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Inter- and intra-species competition as influenced by variable seeding rates and nurse crop association

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Introduction

- Commonly cultivated subtropical grass species in South Africa
 - *Eragrostis curvula*, *Digitaria eriantha* and *Chloris gayana*



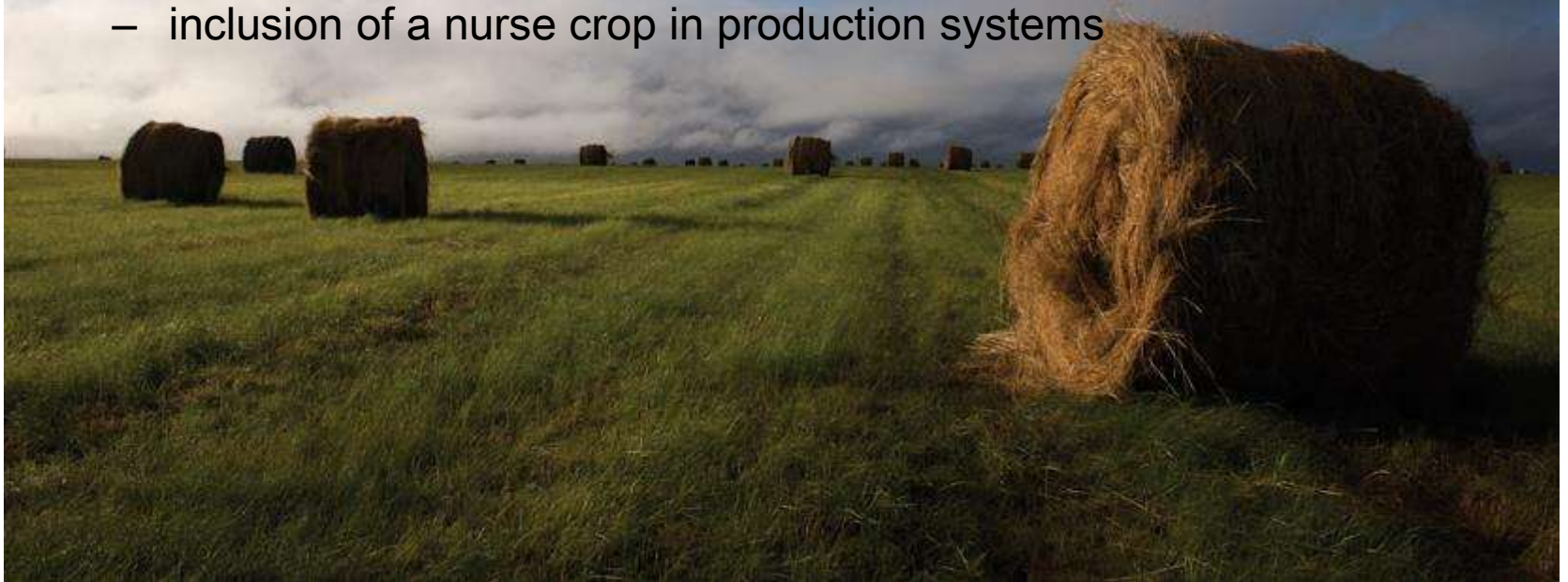


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Introduction

- Successful planted pastures - good establishment techniques
- Debate whether significant competitive effects exist amongst plants in a sward
 - higher or lower seeding rates of pasture species
 - inclusion of a nurse crop in production systems





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Aim

The aim of this study is to determine whether:

- (i) adjusting the seeding rate and/or
- (ii) using a nurse crop, has any significant effect on the establishment success of the test grass species





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Hypothesis

It is hypothesized that adjusting the seeding rate of the perennial species and the use of a nurse crop will have significant effects on the establishment success of the perennial species





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Materials and Methods

- University of Pretoria's Experimental farm
- Three field experiments were conducted using *C. gayana* (var. Katambora), *E. curvula* (var. Ermelo) and *D. eriantha* (var. Irene)
- Dry land conditions





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Materials and Methods - experimental layouts

Table 1: *Eragrostis curvula*-, *Digitaria eriantha*- and *Chloris gayana* experimental treatments

| Treatment | Factor by which the experimental units increase | Description |
|---------------|---|---|
| Coated | 2 | <ul style="list-style-type: none"> Coated or uncoated |
| Nurse crop | 2 | <ul style="list-style-type: none"> <i>E. tef</i> used or not used as nurse crop (5 kg.ha⁻¹) |
| Seeding rates | 3 | <ul style="list-style-type: none"> 80%, 100% and 120% of a selected seeding rate |
| Replications | 3 | |



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Materials and Methods

- Coated and uncoated seed was planted
- Thousand seed mass was calculated for the test species

Table 2: Ratios of seed numbers between uncoated and coated seed for the same mass of seed.

| Species | Uncoated | Coated |
|--------------------|----------|--------|
| <i>E. curvula</i> | 2.2 | 1 |
| <i>D. eriantha</i> | 4.8 | 1 |
| <i>C. gayana</i> | 7.7 | 1 |



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Materials and Methods

- Seeding rates were selected for test species according to the current commercial recommendation (Pasture Handbook 2007).

Table 3: Seeding rates (kg.ha⁻¹) used for every species.

| Species | 80% | Selected | 120% |
|--------------------|-----|----------|------|
| <i>E. curvula</i> | 5.6 | 7 | 8.4 |
| <i>D. eriantha</i> | 6.4 | 8 | 9.6 |
| <i>C. gayana</i> | 5.6 | 7 | 8.4 |

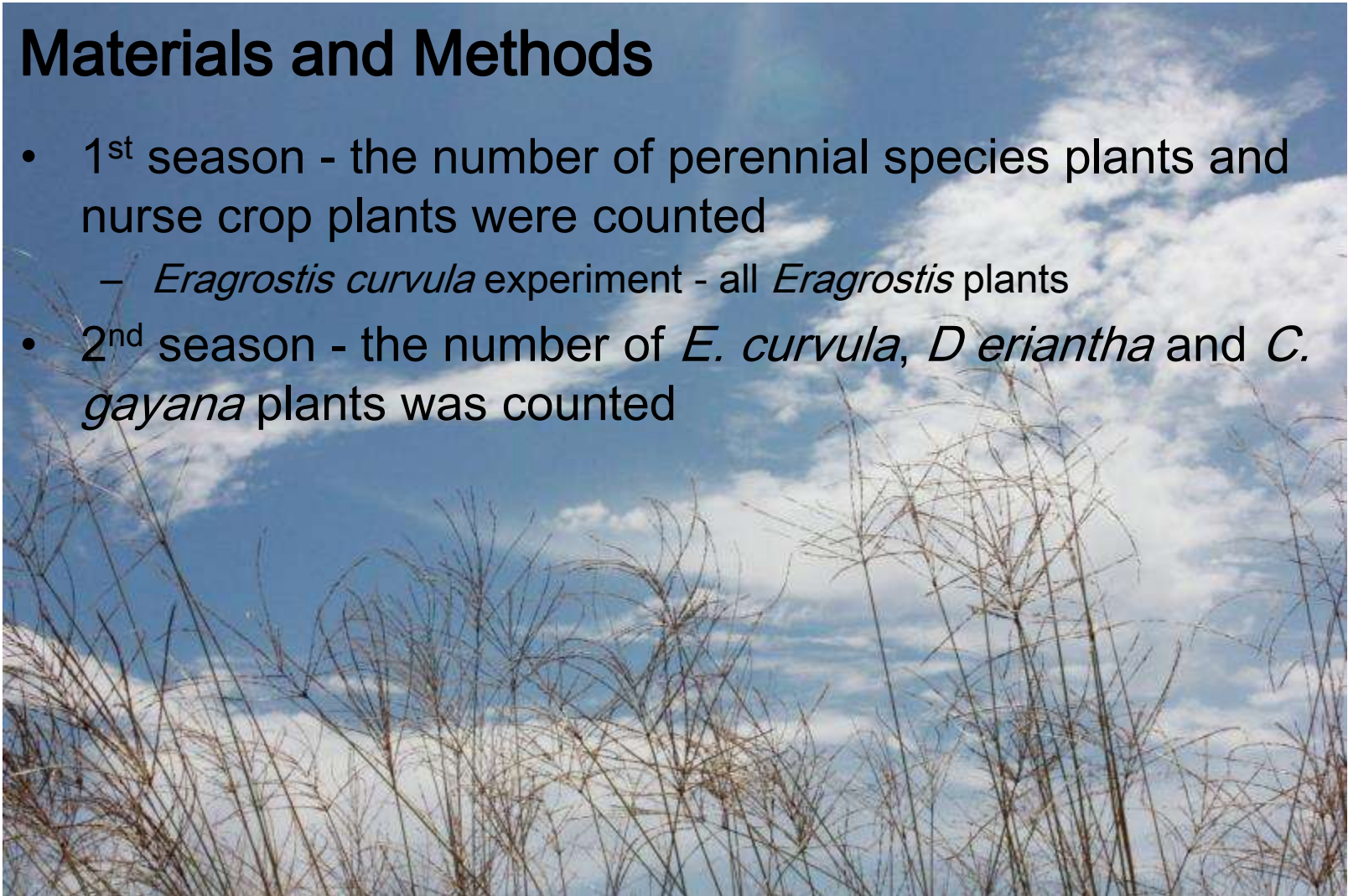


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Materials and Methods

- 1st season - the number of perennial species plants and nurse crop plants were counted
 - *Eragrostis curvula* experiment - all *Eragrostis* plants
- 2nd season - the number of *E. curvula*, *D. eriantha* and *C. gayana* plants was counted





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Results and Discussion





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Seeding rates – *E. curvula*

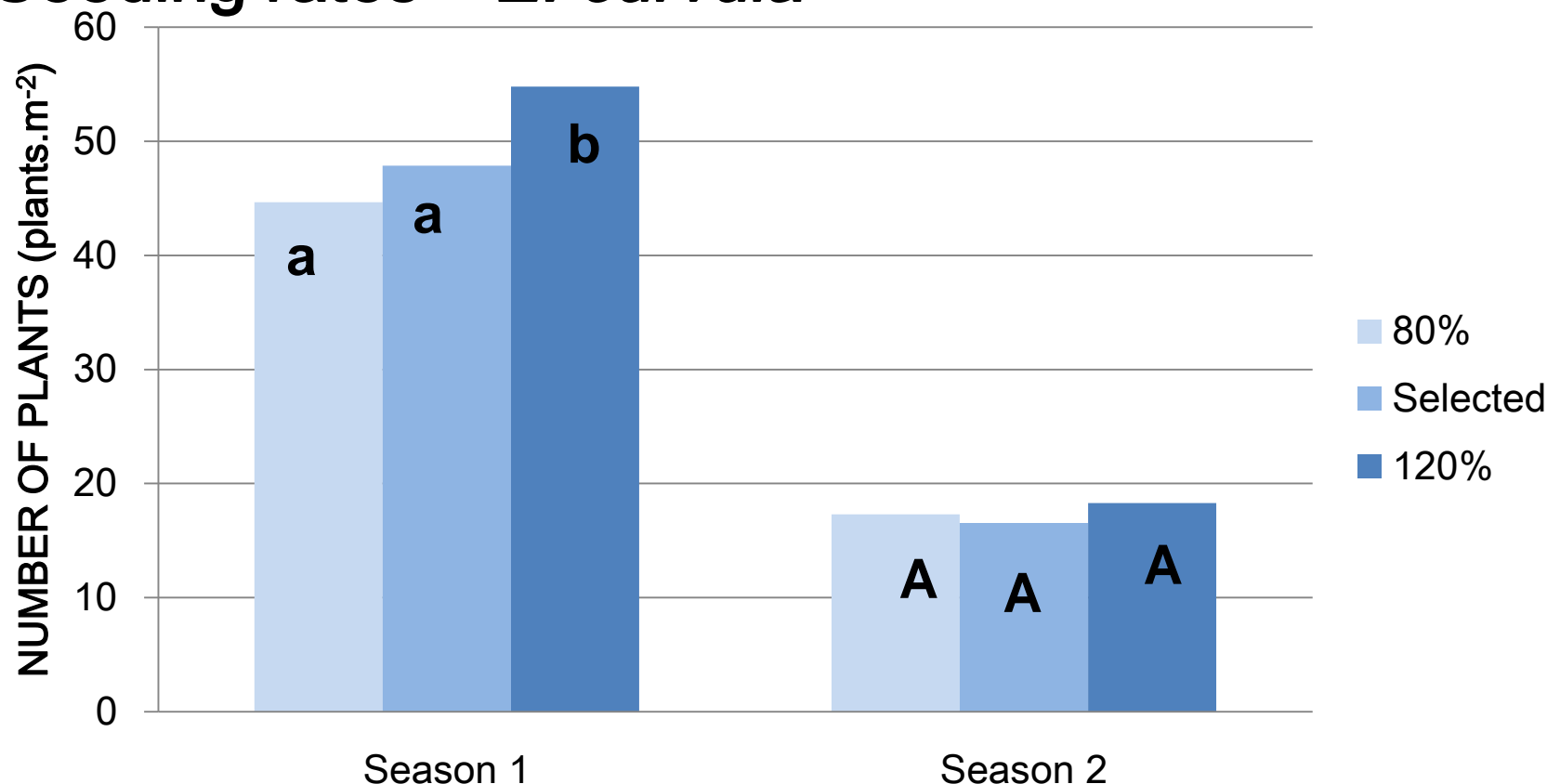


Figure 1: The number of *Eragrostis* species plants.m⁻² area (season one and – two) at three seeding rates.

Means with the same letter are not significantly different at $P > 0.05$



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Seeding rates – *C. gayana*

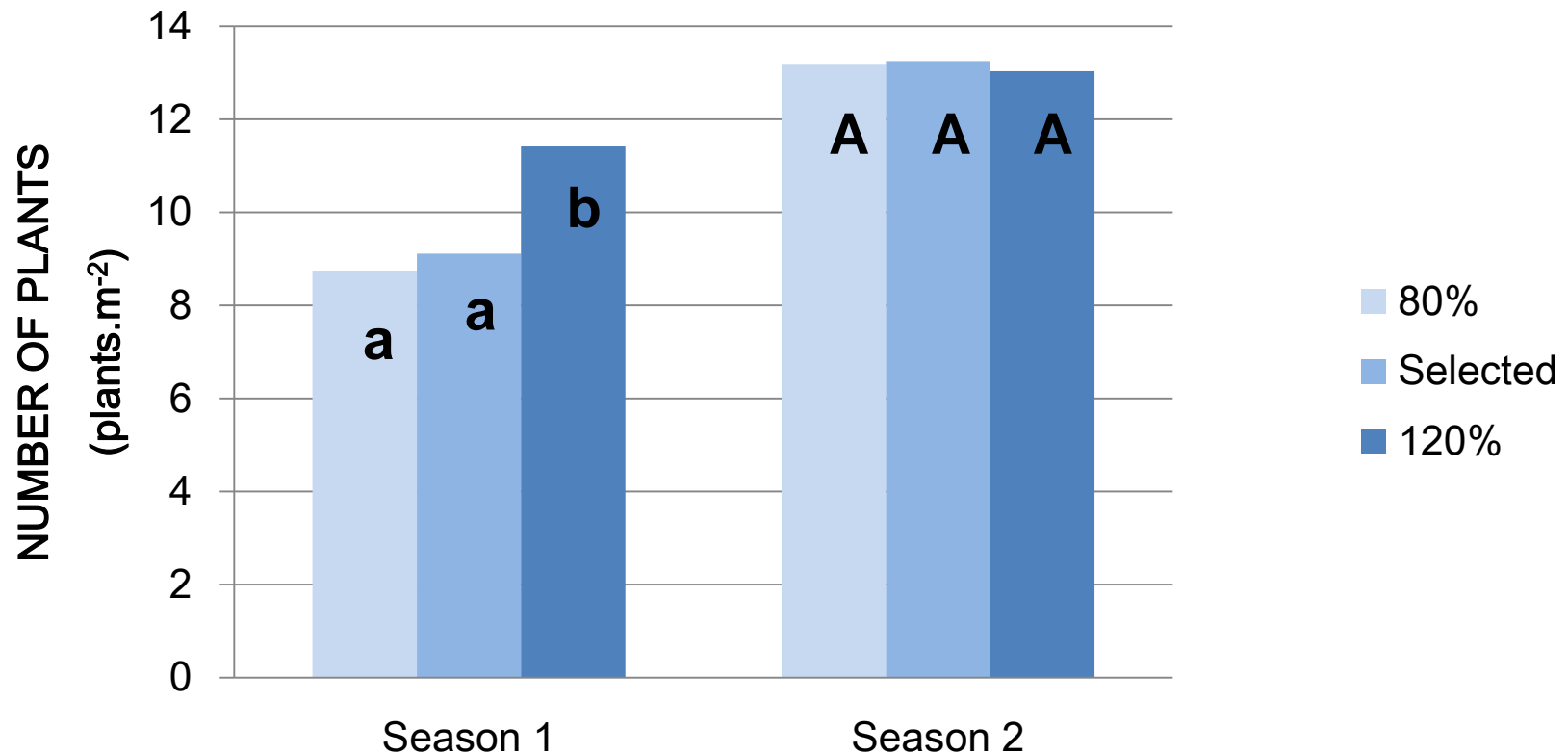


Figure 2: The number of *C. gayana* plants.m⁻² area (season one and -two) at three seeding rates.

Means with the same letter are not significantly different at $P > 0.05$



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Seeding rates – *D. eriantha* season one

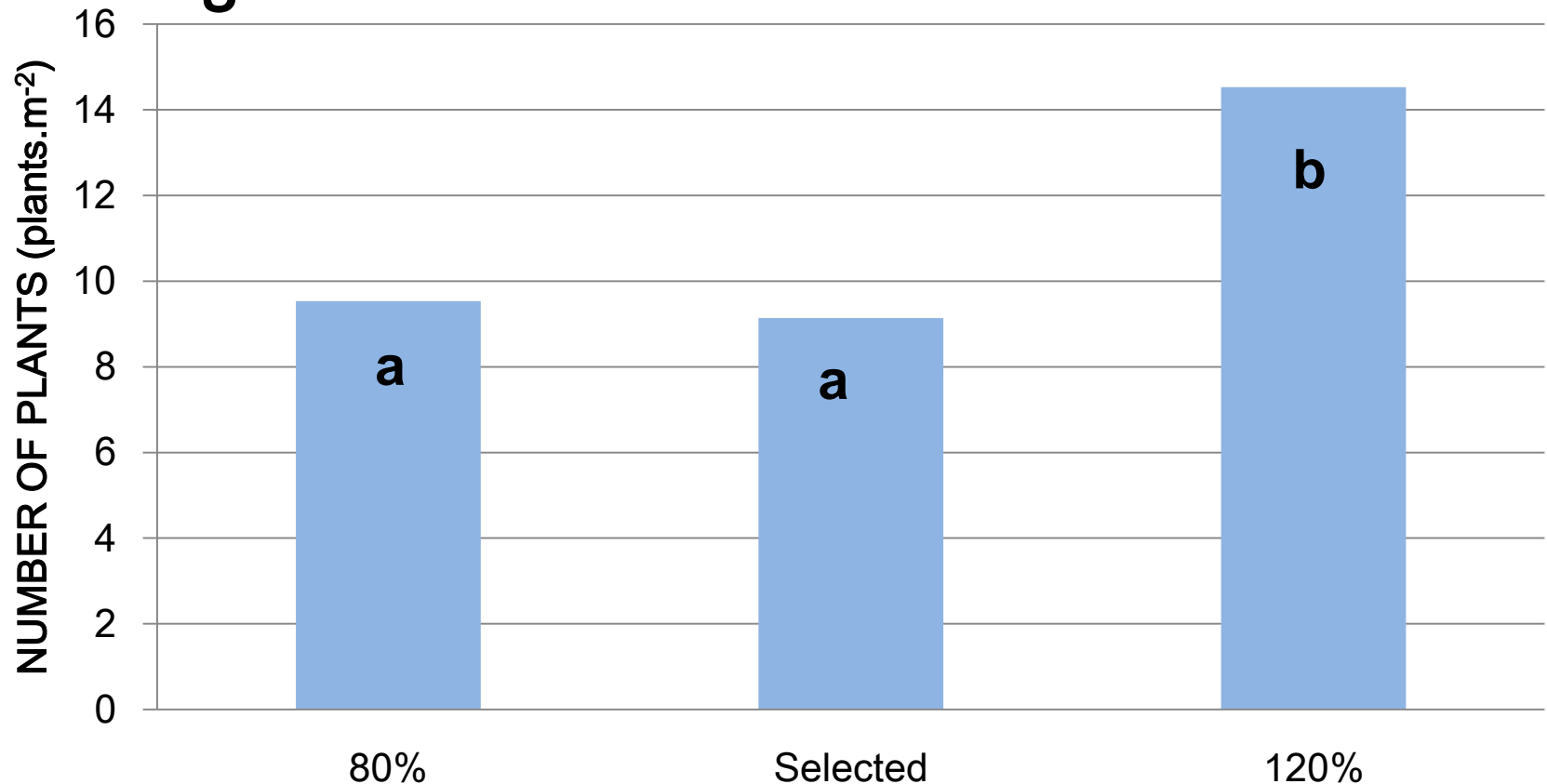


Figure 3: The number of *D. eriantha* plants.m⁻² area (season one) at three seeding rates.

Means with the same letter are not significantly different at P>0.05



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Seeding rates – *D. eriantha* season two

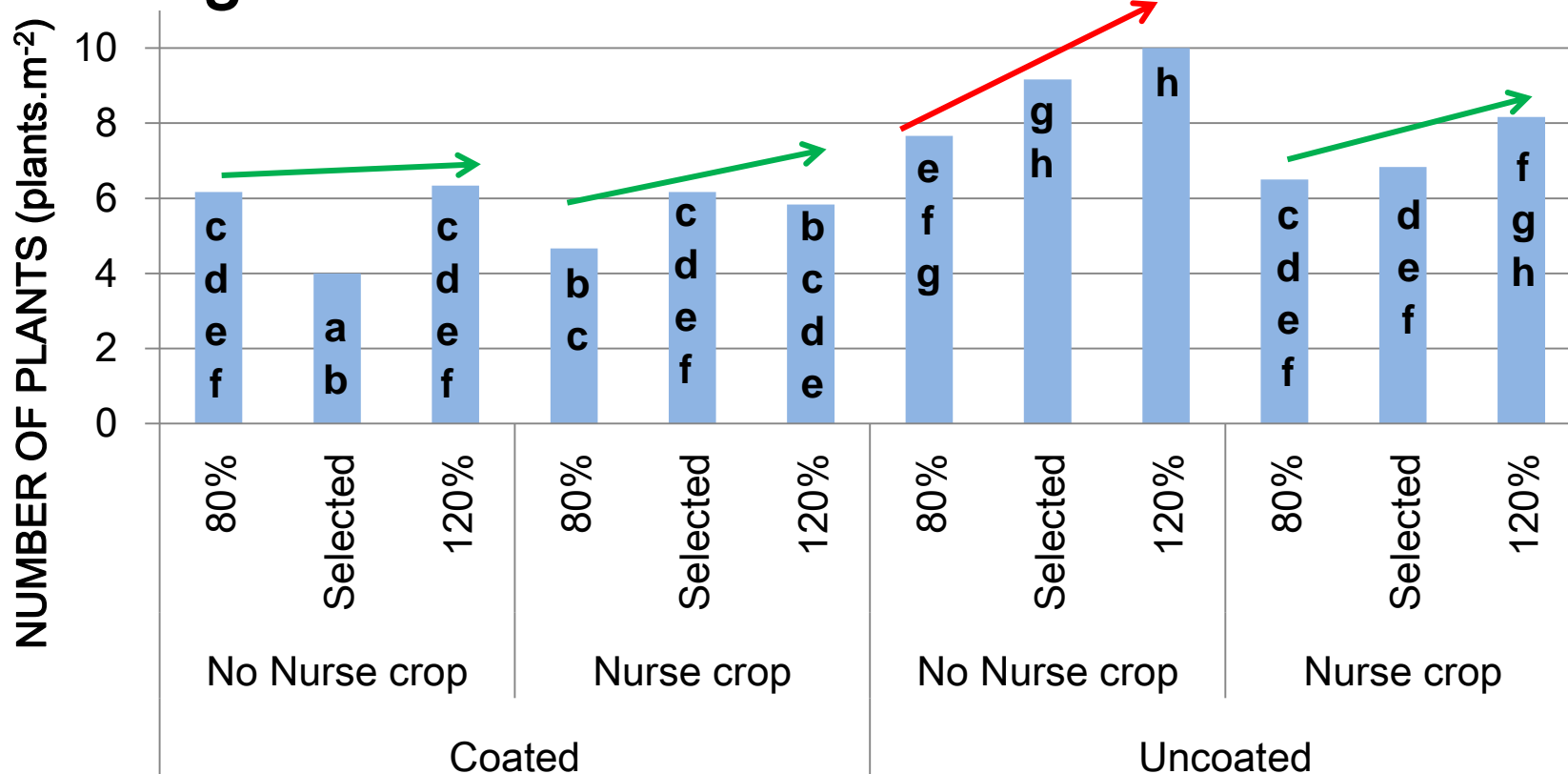


Figure 4: The number of *D. eriantha* plants.m⁻² area (season two) as influenced by the interactive effect of seeding rate (weight basis)-, nurse crop- and seed coating treatments.

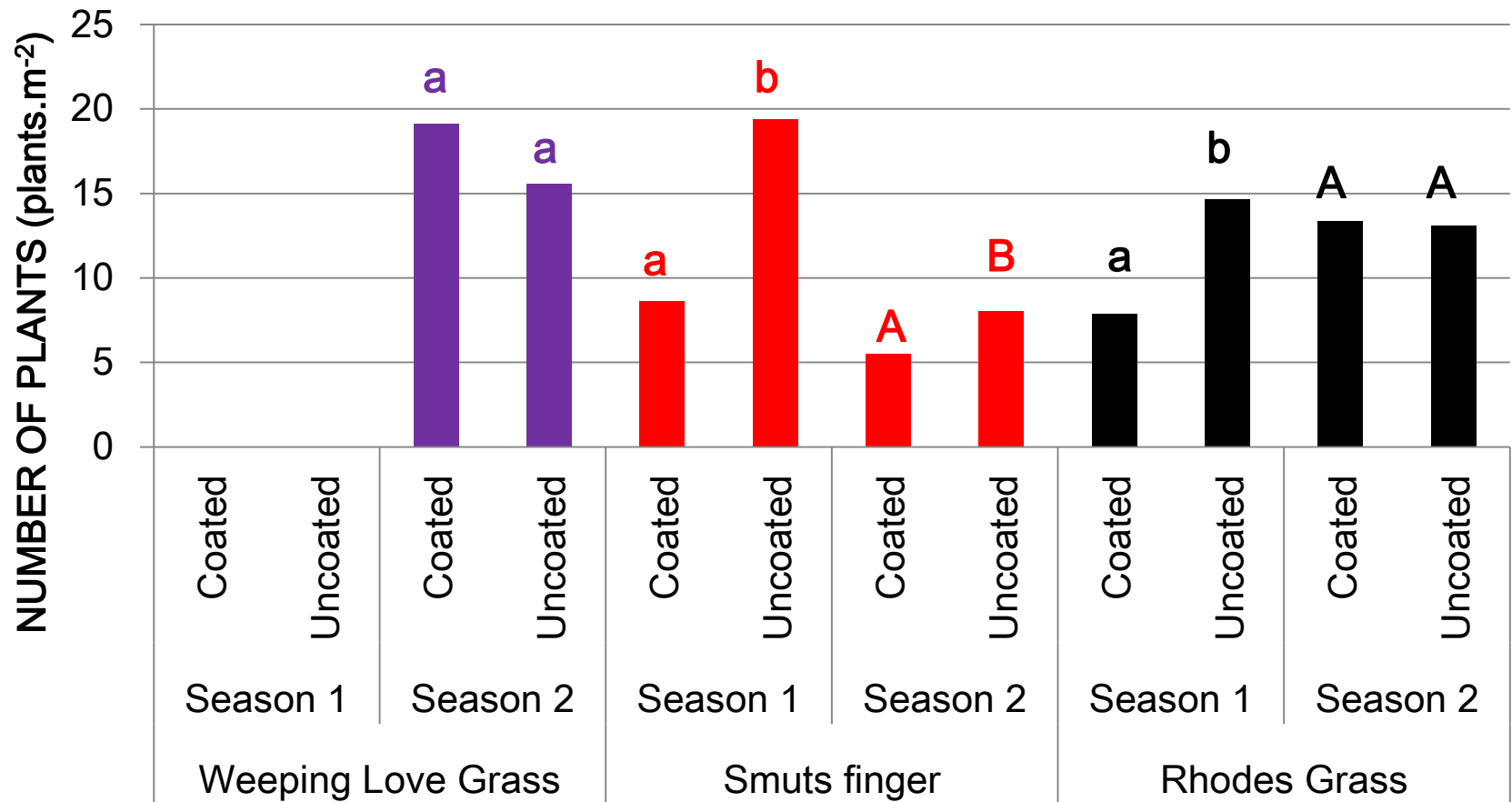
Means with the same letter are not significantly different at P>0.1



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Coated seed





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Nurse Crop – *D. eriantha*

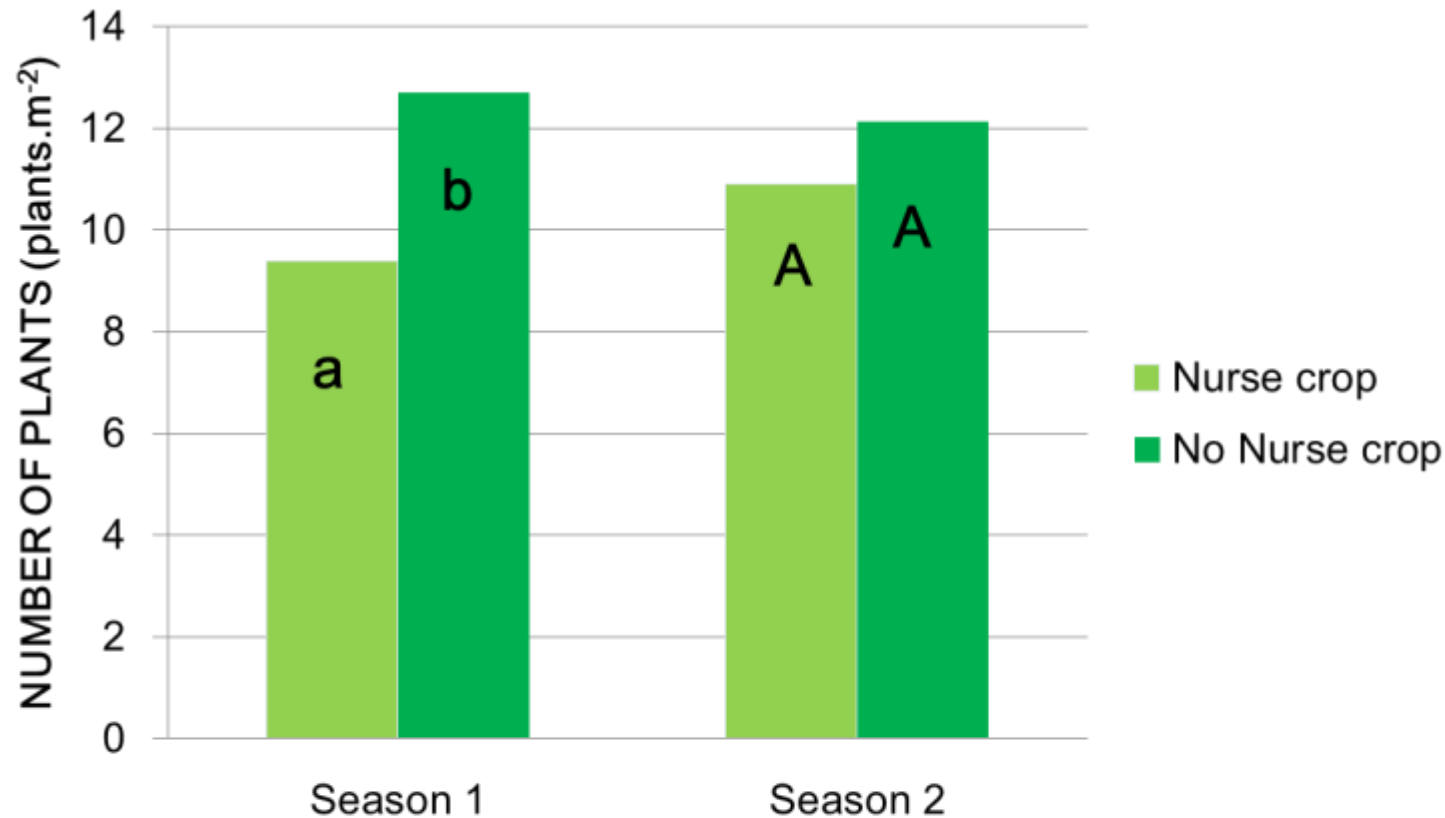


Figure 5: The number of *D. eriantha* plants.m⁻² area (season one) where nurse crop was a treatment.

Means with the same letter are not significantly different at $P > 0.05$



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Nurse Crop – *C. gayana*

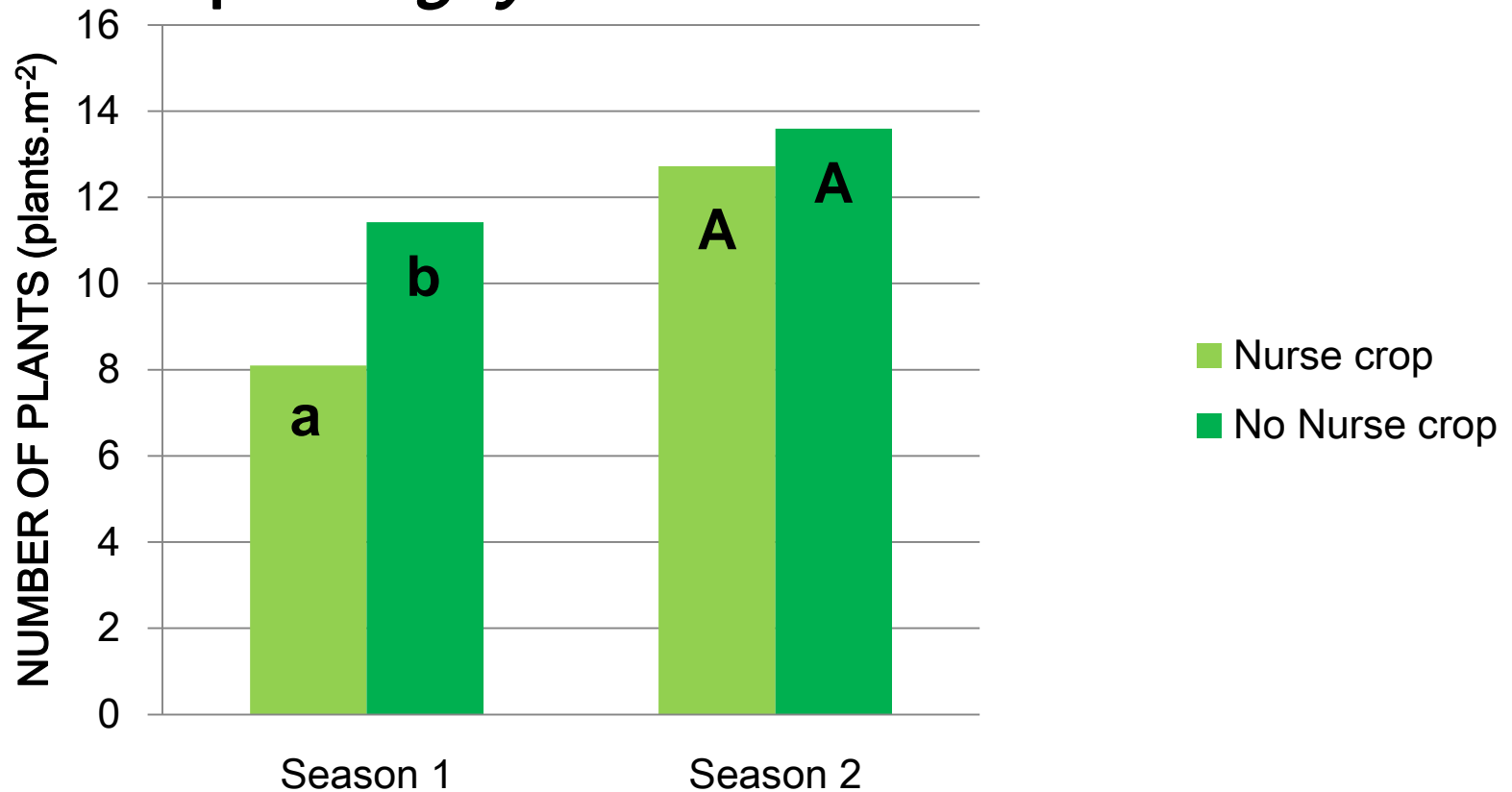


Figure 6: The number of *C. gayana* plants.m⁻² area (season one and –two, spring planting date) where nurse crop was a treatment.

Means with the same letter are not significantly different at P>0.05



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Nurse Crop – *E. curvula*

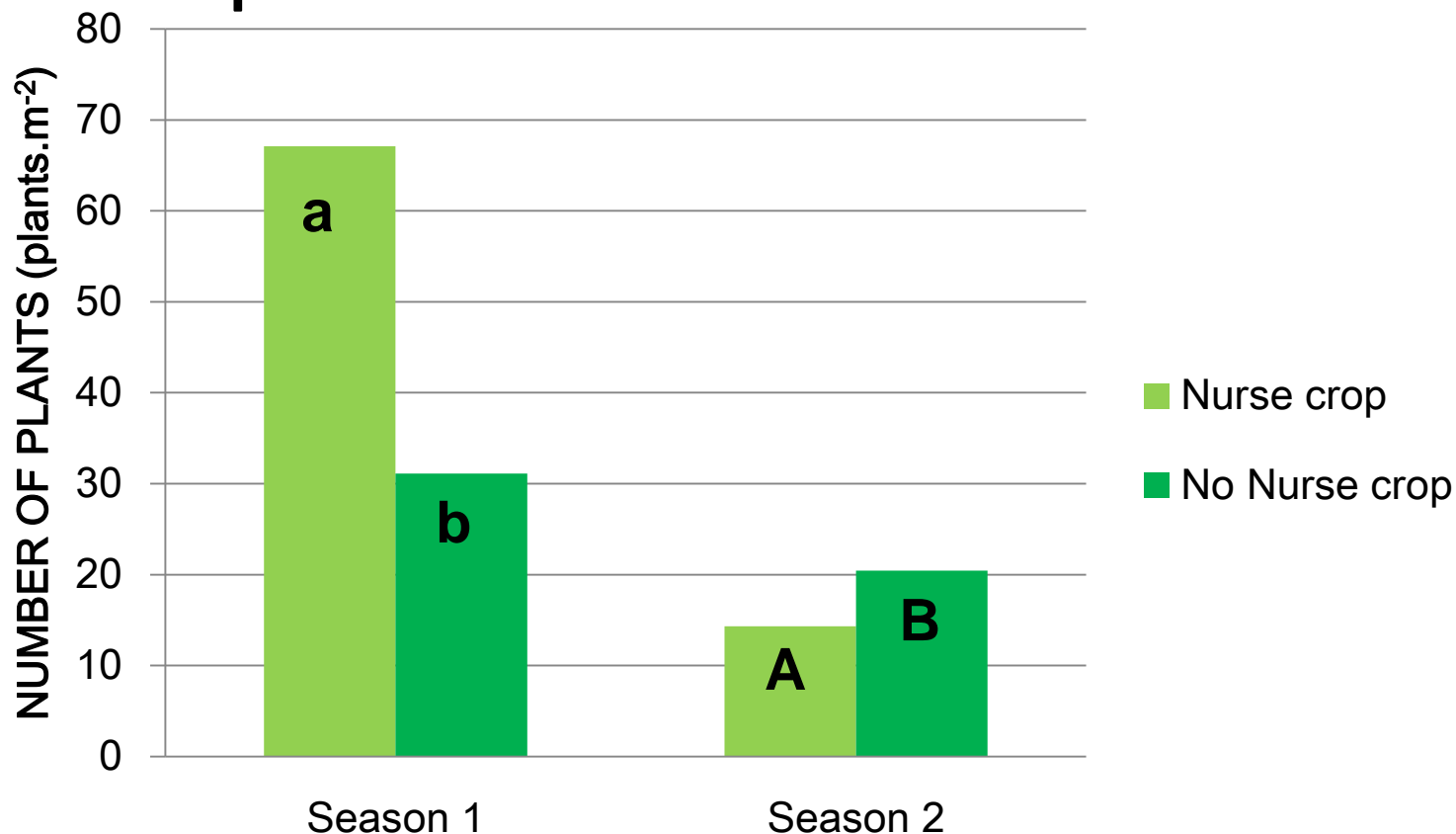


Figure 7: The number of *E. curvula* plants.m⁻² area (season one and –two) where nurse crop was a treatment.

Means with the same letter are not significantly different at $P > 0.05$



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Conclusions – Seeding rates

- 1st season - ↑↑ the seeding rate will result in a higher plant density
- 2nd season - *E. curvula* or *C. gayana*:
 - ↑↑ seeding rate - no significance in the number of plants

D. eriantha:

 - ↑↑ seeding rate - number of plants can still be higher due to secondary dormancy qualities
 - It takes long for *D. eriantha* to establish



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Conclusions – Nurse crop

Eragrostis tef as a nurse crop for *D. eriantha* or *C. gayana*

1st season: Higher plant density, but significantly lower perennial plants

2nd season: no significant differences in plant density

- Inter-species competition between *E. tef* and *D. eriantha* and *C. gayana* was low. These species belong to different genus's





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Conclusions – Nurse crop

Eragrostis tef as a nurse crop for *E. curvula*

1st season: higher plant density (undistinguished)

2nd season: lower number of perennial spp

- High inter-species competition, especially when it is taken into consideration that *E. tef* and *E. curvula* are species from the same genus (*Eragrostis*)
- Adjusting the seeding rates and using of a nurse crop does have significant effects on the establishment success of perennial species



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References

Payne RW, Murray DA, Harding SA, Baird DB, Soutar DM. 2012. GenStat® for Windows™ (15th Edition). Introduction. VSN International, UK.

Snedecor GW, Cochran WG. 1980. Statistical methods (7th Ed.). Ames: Iowa State University Press, p 234.



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Thank you

