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EVALUATION OF SUNNHEMP TREATED WITH A BIO-CONTROL AGENT IN SHORT ROTATIONS FOR CONTROL OF ROOT-KNOT NEMATODE (*MELOIDOGYNE JAVANICA*) DISEASE COMPLEXES

Kutsaga Research Station

Harare, Zimbabwe.

T. Mahere, M. Marunda, C. Chinheya, S. Dimbi.

CORESTA AP CONFERENCE, CANCUN, MEXICO

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Presentation Outline

1. **Introduction**
2. **Main objective**
3. **Materials and Methods**
4. **Results**
   i. Nematode population monitoring
   ii. Soreshin disease index
   iii. Root Galling index
5. **Discussion and Conclusion**
6. **Acknowledgements**

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Background:

- It has become **standard practice**, the world over – crop production practices be done in a **sustainable** manner;
- Integrated Pest Management (**IPM**) Strategy adopted
- Tobacco is no exception;
- In Zimbabwe an IPM Approach to Pest and Disease Mgt is recommended to all growers

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Introduction

- IPM in root-knot nematode control adopted
  - **Plant resistance** (all Kutsaga varieties have varying levels of RKN resistance);
  - **Greener nematicides** (plant based);
  - **Biological control** – testing a wide range from various sources worldwide & intensive work to search for new suitable local isolates
  - **Cultural control** (float tray seedling production method, timing of planting, rotations, relay cropping – G HR1,);

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Introduction (Cont'd)

- RKN infection has been reported to occur as a complex with other **soil-borne pathogens** notably *Fusarium* and *Rhizoctonia* spp. (Kassie, 2019; Back *et al*., 2002)
- This necessitates a consideration of combinations in developing suitable management options;
- A combination of rotation crops and **BCAs is one such option**;

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Main Objective

- To evaluate the efficacy of Sunnhemp in combination with *T. harzianum* (T77) for the management of both root-knot nematodes and,
- soreshin causal agents (*Rhizoctonia* | *Fusarium* spp).

Tobacco (K RK26R and K M10) in Nematology Microplots

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Materials and Methods

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Study Site:

Kutsaga Research Station, Harare, Zimbabwe

Location	**17 ° 55’ S ; 31 ° 08’ E**
Altitude	**1479 m asl**
Mean annual rainfall	**750 - 950 mm**
Mean summer temp.	**32°C**
Mean winter temp.	**18°C**

Soils: deep and permeable, light textured sandy loams.

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Materials & Methods (cont'd)

- Microplot trial - 3 seasons;
- Microplots grown to RKN-Susceptible tomato variety;
- Tomato plants inoculated with *M. javanica*;

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Materials & Methods (cont'd)

- Tobacco transplanted into microplots – inoculated with soreshin 0.25 g dried mycelium/ planting station at transplanting;
- *Crotolaria juncea* (Sunnhemp) used.

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Materials & Methods (cont'd)

Rotation cycle procedure

i. Microplots grown to RKN-Susceptible tomato variety; then inoculated with *M. javanica* (5000/p.s.)

ii. Tomato plants maintained for 8 weeks and then cleared;

iii. 24 hours before sowing, seed of relay crop (*Crotolaria juncea* - Sunnhemp) treated with *Trichoderma harzianum* (6-10 g/kg), then sown and maintained for 6 weeks;

iv. At flowering 6 WAS - ploughed under and left to decompose for a further 9 weeks

❖ For Control plots only steps iii. and iv. not done.

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Materials & Methods (cont'd)

Soreshin assessment of tobacco

Rotation cycle procedure (contd)

- Tobacco transplanted into microplots & inoculated with *Rhizoctonia solani* and *Fusarium oxysporum*.
- 0.25 g dried mycelium of each pathogen/ planting station at transplanting;
- Trichoderma applied at transplanting (0.2 g/ p.s.)

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Materials and Methods

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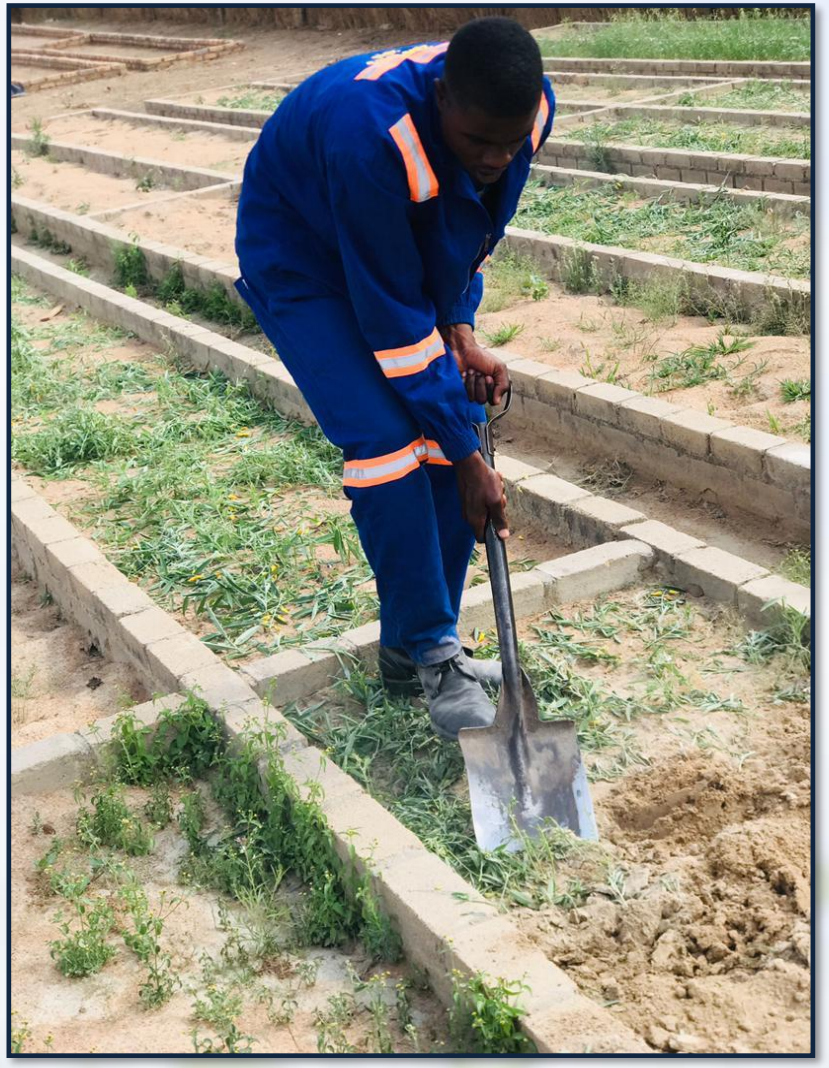
Six treatments as follows:

1) Untreated Control (clean)
2) Disease Control (RKNs + Complex)
3) Trichoderma-treated sunnhemp
4) Trichoderma-treated sunnhemp + Trichoderma at planting
5) Trichoderma only
6) Sunnhemp only



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Experimental Design

- **CRD:** 2 x 6 Factorial arrangement replicated 3 times [10 plants/plot];

	Factor 1 (Variety)		**Factor 2 (Rotations)**
1.	K M10	1.	Control (with RKNs + soreshin)
2.	K RK26R	2.	Control (without disease)
		3.	Trichoderma (T77) at planting
		4.	Sunnhemp 15 WBP
		5.	Sunnhemp (T77 seed-treated) 15 WBP
		6.	Sunnhemp (T77 seed-treated) 15 WBP+ T77 at planting

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The Procedure (Cont'd)

T77 recovered from root samples

Leaf assessments

- Soreshin disease assessments - 4 and 6 weeks after planting.
- RKN population trends at 5, 10 and 15 WAP;
- End-of-season root galling assessments at 20 WAP;

{**NB**: Trial repeated for 3 seasons}

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Measurements

1) **RKN population trends** at 5, 10 and 15 WAP;

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Measurements (cont'd)

2) **Soreshin disease severity**
using 0-5 scale where;

0 – no damage

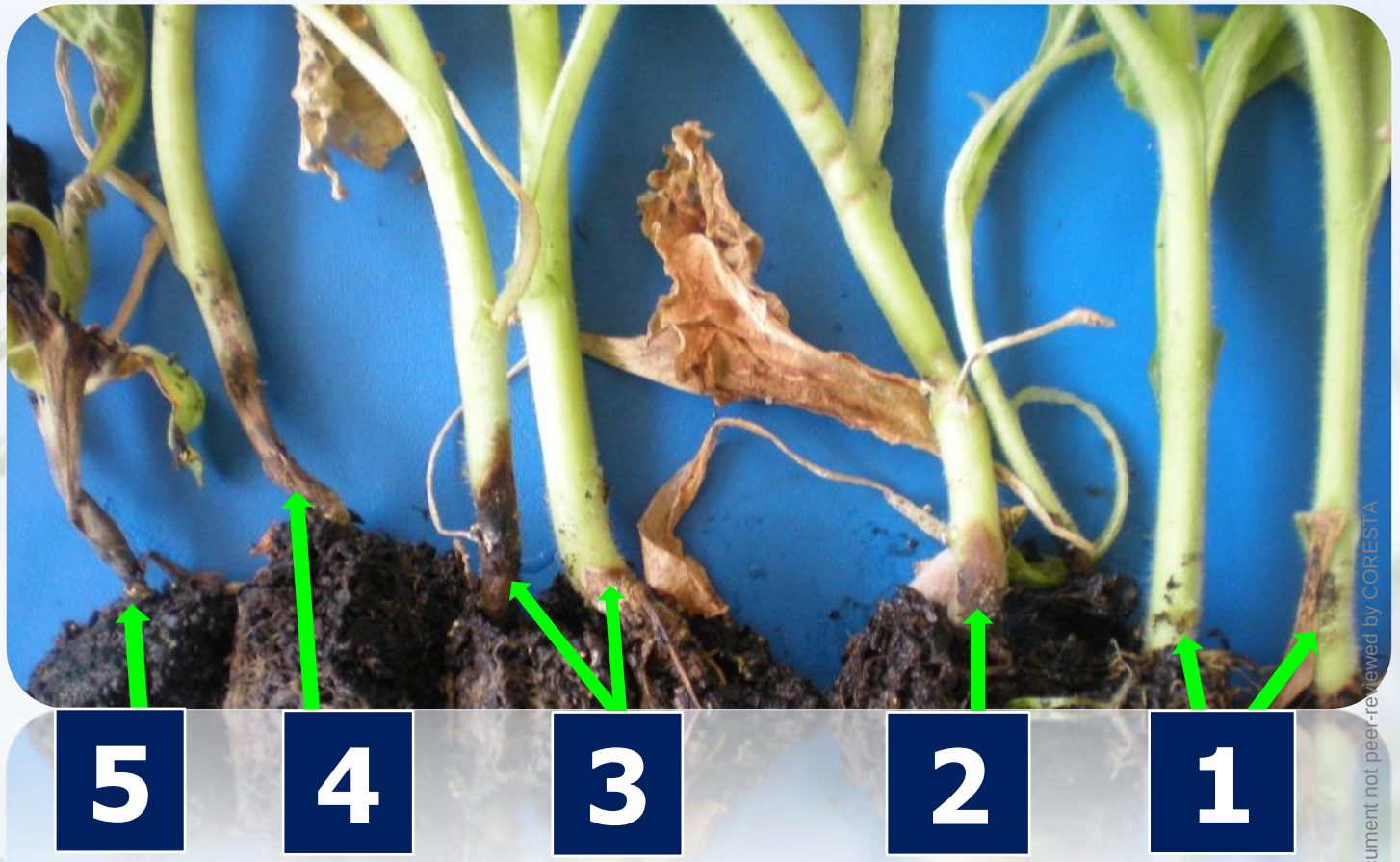
1 – 0 - 1% Slight damage on stem

2 – 1.1 - 10% Two lesions on stem, slight root discoloration

3 – 11 - 25% Several lesions on stem, about one third of root discoloured

4 – > 26% Extensive lesions on stem, remains of root discoloured

5 – Plant dead



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Measurements (cont'd)

3) **Root knot damage severity** using Nusbaum and Dalton scale where;

Infection class	Description of degree of galling
0	Free from galls
1	Trace infection, less than 5 galls
2	Very slight, trace to 25 galls
3	Slight, 26 to 100 galls
4	Moderate, numerous galls, mostly discrete
5	Moderate, heavy, numerous galls, many coalesced
6	Heavy, very numerous galls, mostly coalesced, root growth slightly retarded
7	Very heavy, mass invasion, slight root growth
8	Extremely heavy, mass invasion, no root development

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Data analysis

- ANOVA - Genstat Statistical Package (Version 22)
- 5 % level of significance
- Duncan's post-hoc test was performed for the multiple comparisons.

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RESULTS

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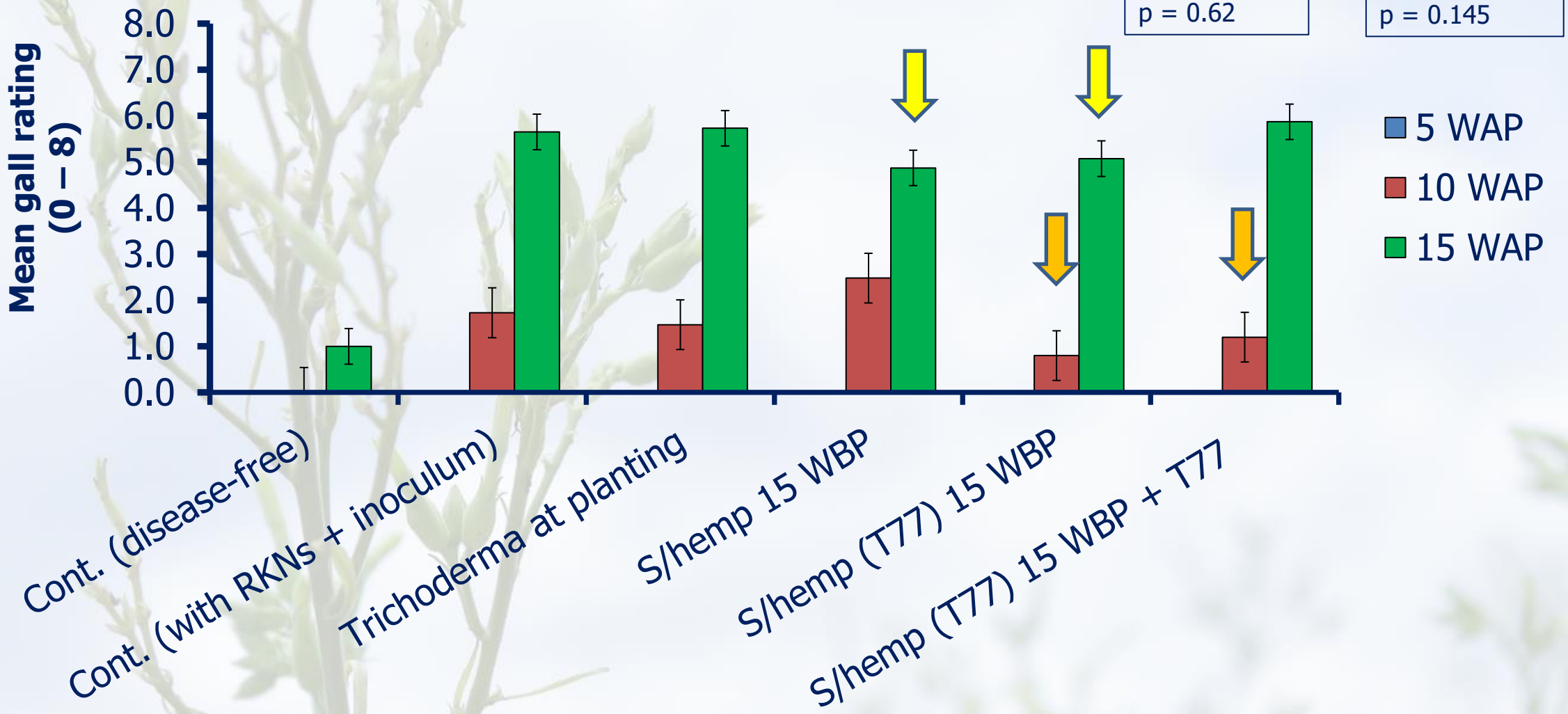
RKN Populations - K M10 – S1

10 WAP
S.E. = 0.74,
LSD = 1.53,
p = 0.62

15 WAP
S.E. = 0.53,
LSD = 1.09,
p = 0.145



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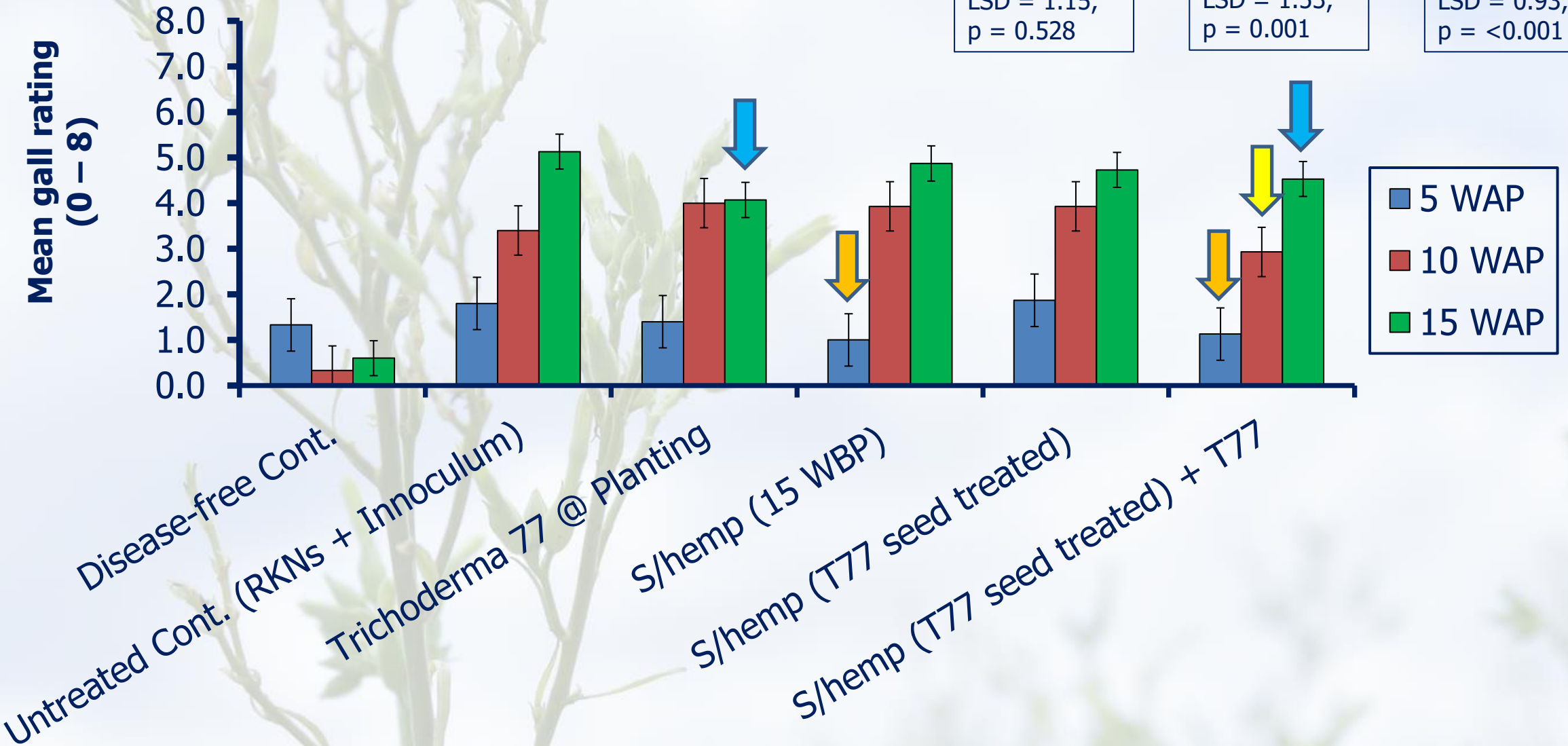
RKN Populations - K M10 – S2

5 WAP
S.E. = 0.53,
LSD = 1.15,
p = 0.528

10 WAP
S.E. = 0.70,
LSD = 1.53,
p = 0.001

15 WAP
S.E. = 0.43,
LSD = 0.93,
p = <0.001



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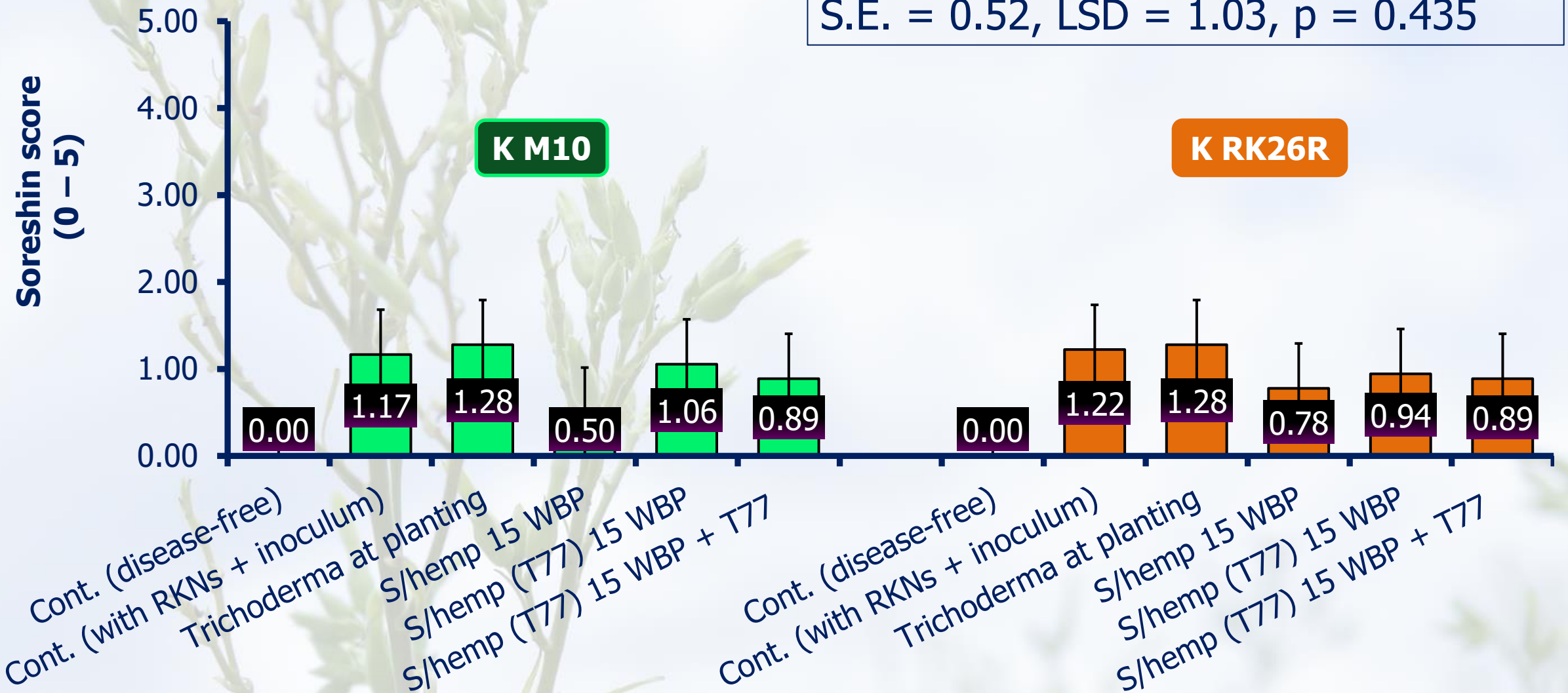
Soreshin Data (4 WAP) – S1

S.E. = 0.52, LSD = 1.03, p = 0.435



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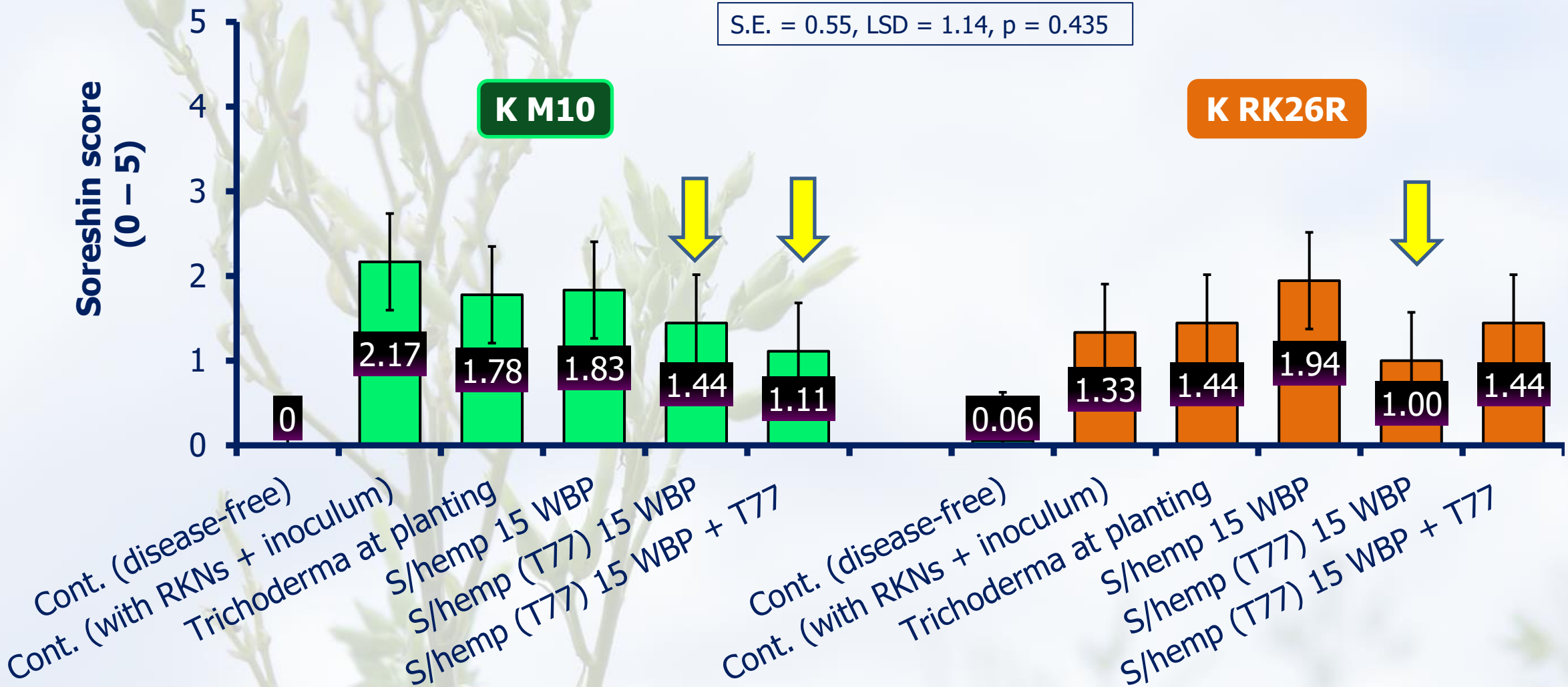
Soreshin Data (6 WAP) – S1



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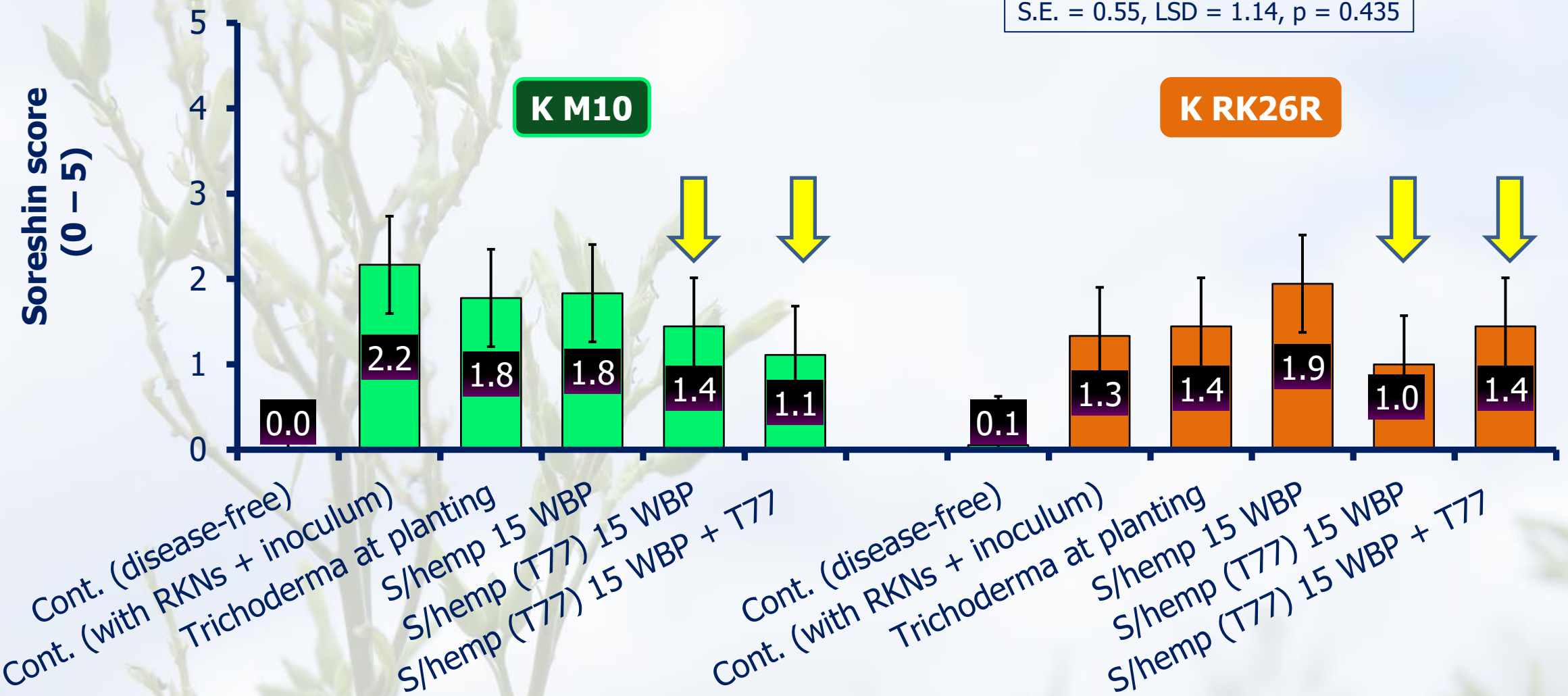
Soreshin Data (4 WAP) – S2

S.E. = 0.55, LSD = 1.14, p = 0.435



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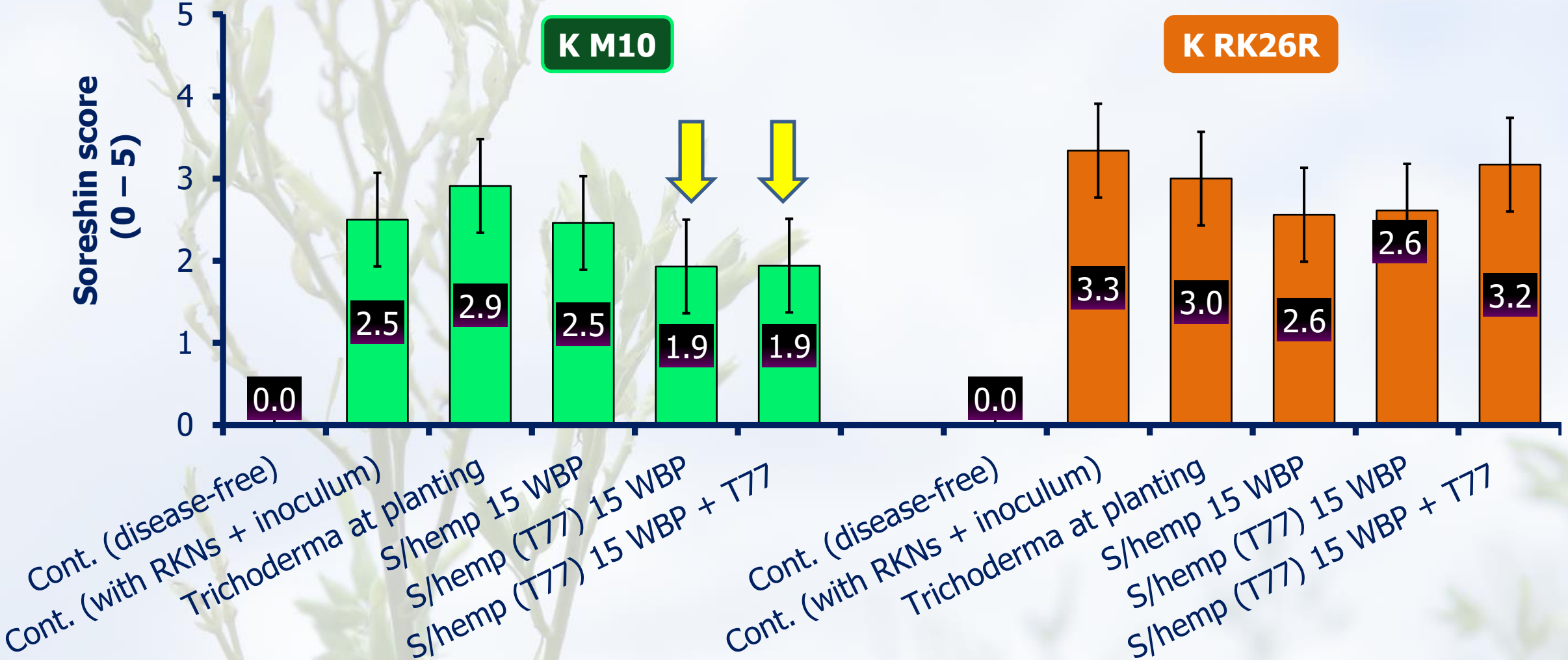
Soreshin Data (6 WAP) – S2

S.E. = 0.55, LSD = 1.14, p = 0.435



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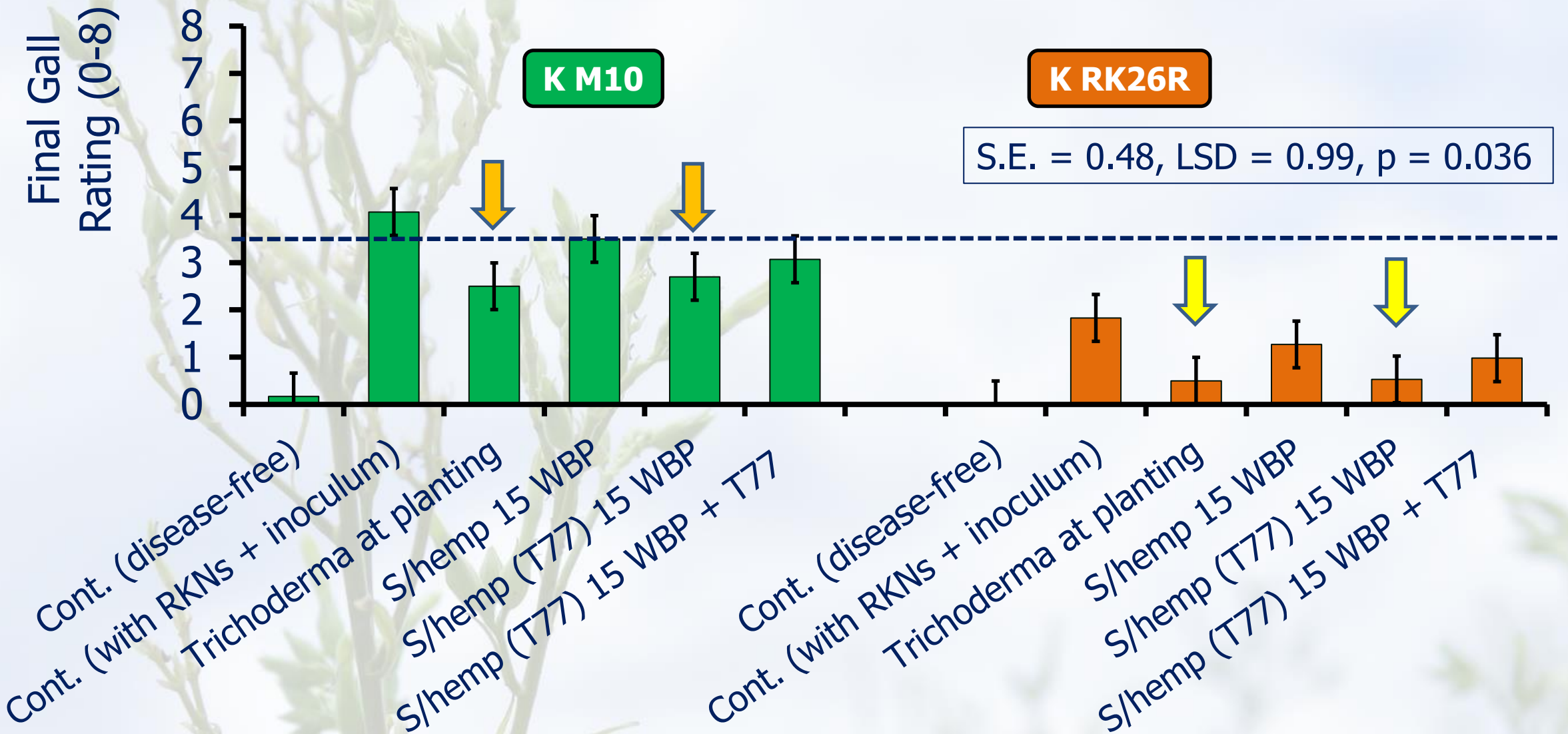
Final Mean Gall ratings – S1



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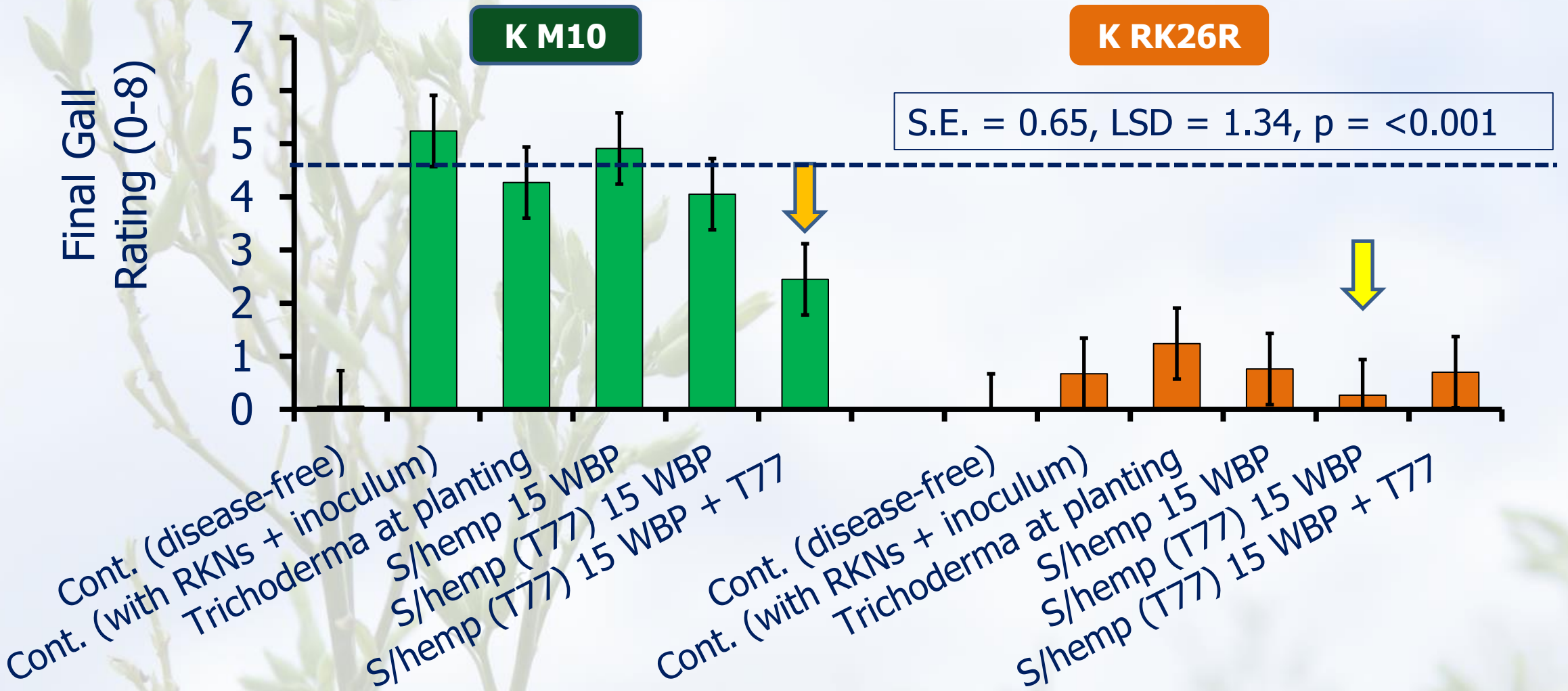
Final RKN Gall ratings – S2



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Summary of Results

- Sunnhemp seed-treated with T77 suppressed RKN populations EFFECTIVE;
- Most notable at 10-15 WAP;
- Application of T77 at planting after having a seed-treated relay crop improves the control of both *Fusarium*, *Rhizoctonia* and RKNs

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Discussion and Conclusion

- Combination of suitable relay crops with T77 provides an **effective nematode management option** for the Zimbabwean tobacco grower;
- Used in an **IPM** setting in combination with **resistant varieties, recommended cultural control** measures and the available greener nematicides;
- Continuous use has greater benefit;
- Continued testing & **Bioprospecting** required to find more isolates.

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Acknowledgements

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- **CORESTA Secretariat**

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Linked in Tafadzwa Mahere

tmahere@kutsaga.co.zw

+263 771 523 469

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