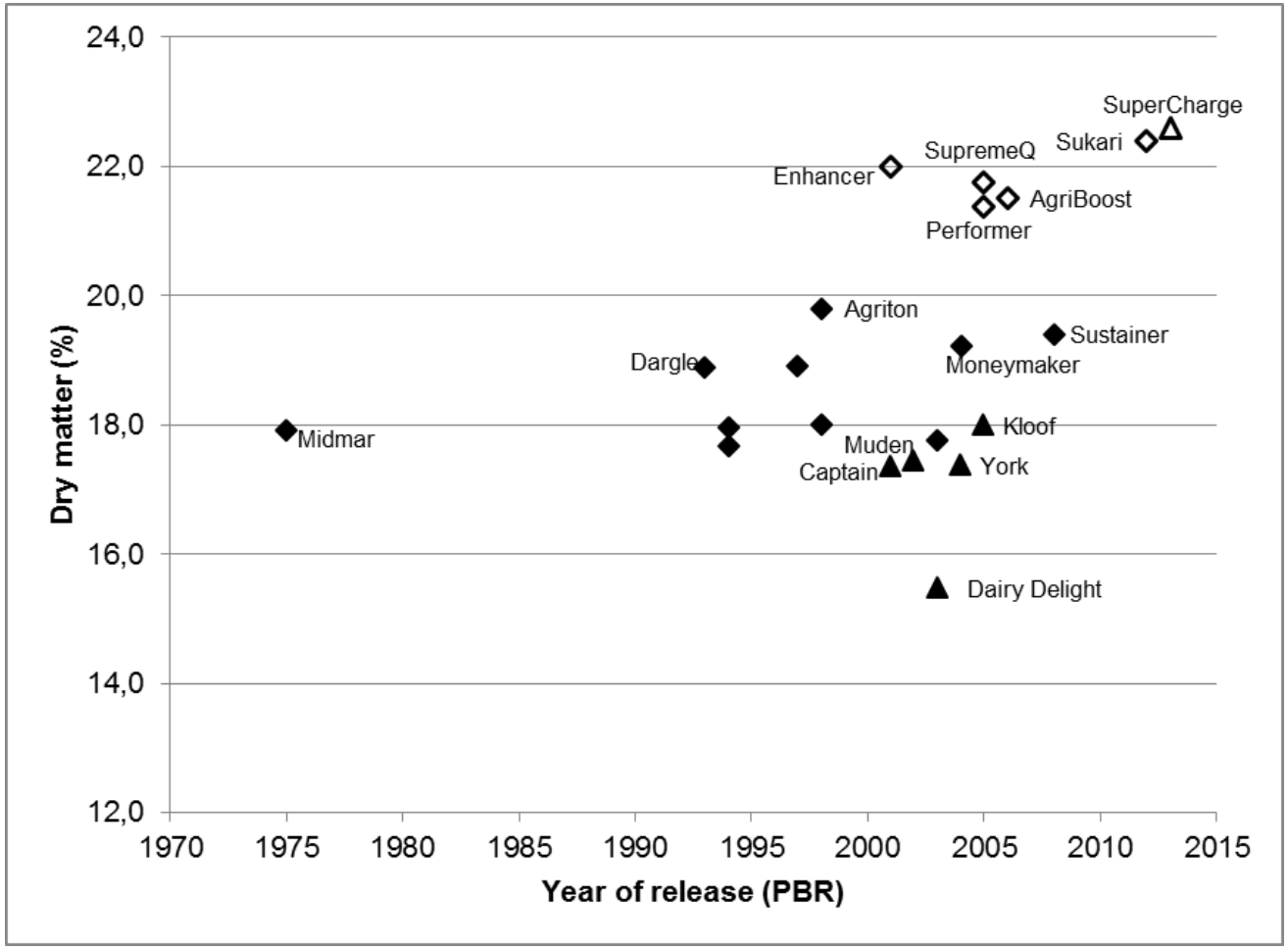
Figure 6: Mean autumn dry matter content



◆ Diploid ▲ Tetraploid ◇ Diploid bred for high DM% △ Tetraploid bred for high DM%

Lolium multiflorum breeding programme

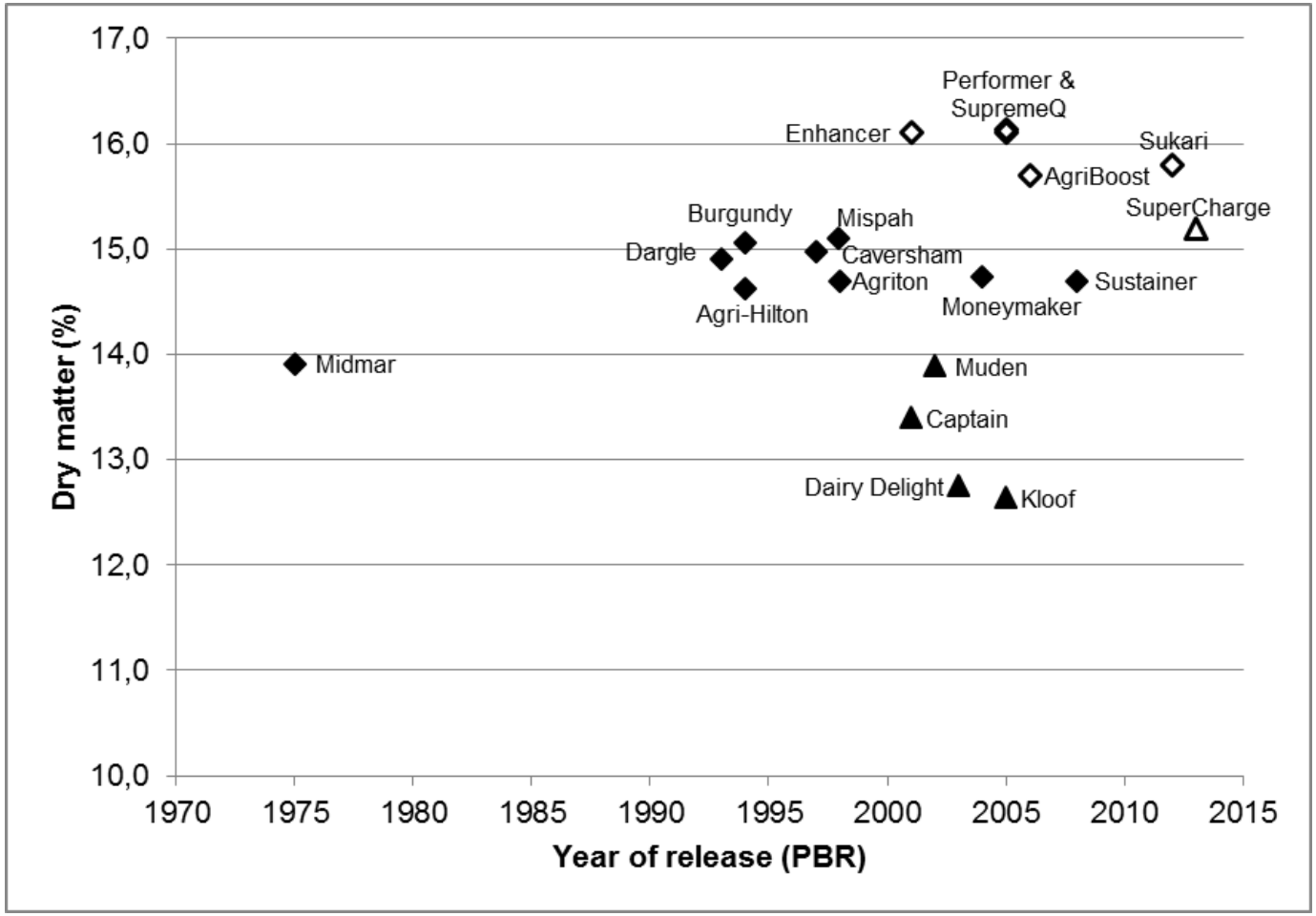
Figure 7: Mean winter dry matter content



◆ Diploid ▲ Tetraploid ◇ Diploid bred for high DM% △ Tetraploid bred for high DM%

Lolium multiflorum breeding programme

Figure 8: Mean spring dry matter content



◆ Diploid ▲ Tetraploid ◇ Diploid bred for high DM% △ Tetraploid bred for high DM%

Pasture plant breeding in South Africa: past and future

What are the challenges?

- **Pasture breeding far more complex than single harvest crops**

- **Crops: improve the harvest index**

Pasture plant breeding in South Africa: past and future

What are the challenges?

- **Grass:**
  - **Removal of photosynthetic capacity**
  - **Trade-off between leaves removed and leaves remaining**
  - **Multiple harvests during the year**
  - **Cannot only breed for total yield – seasonal yield vital**
  - **Success of pasture is reflected via animal production**
  - **Forage quality consists of number of traits**
  - **Breeding as single spaced plants but used in a sward with competition effects**
  - **Varieties must have good seed delivery traits**

Western Cape Government

ARC • LNR

Pasture plant breeding in South Africa: past and future

What are the challenges?

- **Funding**
  - **Limited to seed companies not end user**
  - **Not a high value crop, as for instance maize or vegetables**
  - **Value is realised through the animals hence not as visible as yield of a single harvest crop.**

Pasture plant breeding in South Africa: past and future

What are the challenges?

- **Capacity**
  - **Currently pasture breeding taking place on a very limited scale in SA**
  - **Expertise has not been passed onto young professionals**
  - **Especially in view of the complexity of pasture plant breeding**
  - **Facilities**

Pasture plant breeding in South Africa: past and future

Future needs

- **Pasture breeding aims to address local challenges**
  - Climate, soil, water resources, production systems, fodder flow requirements.
- **More research on management x variety interactions**
- **Close gap between genetic potential and farm yield**

- **Water use efficiency (WUE)**
- **Persistence of perennial species**
- **Disease resistance**
- **Improve species such as Tall Fescue: forage quality**

Pasture plant breeding in South Africa: past and future

Future needs

- **Stewart & Hayes (2010), Parsons *et al* (2011), Lee *et al* (2012):**
- **Forage quality – aim at specific targets**
  - **Factors that improve intake**
  - **Increase WSC:CP ratio,**

    also for environmental reasons
  - **ME**

Pasture plant breeding in South Africa: past and future

Future needs

- **Other traits**
  - **Persistence**
  - **Disease resistance**
  - **Seed delivery traits**
  - **Develop tetraploids with tiller numbers similar to diploids**
  - **G x E interactions: need more trial sites**
    - **Always same control variety (Parsons et al 2011)**
    - **Robust to determine real differences**

Pasture plant breeding in South Africa: past and future

Future needs

- **Need an integrated approach between pasture breeding, pasture science, animal production, agronomy and others**
- **Locally adapted varieties**
- **Breeding for very specific, well defined objectives**
- **Robust variety evaluation associated and linked with the plant breeding programmes**
- **Funding over and above the seed industry**
- **Continuity, as historical experience has taught**

Thank you

Contact Us


Western Cape Government
Agriculture
BETTER TOGETHER.
Sigrun Ammann
Tel: 044 803 3726
Fax: 044 874 7730
SigrunA@elsenburg.com
www.elsenburg.com