



ANNGRO™



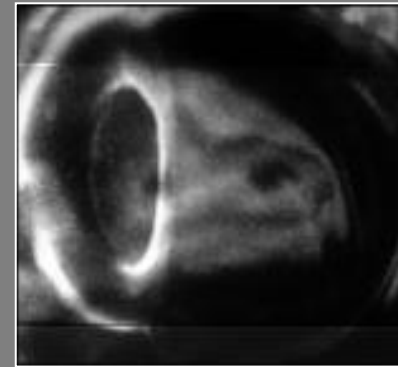
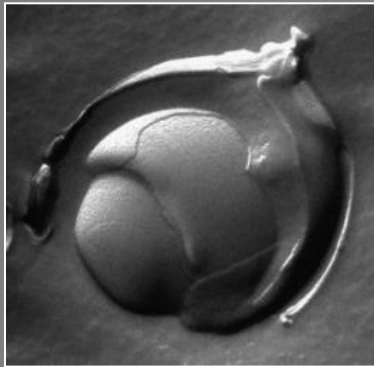
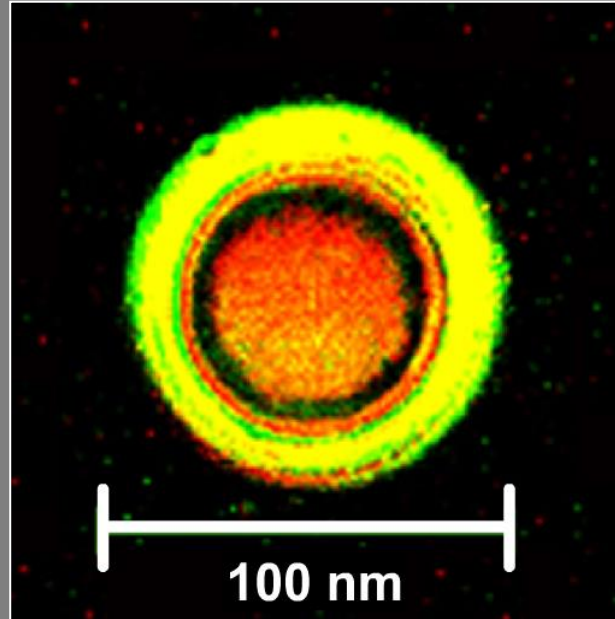
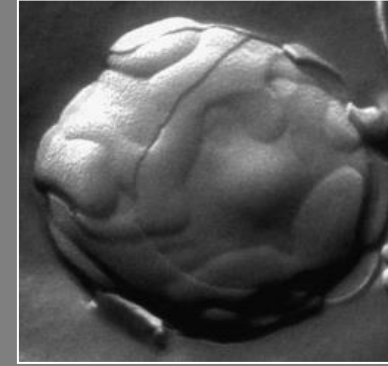
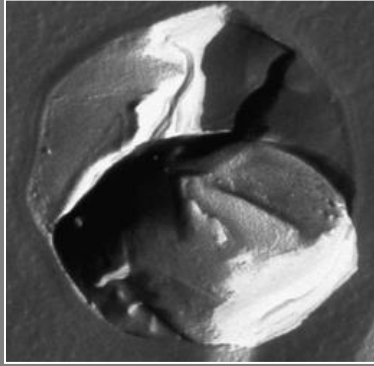
BioPher™

ANNGRO™

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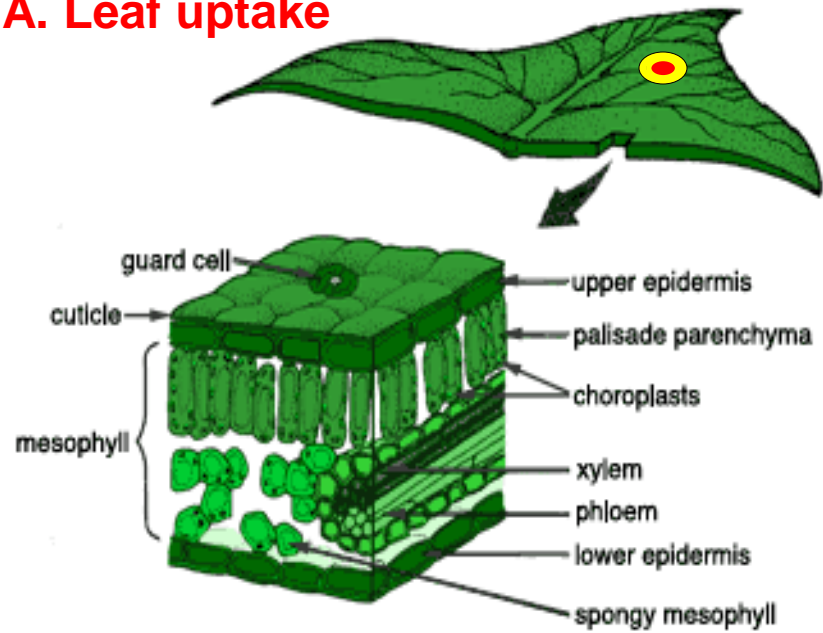
- What is AnnGro™?
- Mode of action
- AnnGro™ & **FOLIAR** applied fertilizer
- AnnGro™ & **SOIL** applied fertilizer
- AnnGro™ & reduced **NITROGEN LEACHING**
- AnnGro™ & **PESTICIDES**
- AnnGro™ & **HERBICIDE**

WHAT IS ANNGRO™: TRANSPORT VESICLE



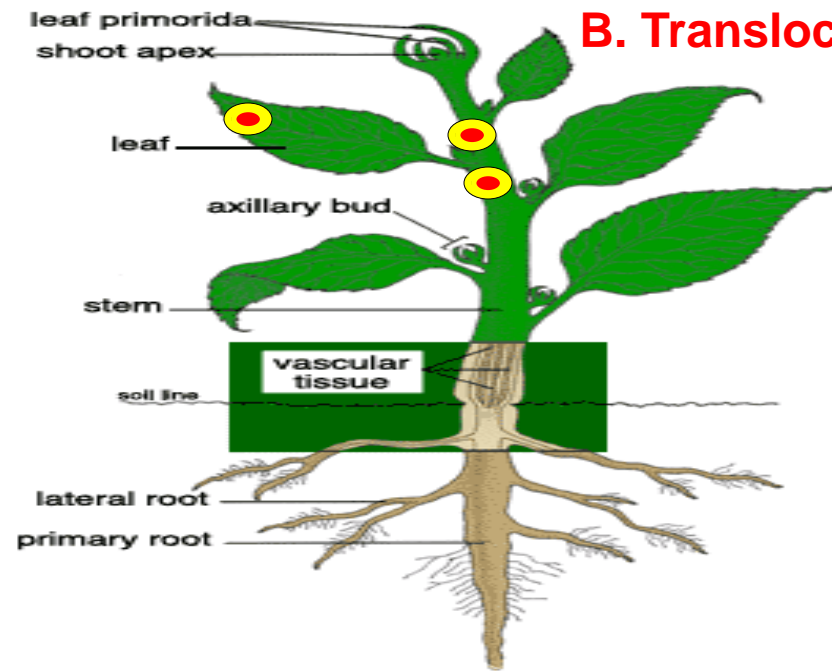
AnnGro™ consists of micro/nano sponges acting as nano transporters that have the ability to package diverse active compounds and swiftly transport them inside the plant as well as over membranes into plant cells. The packed molecules are released intracellular when the AnnGro™ vesicles are metabolized.

A. Leaf uptake



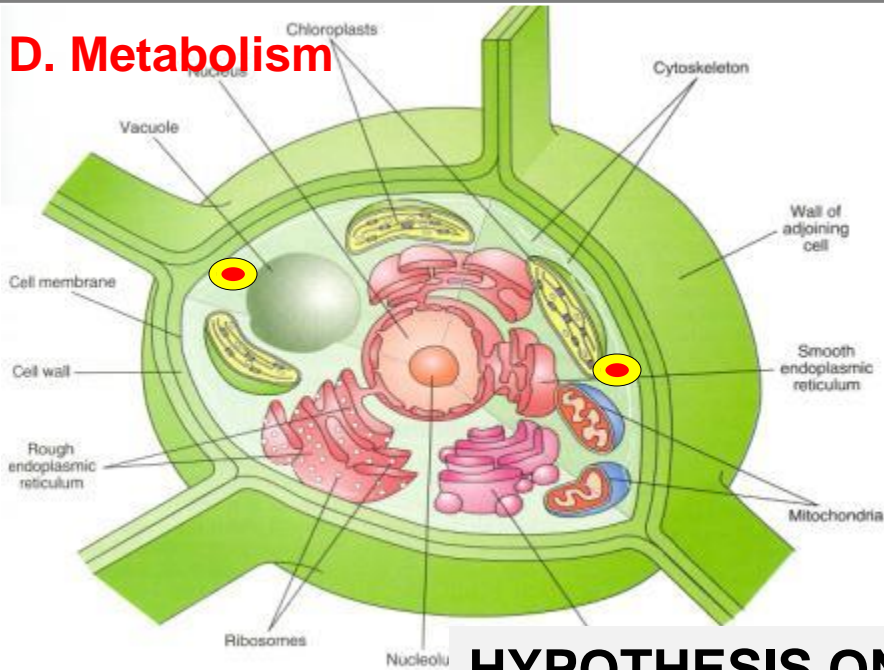
Leaf cross section

B. Translocation



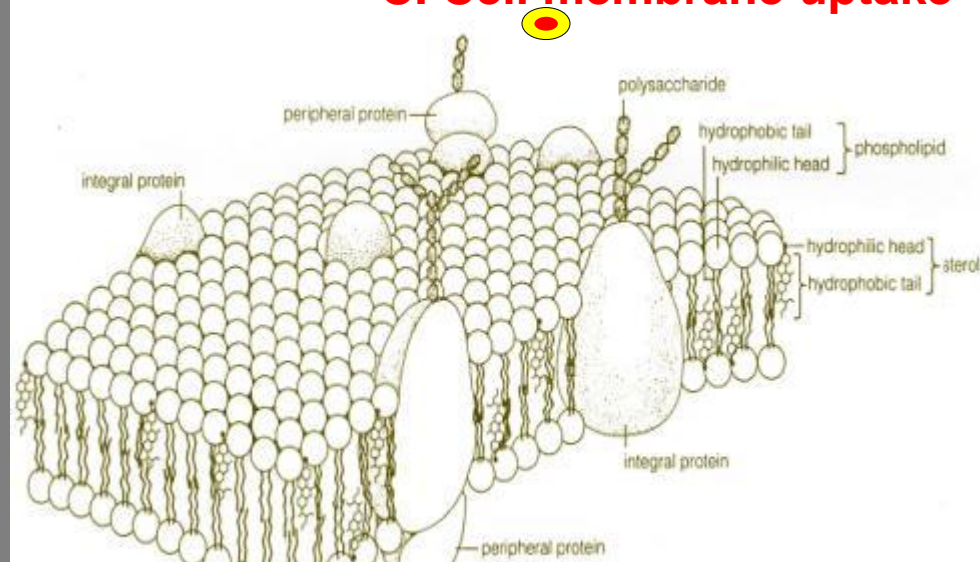
Principal Parts of a Vascular Plant

D. Metabolism



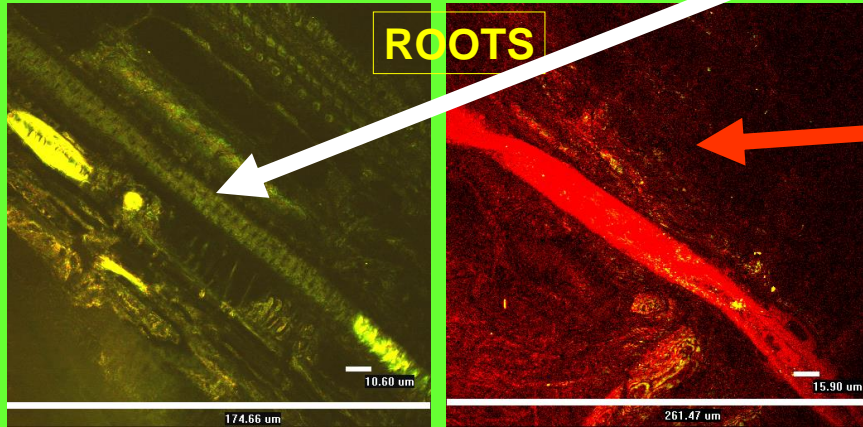
HYPOTHESIS ON MODE OF ACTION

C. Cell membrane uptake



Qualitative illustration of AnnGro's capability as an uptake enhancer, North West University

**Pv - PENETRATION AND DISTRIBUTION
IN DICOTHYL PLANTS - fluorescent
marker Nile Red**



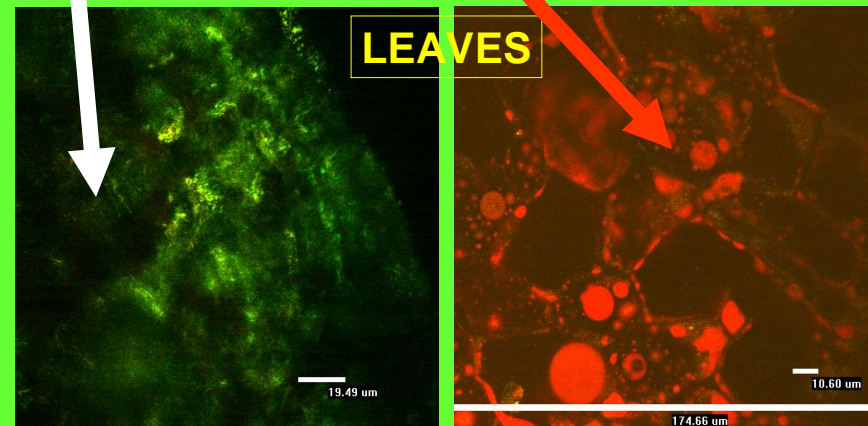
Control

Pv

**Red colouring agent without
AnnGro™**

**Red colouring agent with
AnnGro™**

**Pv - PENETRATION AND DISTRIBUTION
IN DICOTHYL PLANTS - fluorescent
marker Nile Red**



Control

Pv

Pv = AnnGro™

EFFICACY RESULTS

AnnGro & **Foliar** Feeding

A. IMPROVED UPTAKE

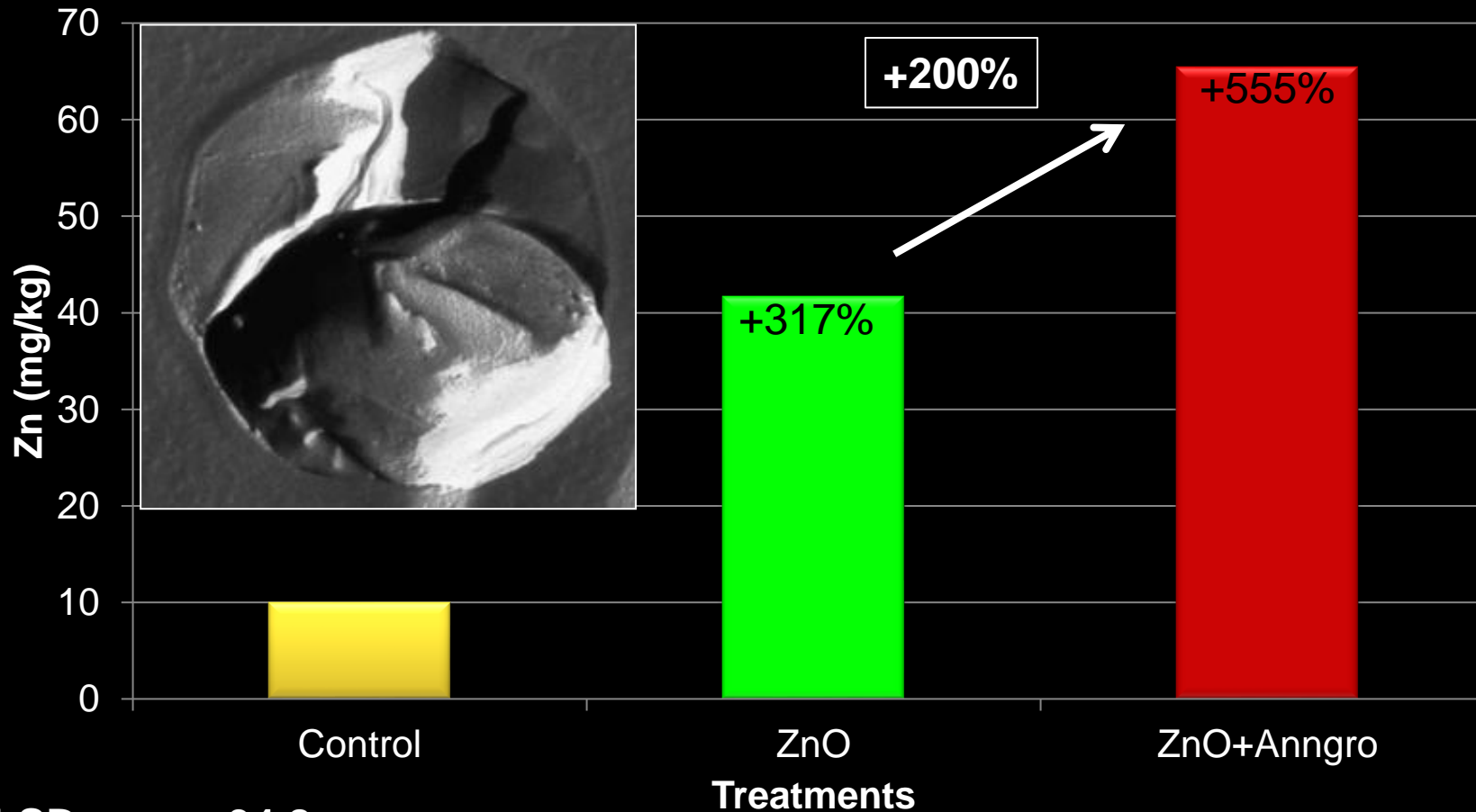
B. ENHANCED TRANSPORT

C. CELL MEMBRANE UPTAKE

D. METABOLISM

A. IMPROVED UPTAKE: zinc uptake in macadamia nuts - Nelspruit, South Africa

Zinc content in the leaf of Macadamias 4h after application



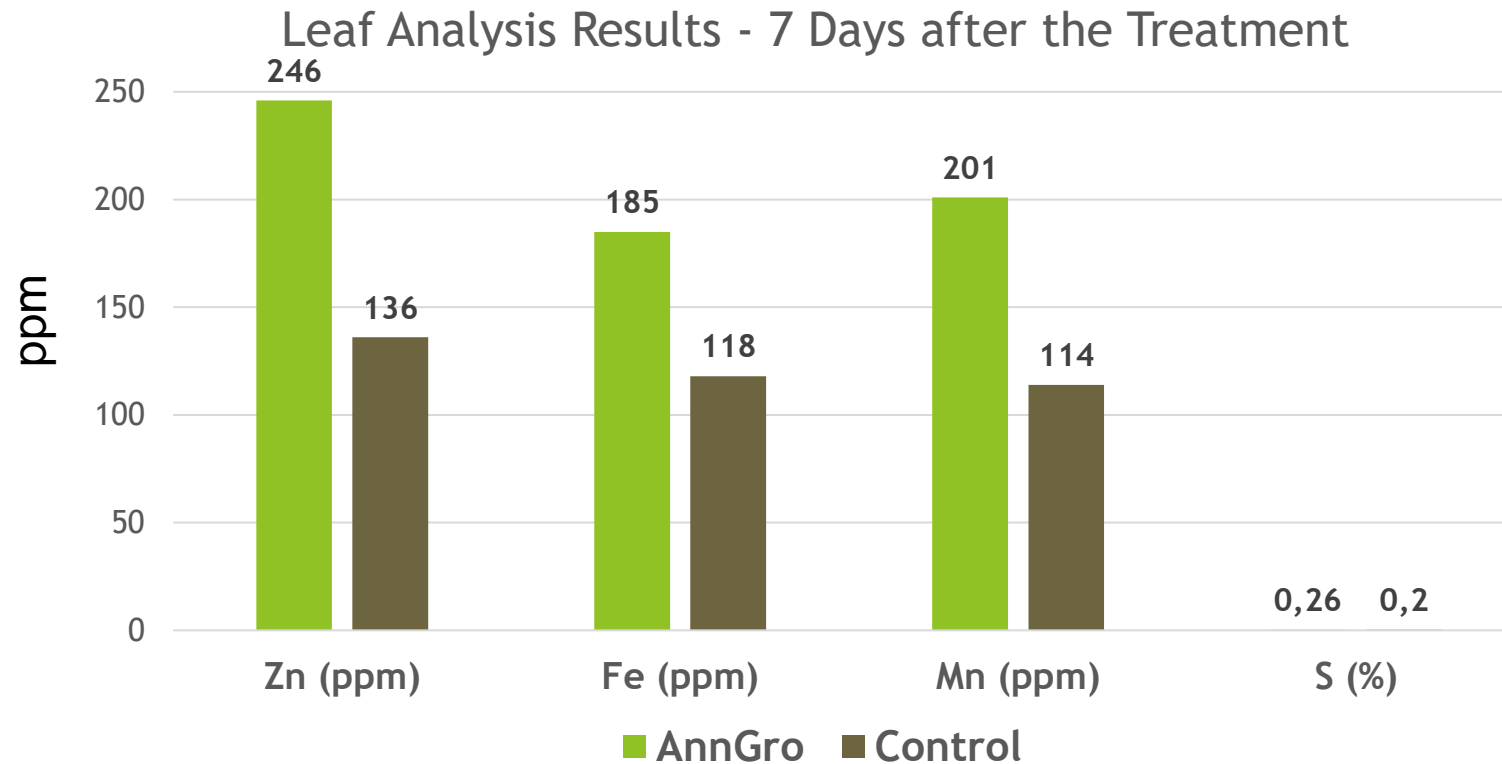
LSD $T(0.05) = 34.8$

Foliar applied $MnSO_4$ on maize,

University of Nebraska Extension Centre in Concord, NE,
USA, 2016

Manganese ppm 24 hour sampling			
Treatment	Average	Std dev.	% increase from control
Check (water control)	54.5	11.6	-
$MnSO_4$ only	188.4	76.3	246%
$MnSO_4$ + AnnGro	221.0	86.0	306%
Prob (all Mn vs check) > F : <.0001			
Prob (Mn-AnnGro vs Mn-only) > F : 0.0629			
Manganese ppm 5 day sampling			
Treatment	Average	Std dev.	% increase from control
Check (water control)	65.5	7.9	-
$MnSO_4$ only	183.3	27.9	180%
$MnSO_4$ + AnnGro	212.3	27.0	224%
Prob (all Mn vs check) > F : <.0001			
Prob (Mn-AnnGro vs Mn-only) > F : 0.0003			

Nutrients Foliar Applied to Almond Trees using AnnGro - April 2019 - SG Crop Science, California, USA



Note: Leaf analysis was completed by Precision Agri Lab April 2019. Data obtained from SG Crop, USA

Gratitude to SG Crop Science & Helena

Trial conducted by Helena R&D Team, Yuma, Arizona, USA,
2019



AnnGro Trial on Lettuce

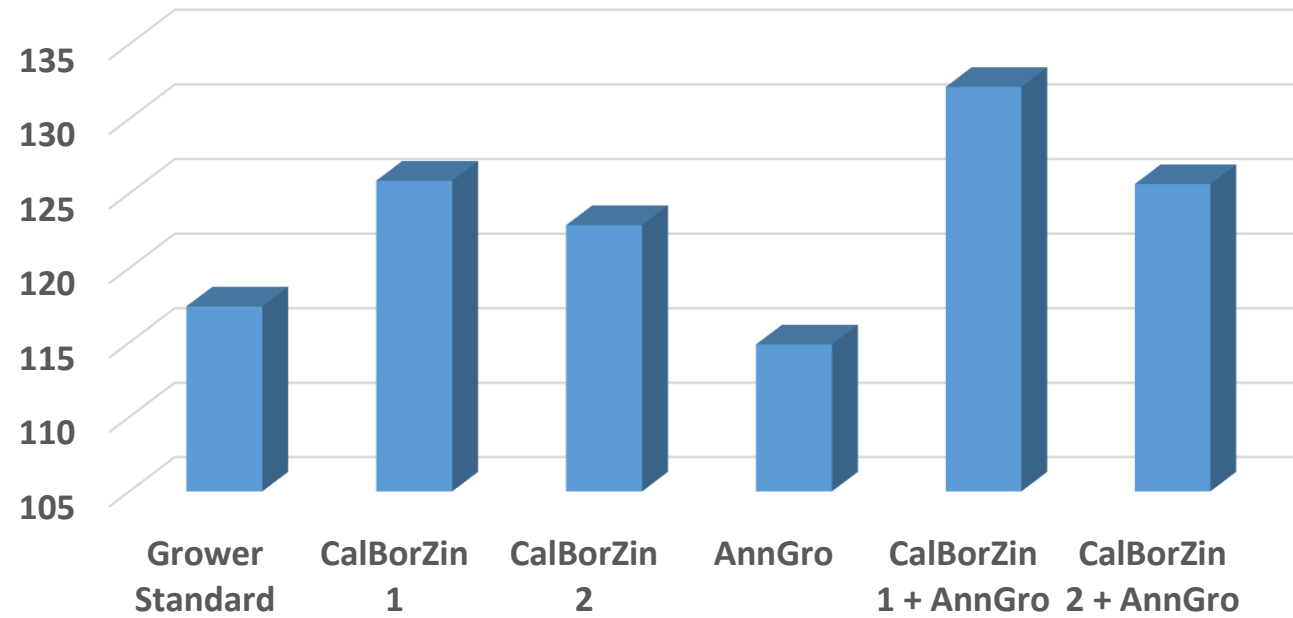
Treatment#	Treatment	Rate	Rate Unit	Timing	Code
1	Grower Standard				
2	CalBorZin	1pt/A		Post thinning	A
3	CalBorZin	1qt/A		Post thinning	A
4	AnnGro	48ml/A		Post thinning	A
5	CalBorZin	1pt/A		Post thinning	A
5	AnnGro	48ml/A		Post thinning	A
6	CalBorZin	1qt/A		Post thinning	A
6	AnnGro	48ml/A		Post thinning	A

- Study conducted in Fall of 2018 (Oct-Dec).
- RCB with 4-replications. Applications made foliar at thinning at 50 GPA
- Location: Yuma, AZ
- Objective: Evaluate AnnGro for its potential to help with uptake of micro-nutrients Ca, B and Zn and for yield increase in Lettuce.

Results



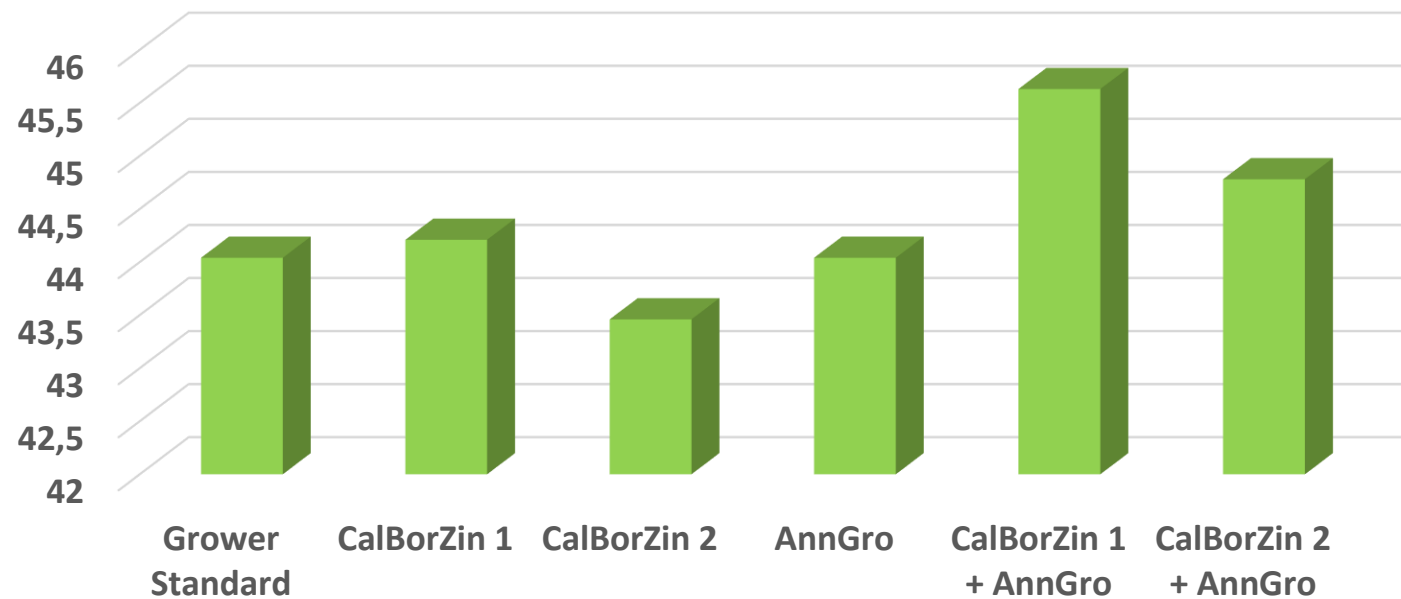
Plant Volume (cm)



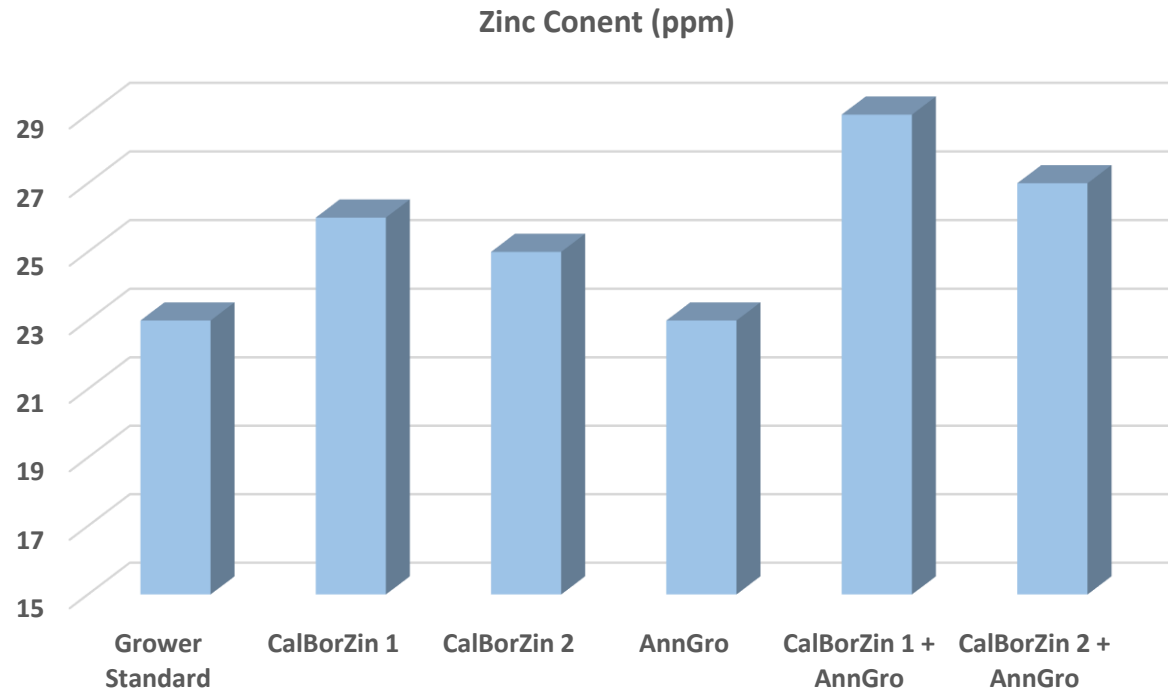
Results



Chlorophyl Content (SPAD)



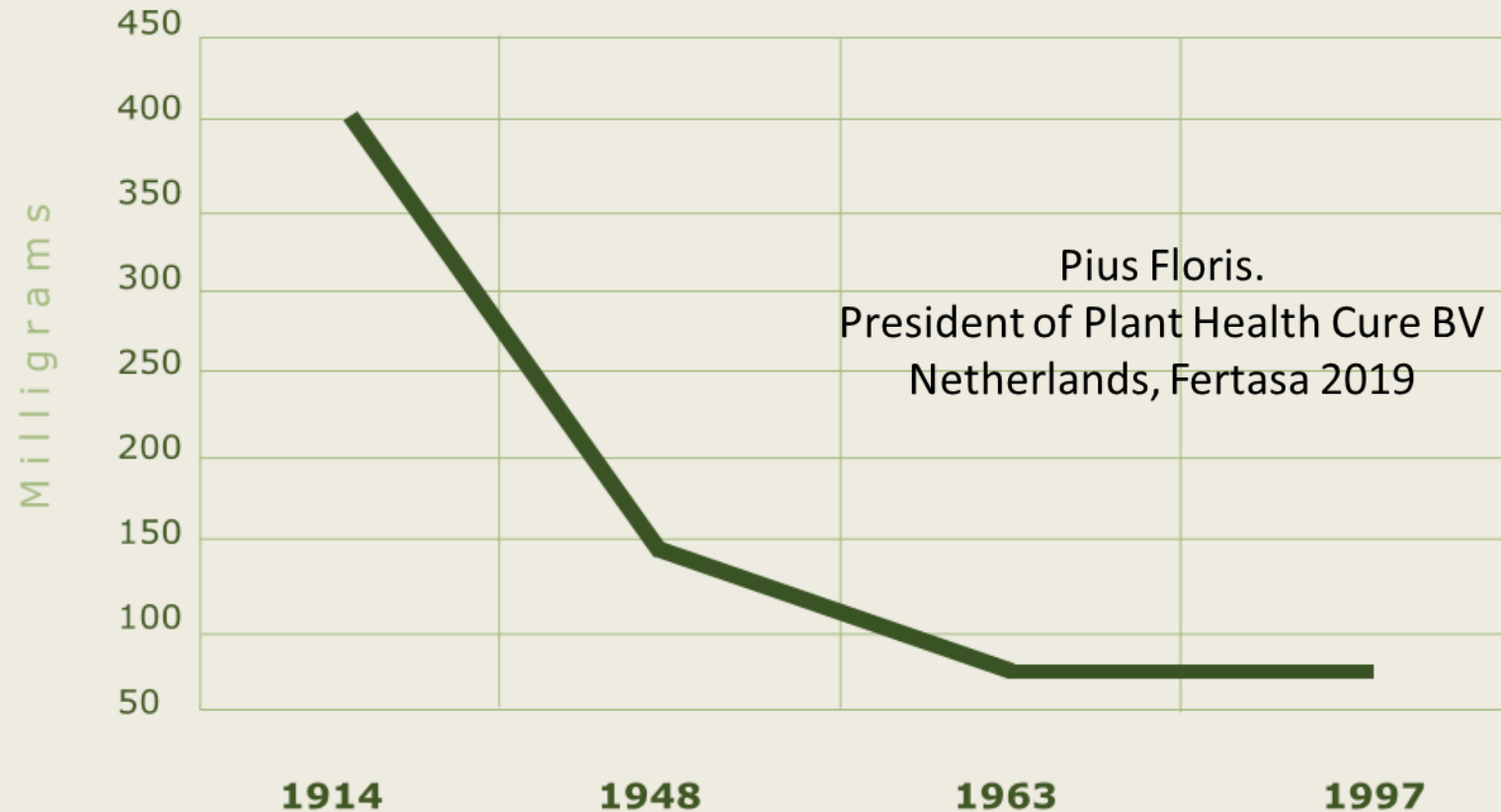
Results: Nutrient Uptake



1 + 1 = 3

Average Mineral Content in Selected Vegetables, 1914 -1997

Sums of averages of calcium, magnesium and iron in cabbage, lettuce, tomatoes and spinach



Pius Floris.
President of Plant Health Cure BV
Netherlands, Fertasa 2019

AnnGro[®] as a transporter of ⁶⁵Zn and ⁵⁴Mn into maize (*Zea mays* L.) plants via leaves

¹Shaba TJ, ¹Tshivhase VM, ²Zeevart JR, ¹Dlamini TC

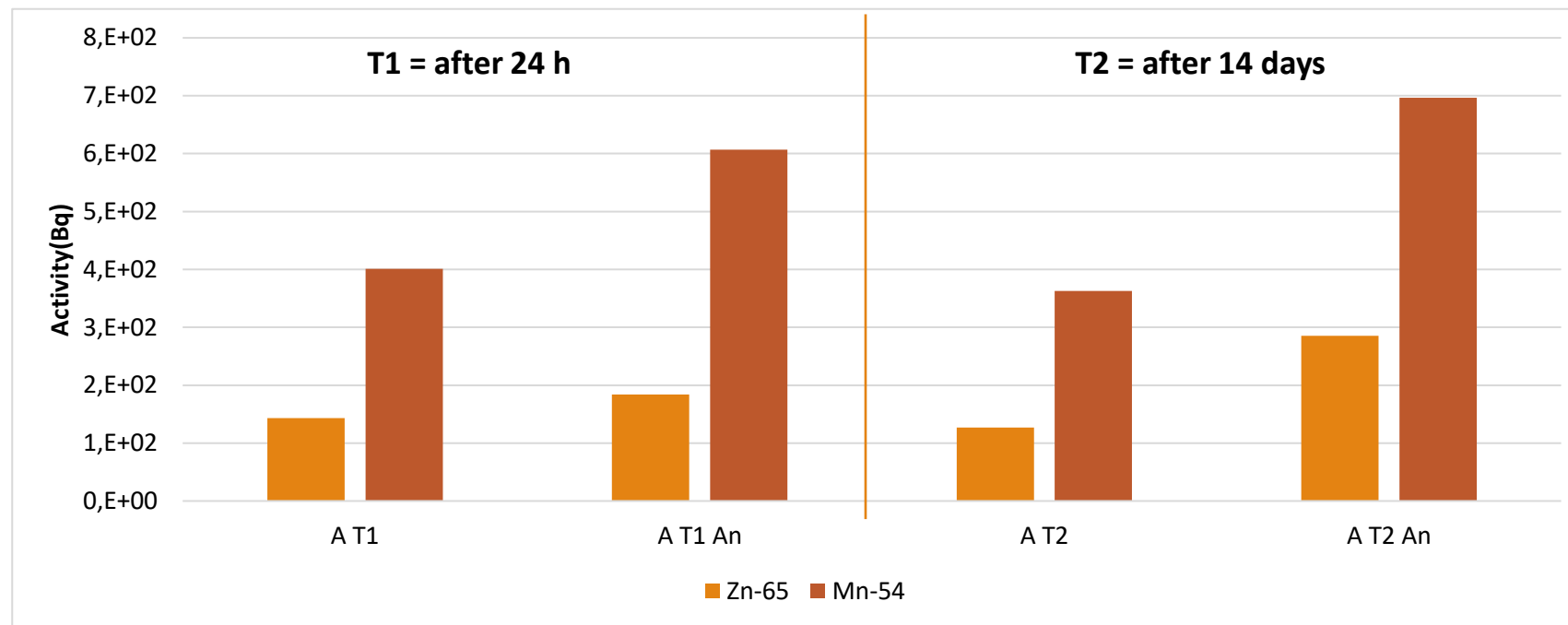
¹Centre for Applied Radiation Science and Technology, North-West University

²Nuclear Energy Corporation South Africa

Date : 25 September 2019



Preliminary data; Experiment 1: The content of ^{65}Zn and ^{54}Mn taken up by the maize leaf 24 h and 14 days after application with and without the addition of AnnGro.



A = Zn-65 activity (Bq) = 661,00; Mn-54 activity (Bq) = 537,00

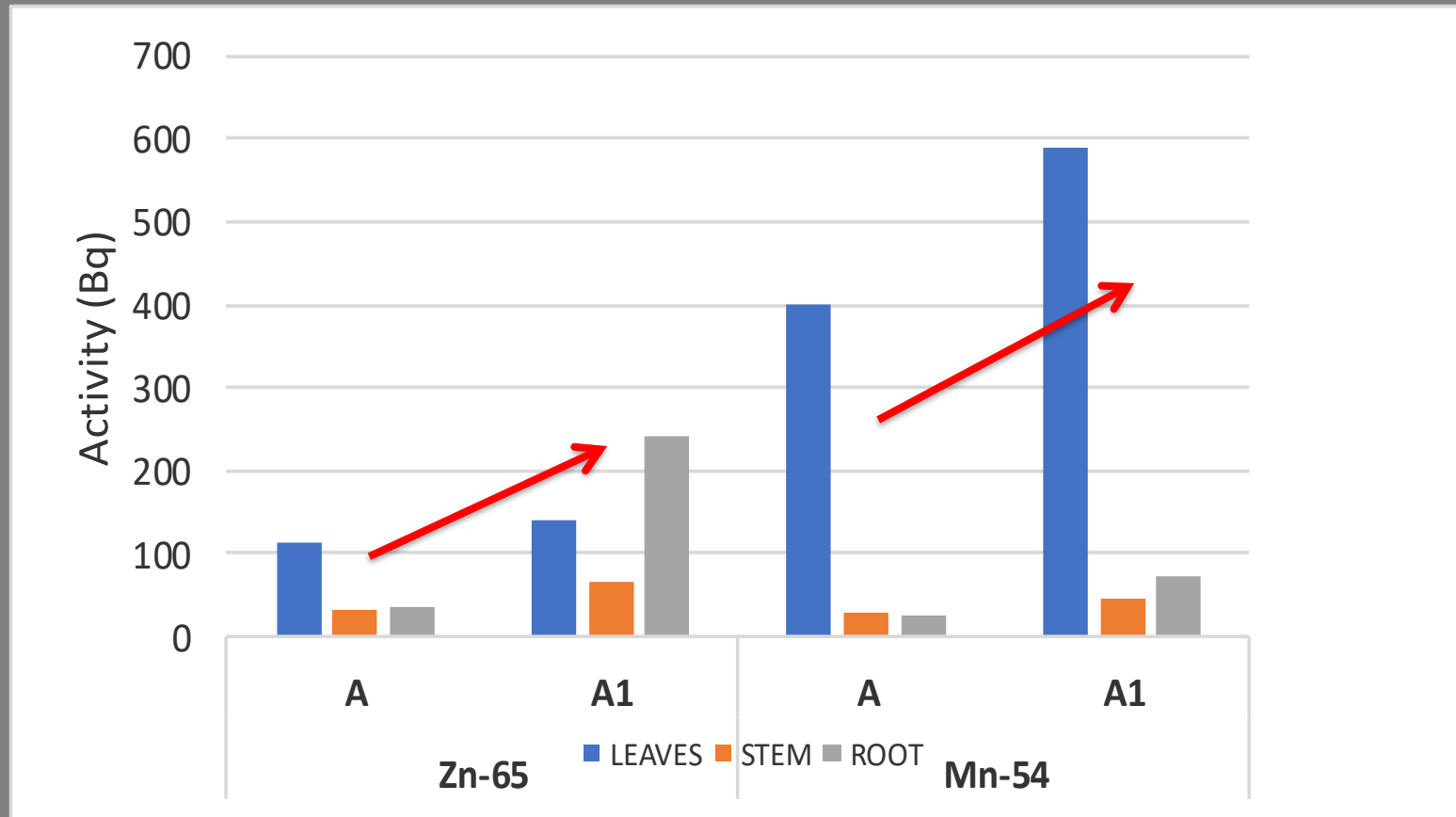
An = 1 ml AnnGro/L spray volume

B. ENHANCED TRANSPORT:

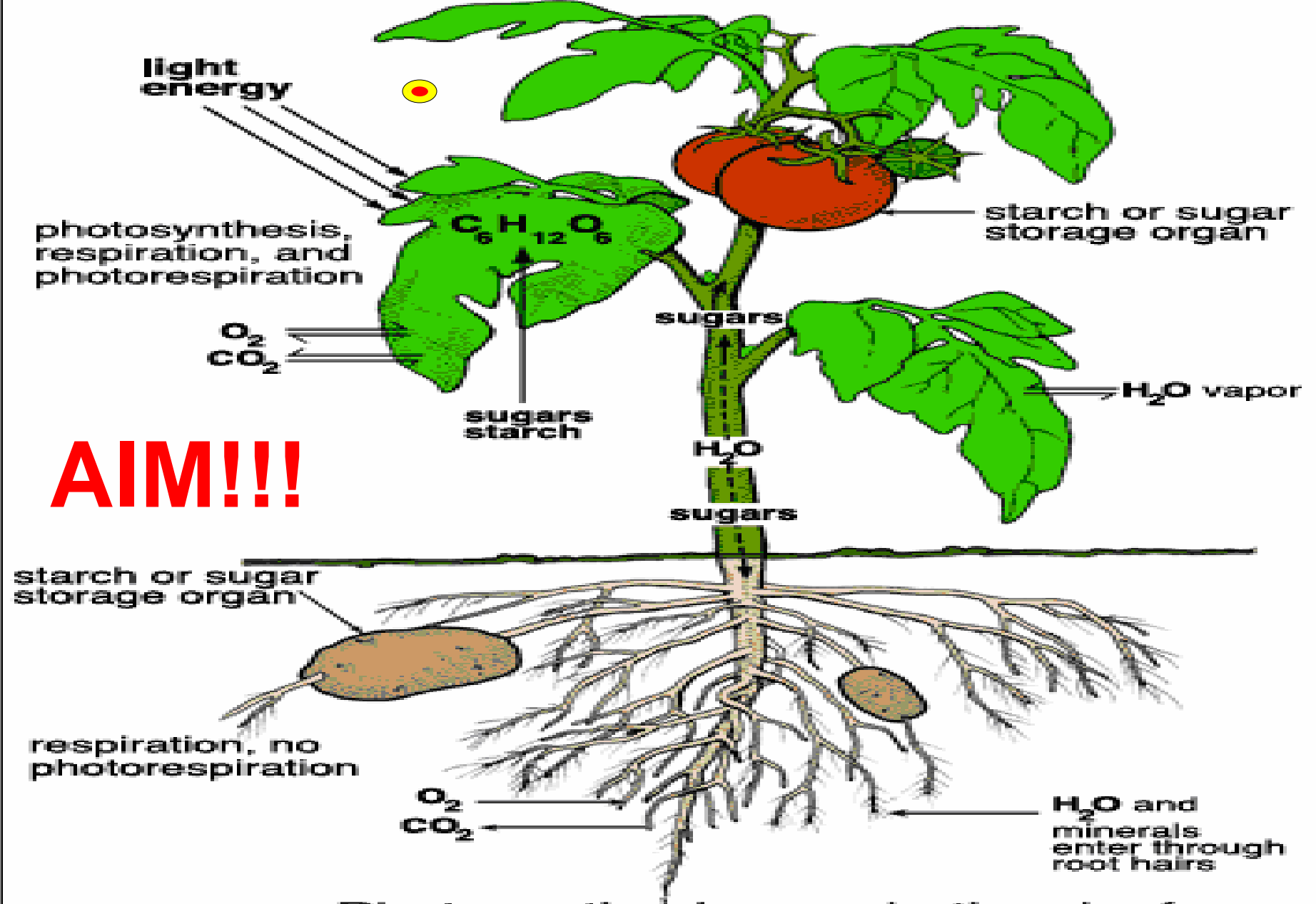
**AnnGro™ used with foliar applied
 $\text{Ca}(\text{NO}_3)_2$ on potatoes**



The distribution of ^{65}Zn and ^{54}Mn that were applied foliar to maize plants were monitored to stems and roots in the absence (A) and presence (A1) of AnnGro[®] 4 hours after application.
TJ SHABA (Northwest University, RSA)



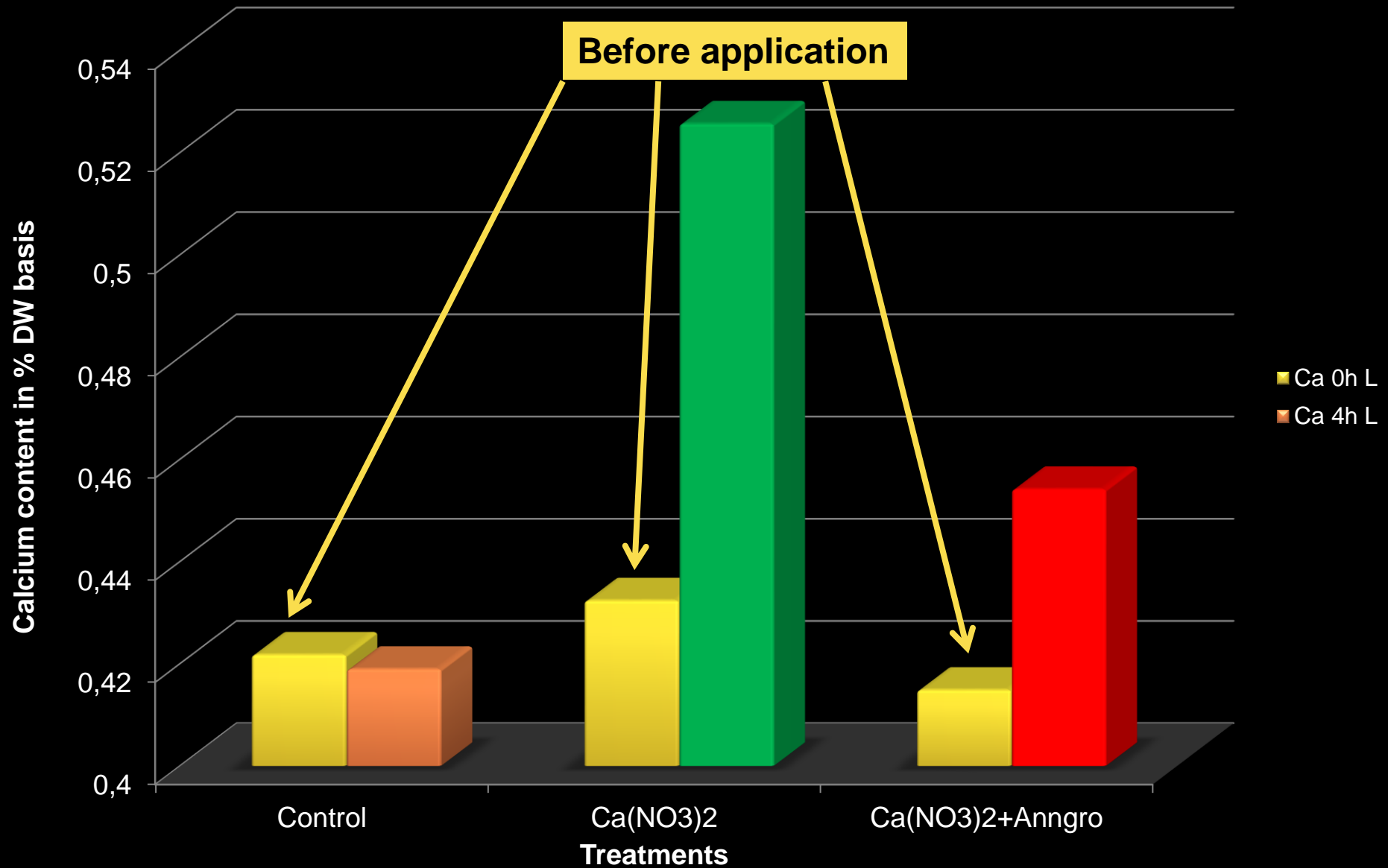
Radioactivity in different plant parts 4 h after ^{65}Zn and ^{54}Mn were applied foliar in the absence (A) and presence (A1) of AnnGro[®].



AIM!!!

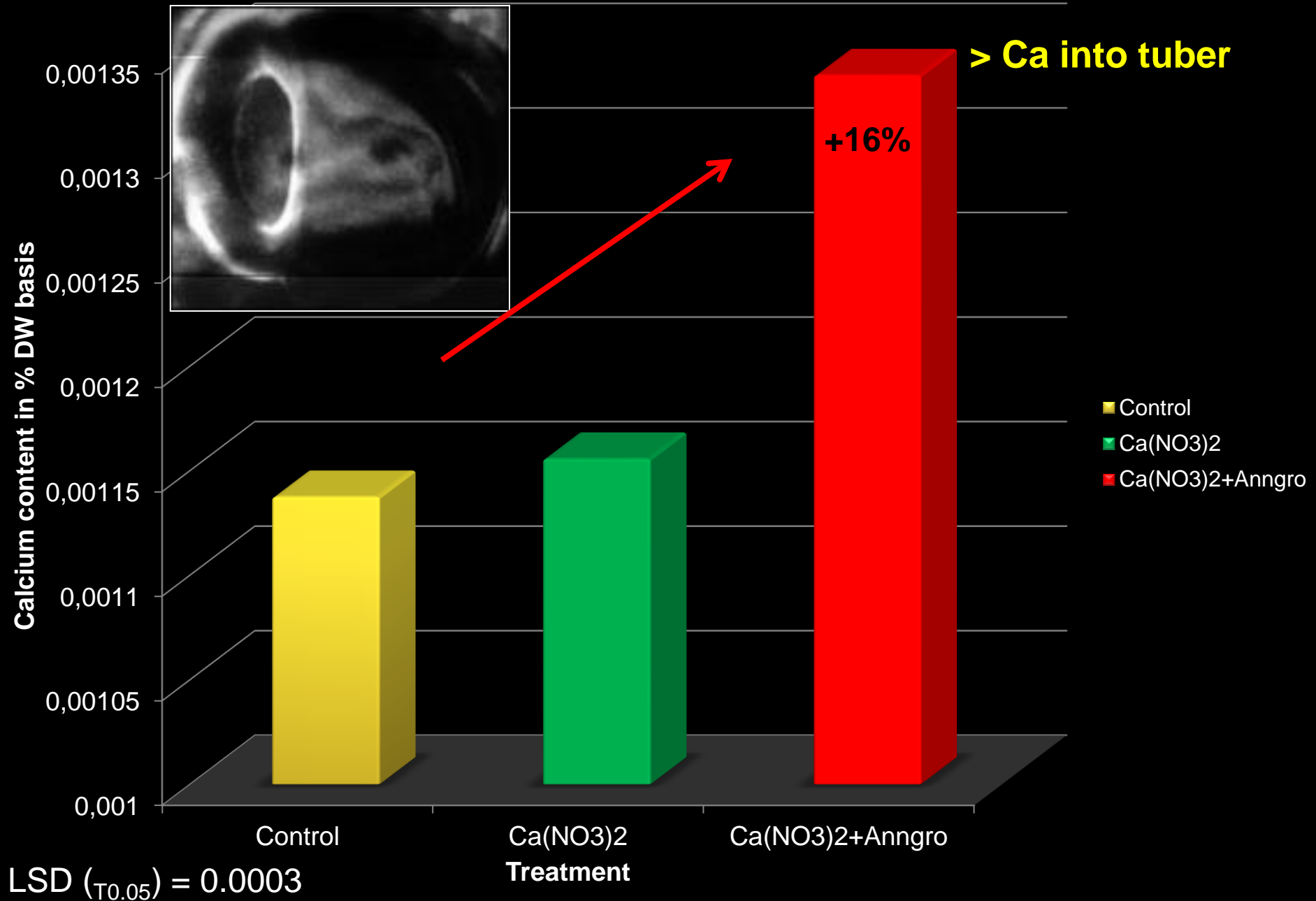
Photosynthesis, respiration, leaf water exchange, and translocation of sugar (photosynthate) in a plant.

Calcium content in potato leaves at tuber initiation - Bloemhof 08/09, RSA

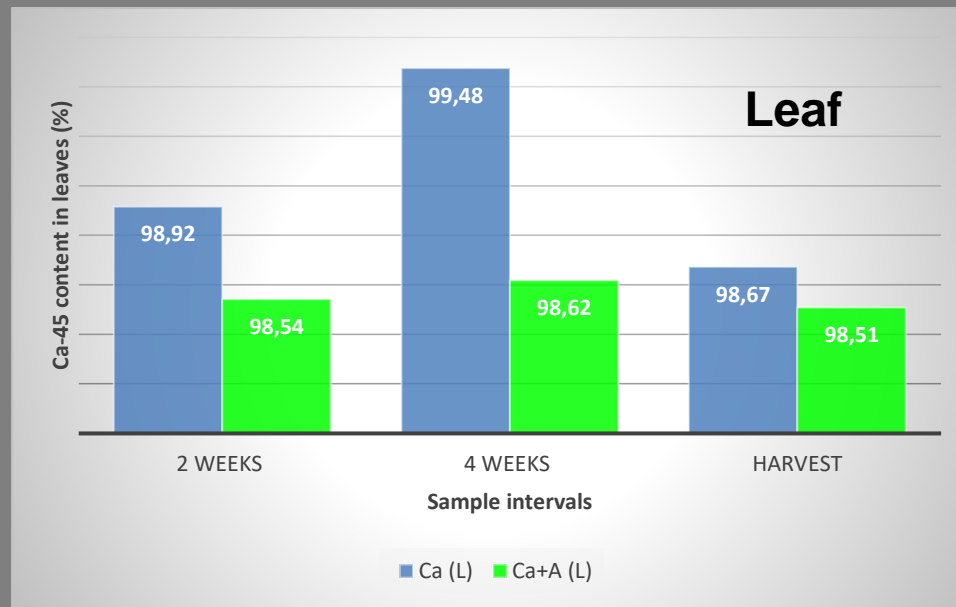


LSD 0h ($T_{\geq 0.05}$) = 0.1632 / LSD 4h ($T_{\geq 0.05}$) = 0.1364

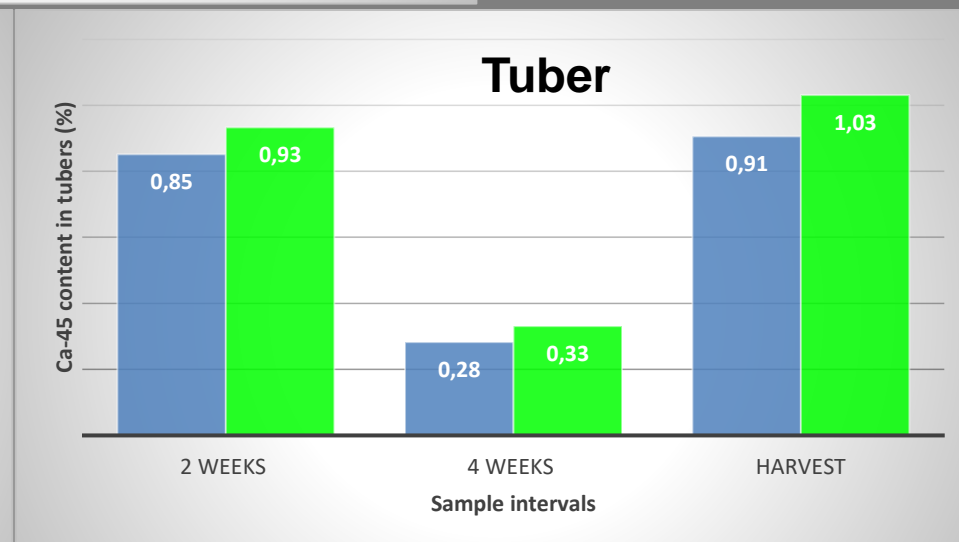
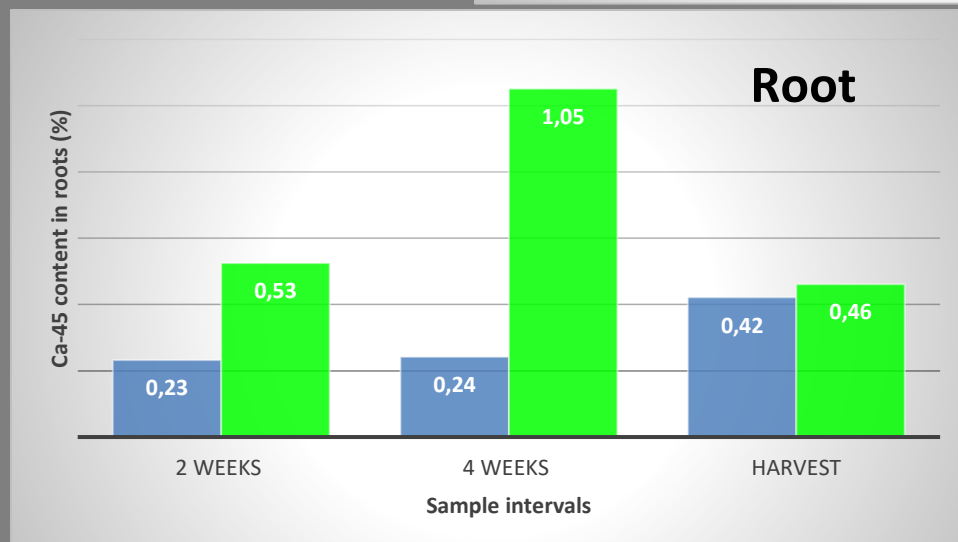
Calcium content of potato tubers at harvest- Bloemhof 08/09, RSA



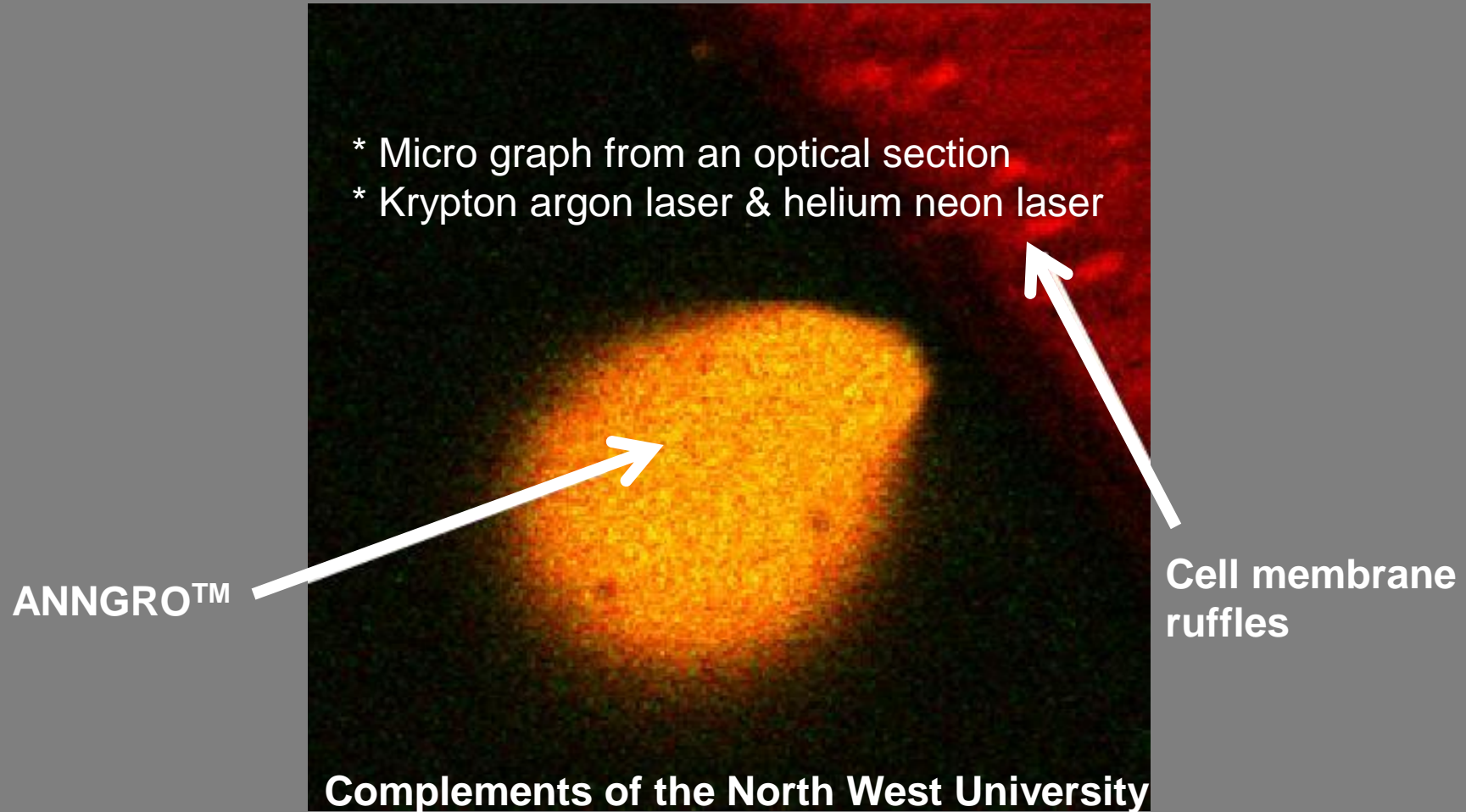
Preliminary data: ^{45}Ca -study to confirm the translocation of Ca in potatoes from the leaves to the roots using AnnGro, 2018



Only one foliar application



C. AnnGro™ and cell membrane uptake



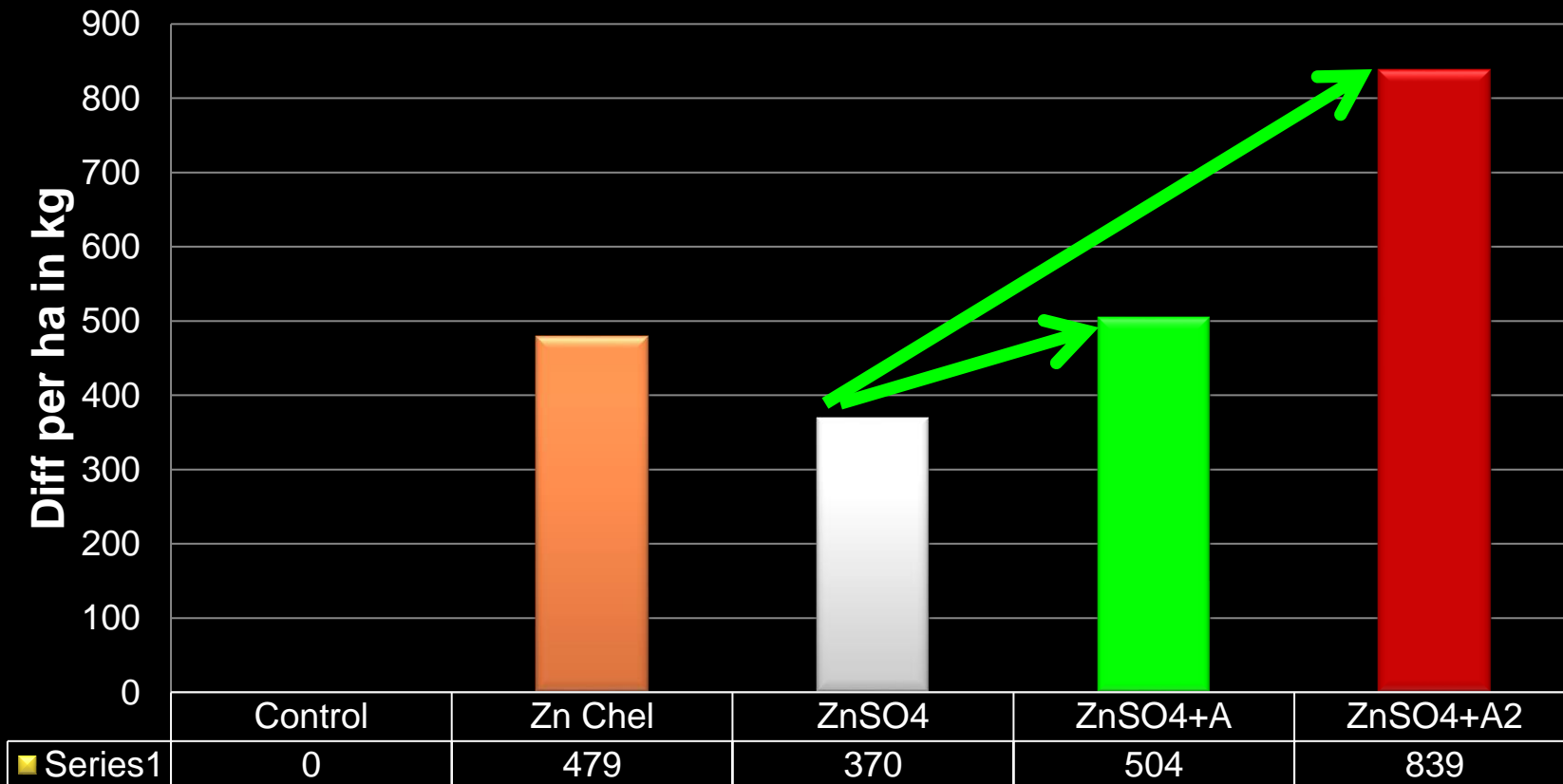


D. METABOLISM: yield effect of foliar applied fertilizer on rain fed maize

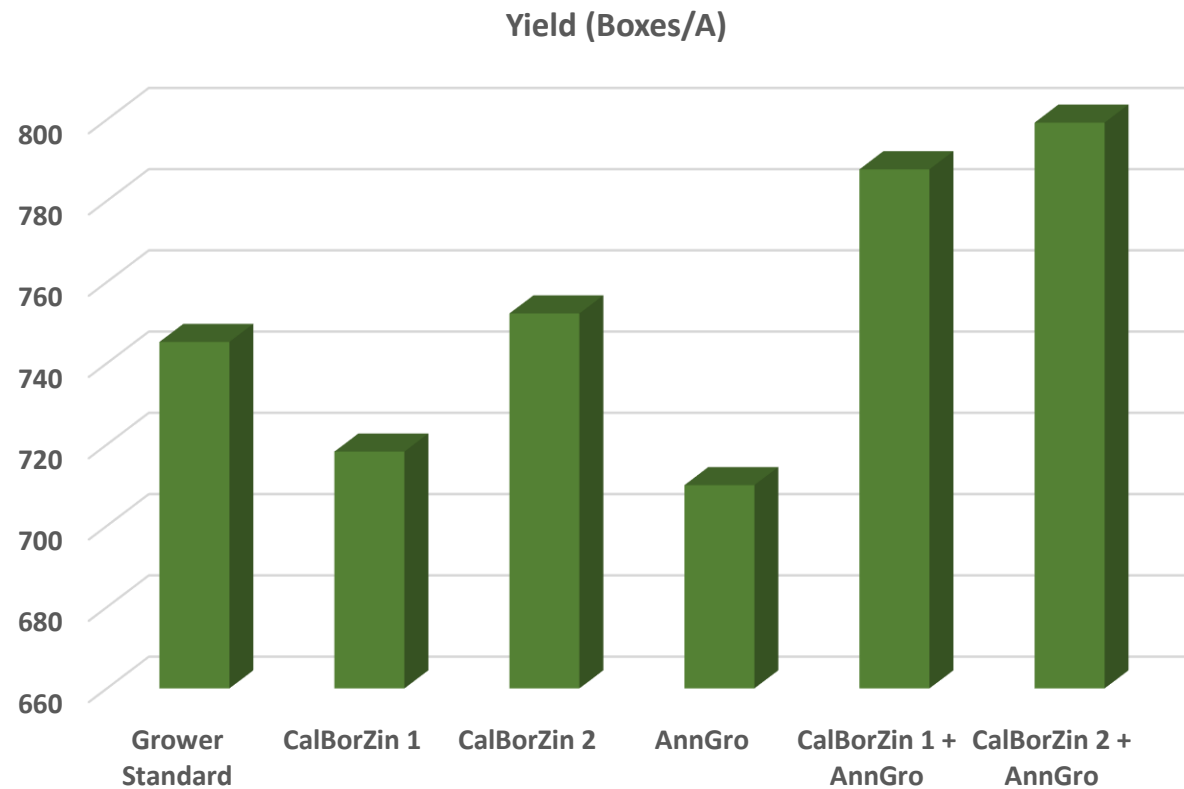
GRAIN YIELD IN MAIZE

2010 – Bultfontein – South Africa

Yield of dry land maize - 2009/2010 - Bultfontein - P Ferreira

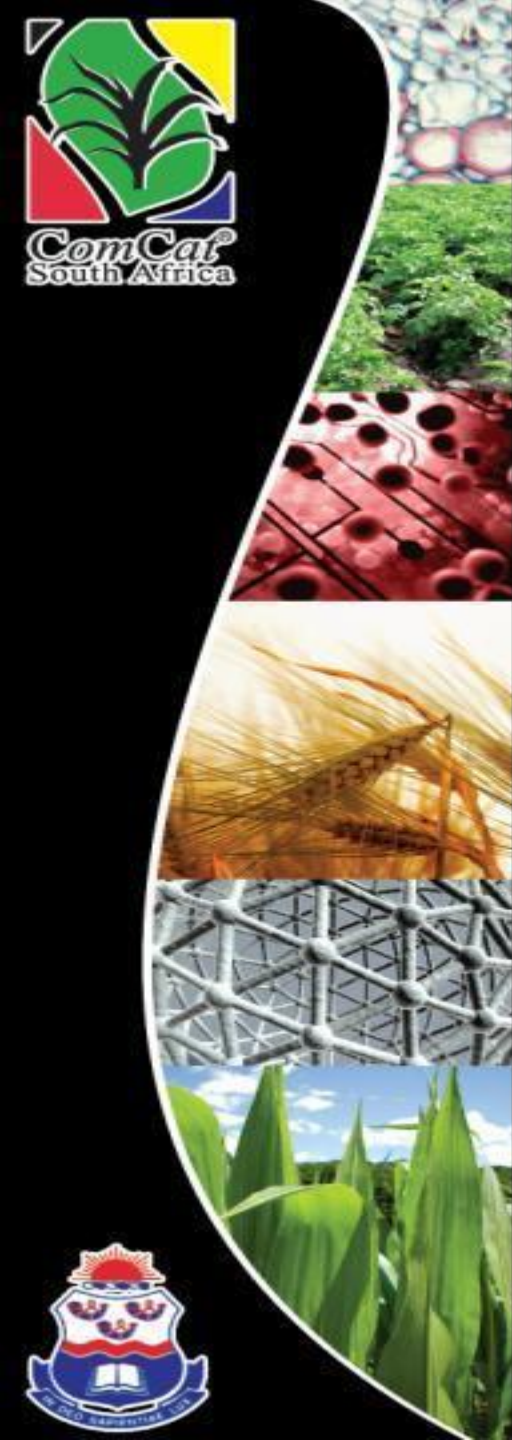


Yield (boxes/A)



**AnnGro™ used with
soil applied fertilizer**





ComCat
South Africa



Photos of sunflower plants treated with the 4:2:1 (18) + 3% S clear liquid fertilizer (Left) and the 4:2:1 (18) + 3% S clear liquid fertilizer + AnnGro™ combination treatment (Right) on 23/3/2011

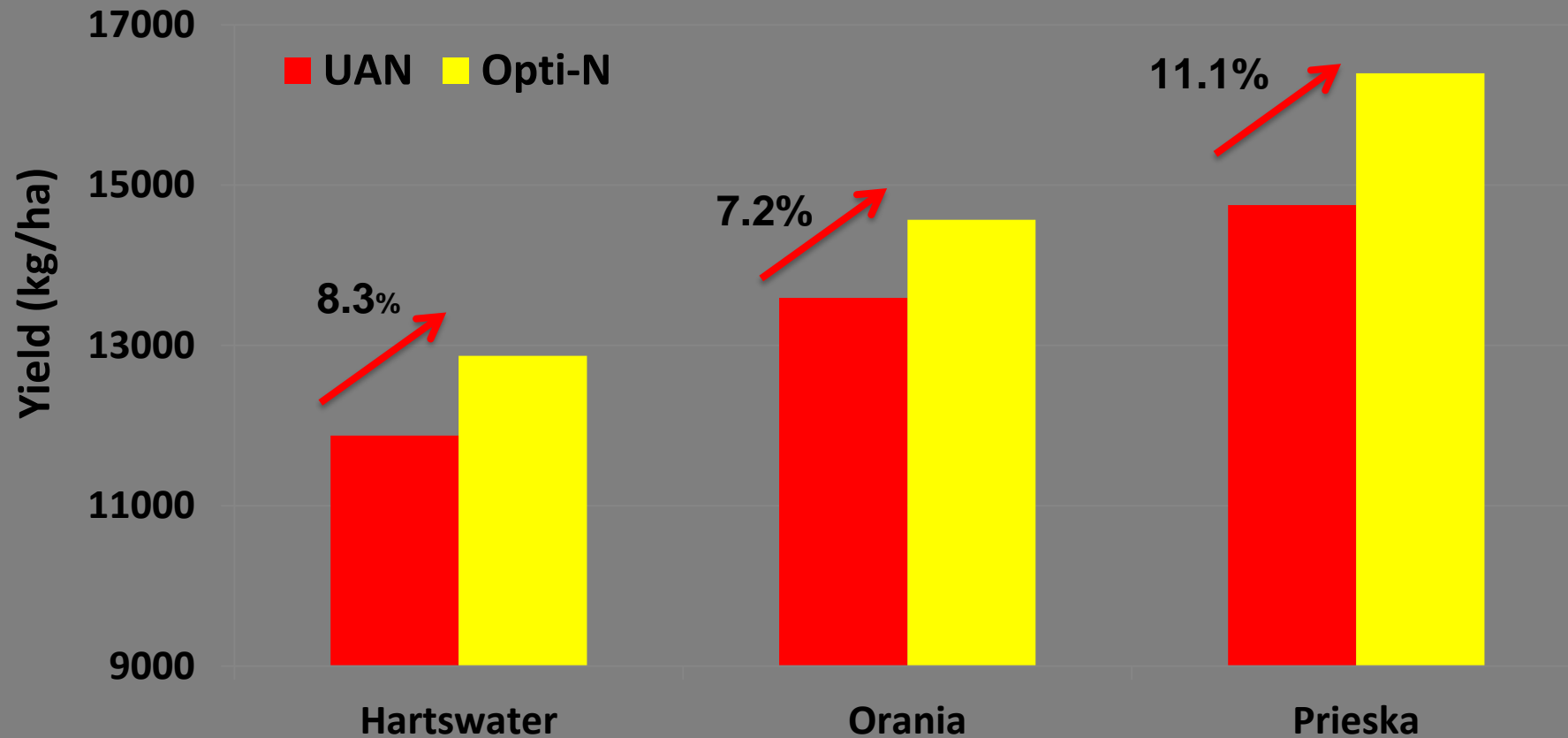
Improved uptake!!!



PILOT TRIAL

Opti-N (Nitrogen + AnnGro™)

Impact of N-carriers on maize yield under irrigation - 2010



N: 40 kg N/ha; applied 3 weeks after emergence

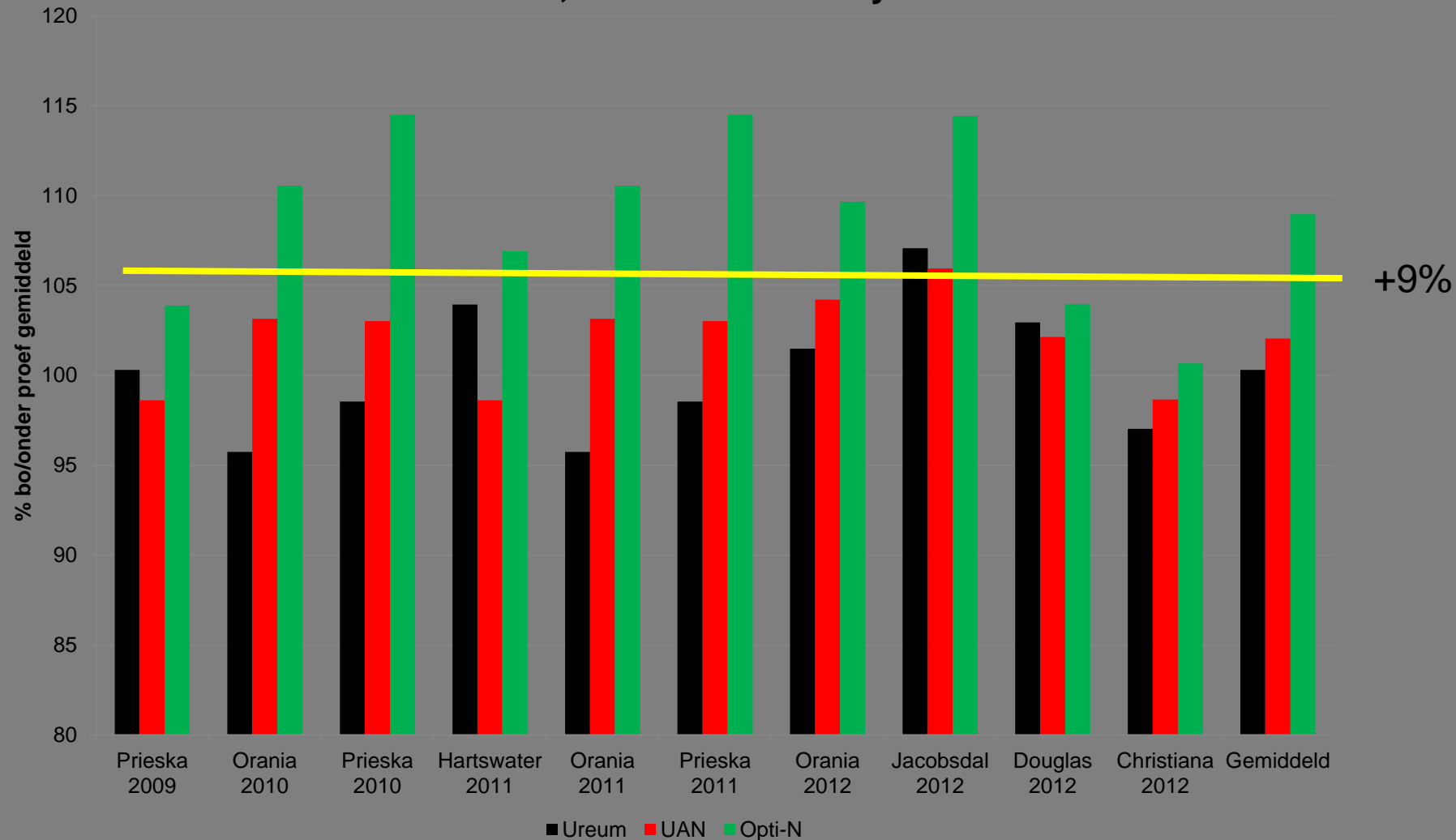
Hartswater: CV = 14.7%; Orania: CV = 7.6%; Prieska: CV = 4.5%

With complements of Sidi Parani Fertilizer South Africa

Yield increase realised by the use of OPTI-N in comparison to other N products in different areas applied via irrigation system on maize. Treatments consisted of 45 N applied for each source, 3 weeks after emergence, under standard farming practices.

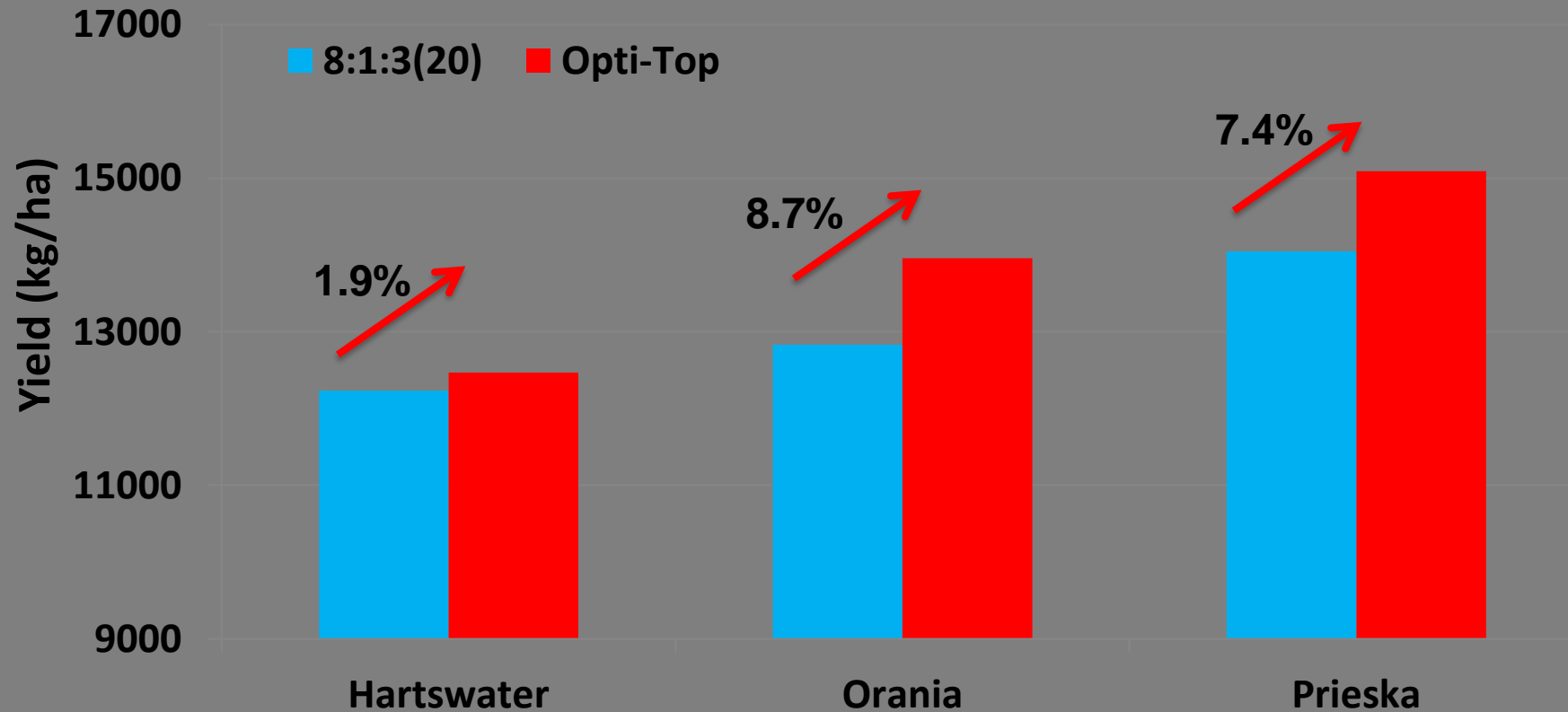
Yellow line = trial average over seasons.

A Prince, Sidi Parani now Kynoch



Opti – TOP (NPK + AnnGro[®])

Impact of N-carriers on yield of maize under irrigation - 2010



N: 40 kg N/ha; applied 3 weeks after emergence

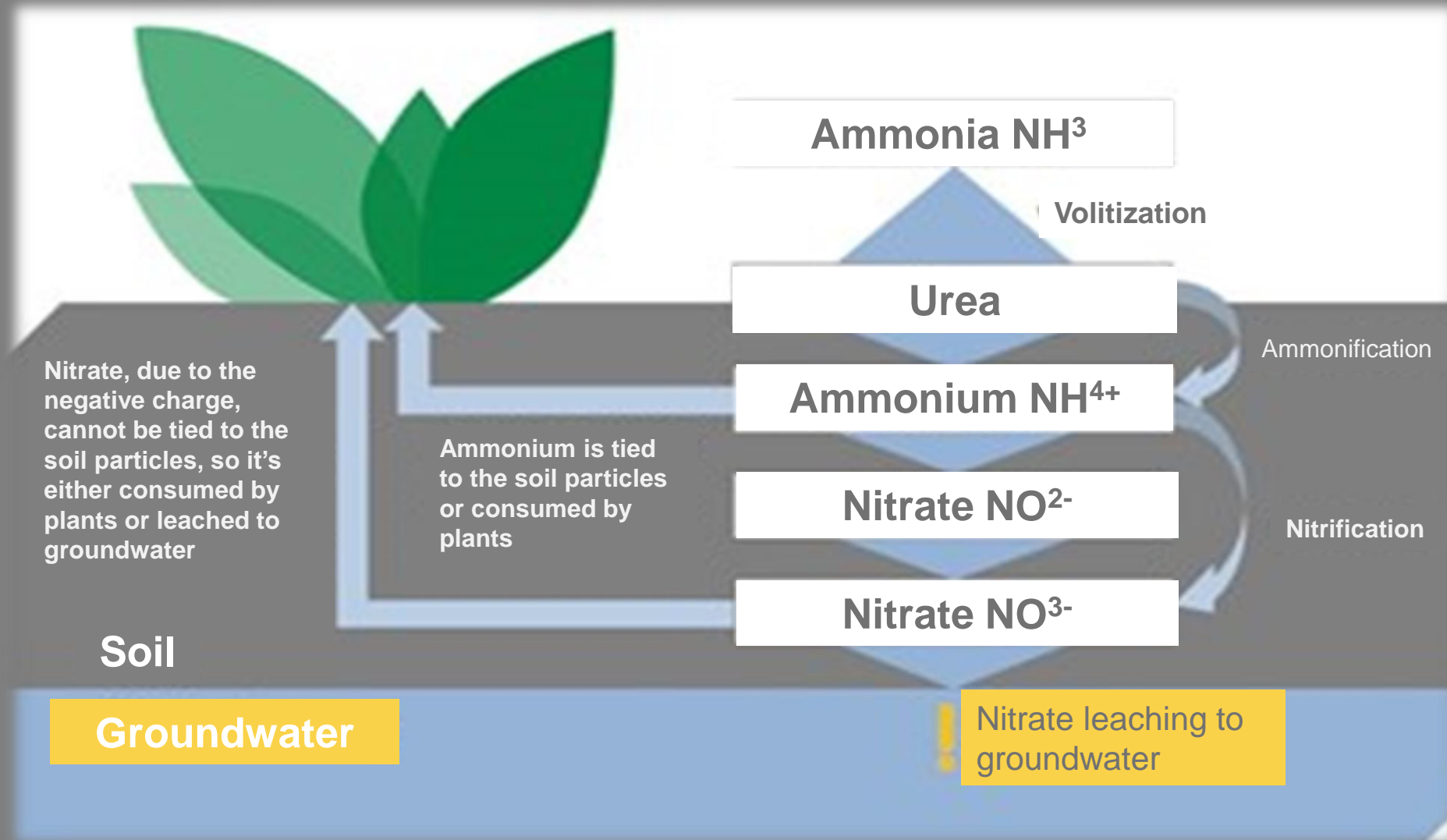
Hartswater: CV = 14.7%; Orania: CV = 7.6%; Prieska: CV = 4.5%

Soil applied PGR on maize, University of Nebraska Extension Centre in Concord, NE, USA, 2016

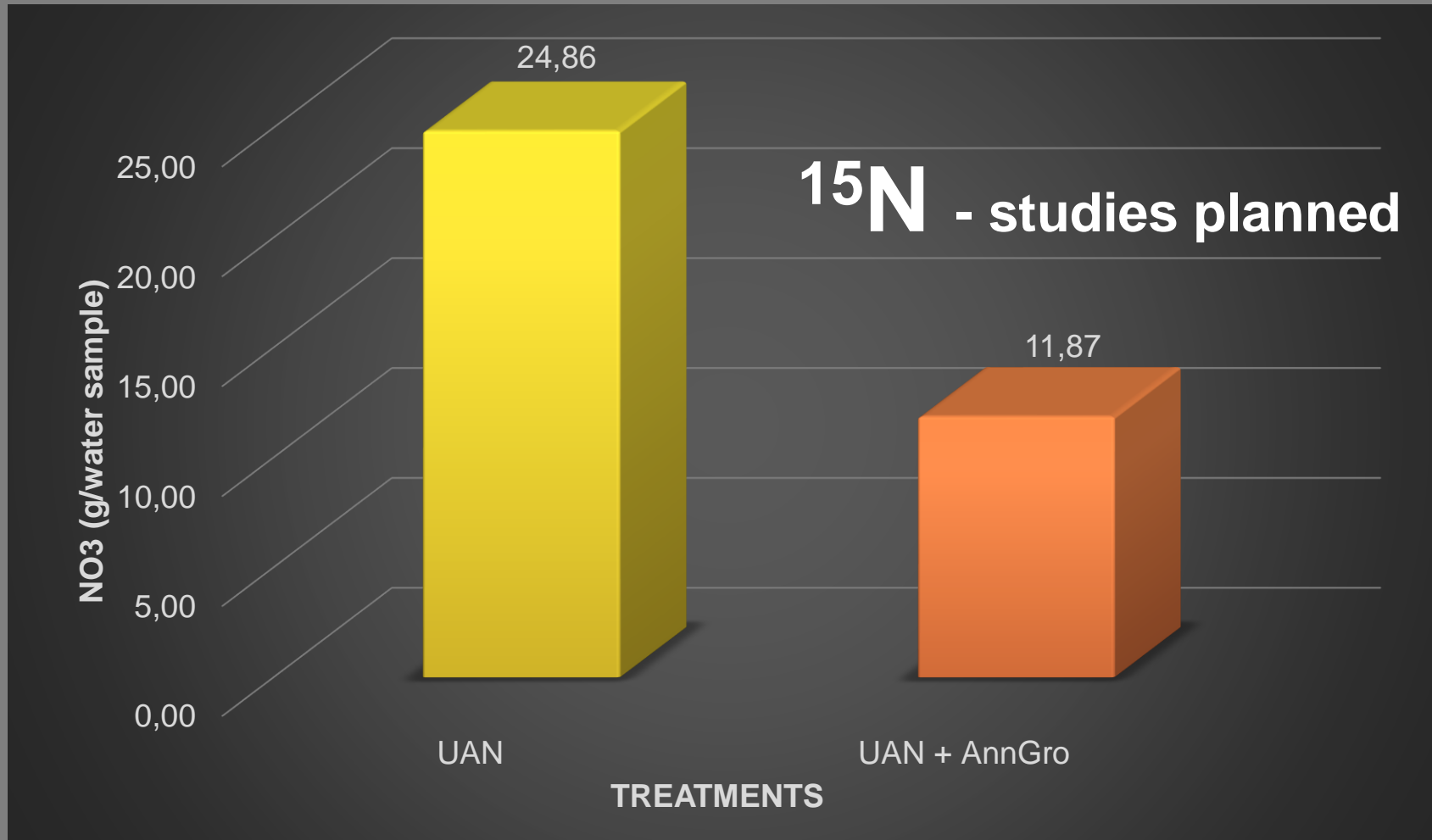
Corn Yield Analysis (bushels)				
Treatment	Yield Average	Difference from check	Difference from Ascend	Grouping
Starter+Zn	227.95	-	-	A
Starter+Zn+Ascend	229.48	1.53	-	A
Starter+Zn+Ascend+AnnGro	232.30	4.35	2.83	A
Least Significant Difference (alpha = 0.05) : 6.0947 bu				
Groupings with the same letter do not differ at the 95% confidence level				

PILOT STUDY/NEW CONCEPT

NITROGEN LEACHING IN SOIL

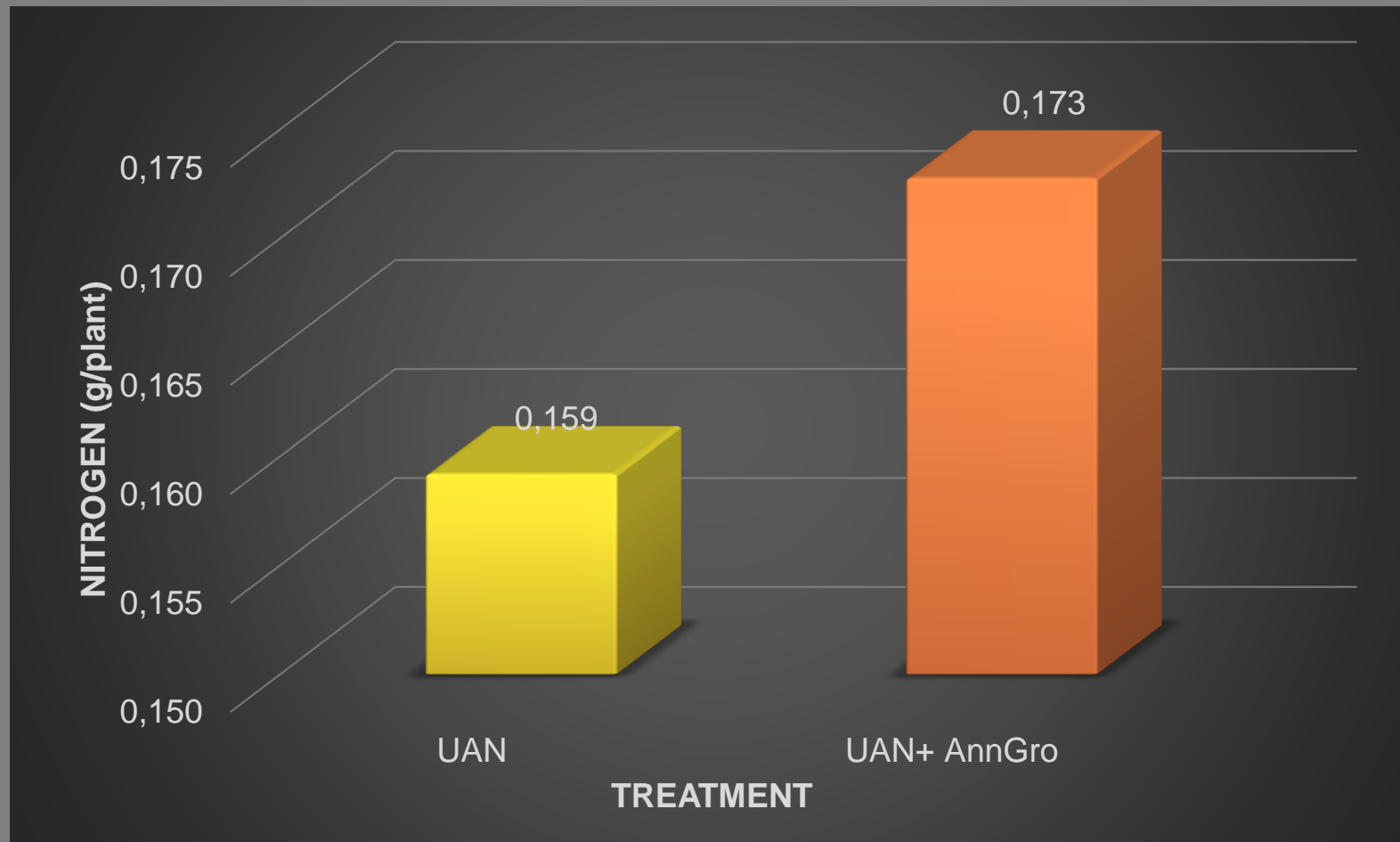


NITROGEN CONTENT IN LEACHED WATER



NITROGEN CONTENT IN AREAL PART OF PLANTS

1 Week after application



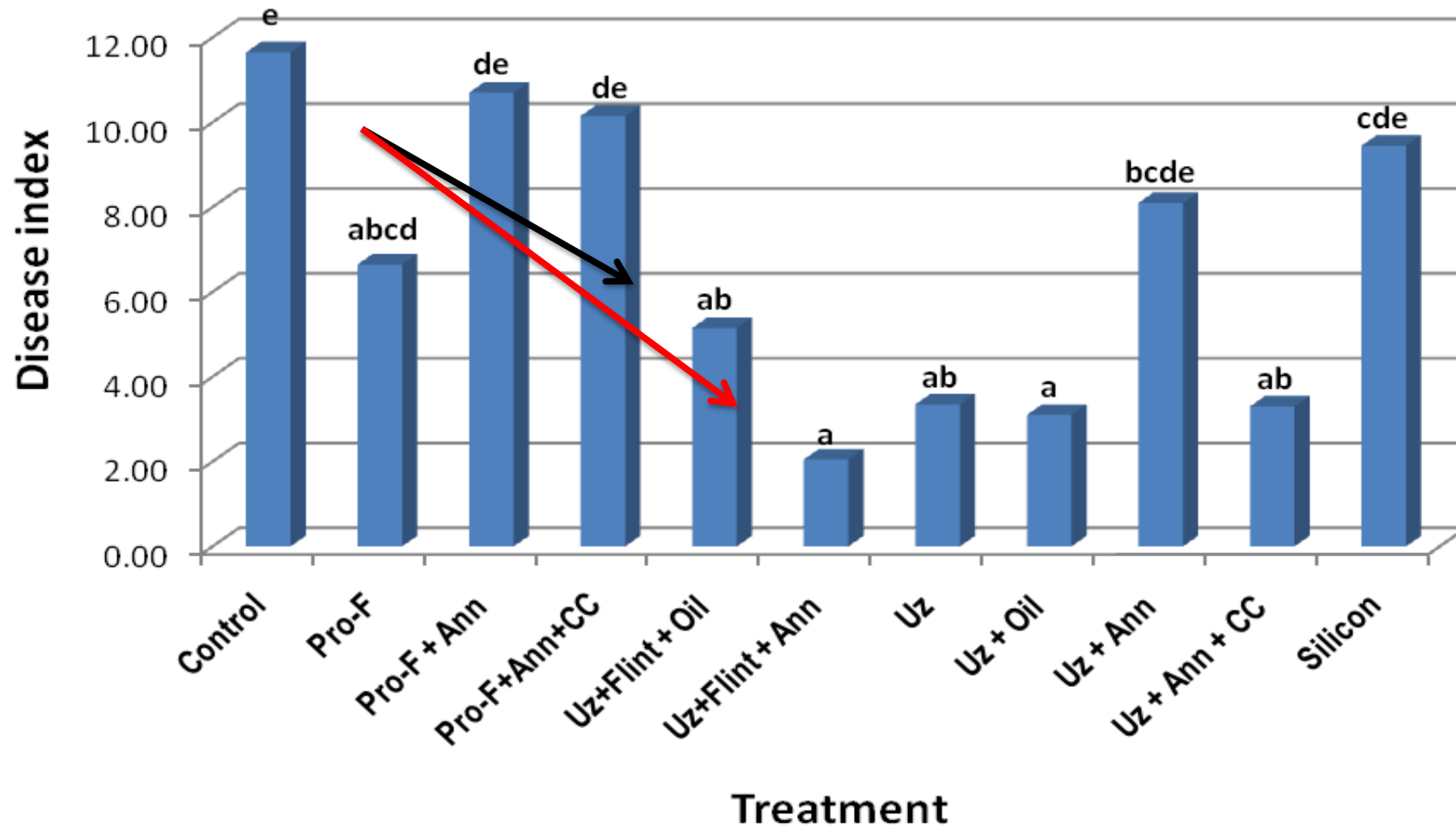
AnnGro™ used with
selected **pesticides** in **tank**
mixes





AnnGro™ used with **FUNGICIDES** (mancozeb +
trifloxystrobin)
to control citrus black spot

Effect of treatments on disease incidence expressed as a disease index on citrus black spot caused by *Guignardia citricarpa* – QMS – 2009 – South Africa





AnnGro™ used with **Insecticides**
Tank mix applications

FASTAC SC = a stable suspension of active ingredient(s) with water as the fluid, intended for dilution with water before use.

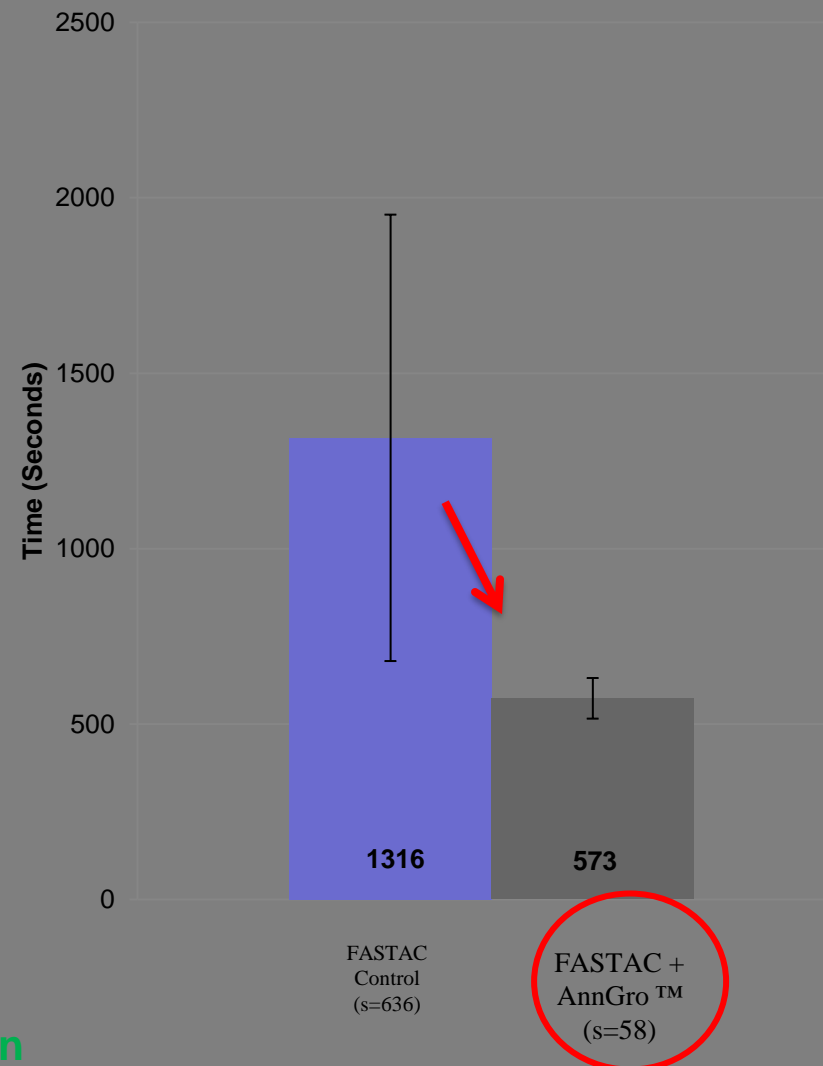
Australian sheep blowfly

Lucillia cuprina



- Concentrations of 200 ml/100 l pesticide for the control and 200 ml/100 l pesticide + 200 ml/100 l AnnGro™. In addition a double dose pesticide was also applied.
- Application with vaporized solution into sealed container.
- Provides correlation that addition of AnnGro™ is related to the decreased time required for the onset of death in *L. cuprina*.
- Only FASTAC® SC provided statistically significant results. ($\alpha=0.1$)

Comparison of Death



FASTAC SC = contact fungicide, alpha-cypermethrin

The efficacy of Biomectin® 18 EC + AnnGro® 25 EW against the American leaf miner in potatoes 2020

Treatments	Conc (ml/ha)	American leaf minor control (%) in potatoes			
		7DA-A	7DA-B	7DA-C	14 DA-C
Biomectin 18+Mineral oil (0,75x)	375+375	50	72	93	84
Biomectin 18+Mineral oil+AnnGro (0,75x)	375+375+90	96	100	100	100
Biomectin 18+Mineral oil (1x)	500+500	75	67	88	100
Biomectin 18+Mineral oil+AnnGro (1x)	500+500+120	100	100	100	100

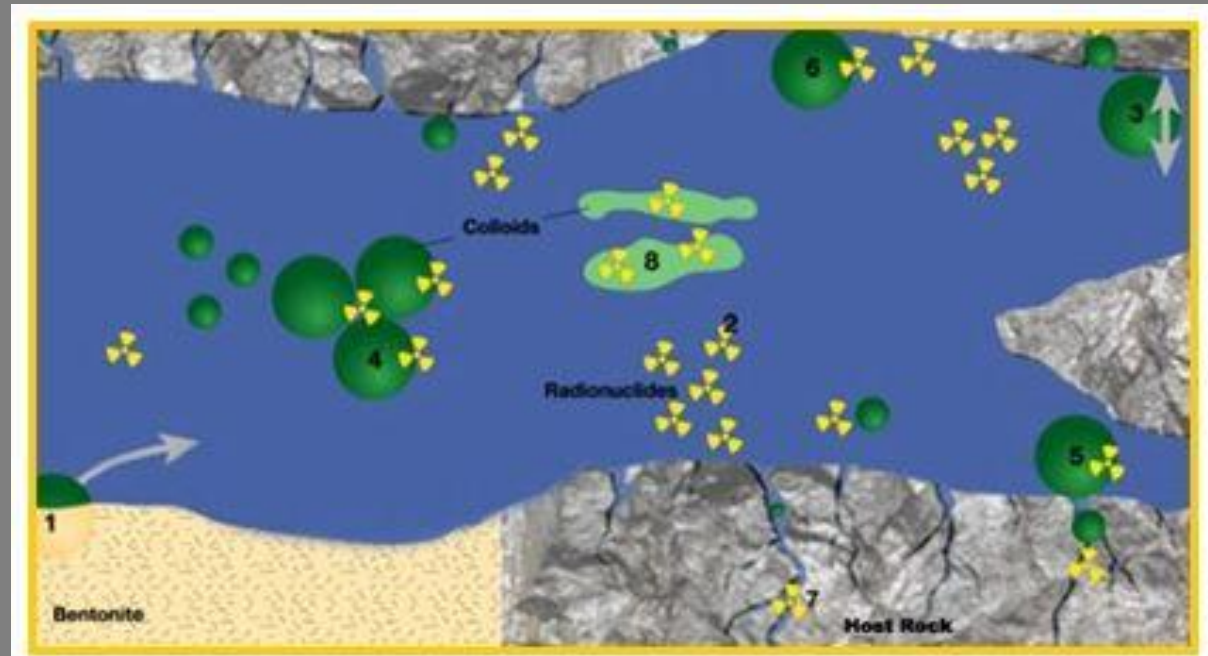
The efficacy of Spirotetramat (Tivoli® 240 SC) + AnnGro® 25 EW against various aphid species in potatoes 2020

Treatments	Conc (ml/ha)	Aphids control (%) in potatoes		
		14DA-A	14DA-B	14DA-C
Tivoli+Charge (0.75x)	22,5+15	56	30	90
Tivoli+Charge+AnnGro (0.75x)	22,5+20+90	74	83	100
Tivoli+Charge (1x)	30+20	63	100	100
Tivoli+Charge+AnnGro (1x)	30+20+120	100	100	100



AnnGro™ used with Herbicides

^{14}C Glyphosate Isotopic Tracer study with AnnGro



Slides were taken 4 days after treatment application of the areal plant parts



¹⁴C Glyphosate+AnnGro

¹⁴C Glyphosate-AnnGro

Observation: The addition of AnnGro to radio-active glyphosate showed a faster translocation downwards in the plant versus the control treatment.

Slides were taken 4 days after treatment application of the root plant parts




Observation: The use of AnnGro increased the accumulation of glyphosate in the roots and stems of *Alternanthera philoxeroides* versus the control

AnnGro & Glyphosate

Jan 2020, Nelspruit, Independent trial

#	TREATMENT	Application rate Formulated product kg/ ha	% Weed Control 10 Days After Application			
			Eleusine	Bidens spp	Convolvulus spp	Richardia spp
1	Glyphosate 540 SL Ammonium sulphate	1.3 L / ha 2%	15%	10%	10%	10%
2	Glyphosate 540 SL Ammonium sulphate	1.7 L / ha 2%	50%	45%	25%	25%
3	Glyphosate 540 SL Ammonium sulphate AnnGro 1 X	1.3 L / ha 2% 70 mℓ (0.1ml/gae)	40%	55%	33%	33%
4	Glyphosate 540 SL Ammonium sulphate AnnGro 1X	1.7 L / ha 2% 92 mℓ (0.1ml/gae)	85%	85%	45%	50%
5	Glyphosate 540 SL Ammonium sulphate AnnGro 2X	1.3 L / ha 2% 140 mℓ (0.2ml/gae)	75%	75%	40%	40%



AnnGro™ & Cyhalofop-butyl, China 2017

The effect of AnnGro® as adjuvant of cyhalofop-butyl on weed control and rice safety

Xiang Shigang¹, Liu qi¹, Qiang Sheng¹, Song Xiaoling^{1*}, Zhang Ruiping² Wei Jiafeng²
(1 Weed Research Lab of Nanjing Agricultural University, 2 Plum Agrochemical Consulting & Service Co., Ltd..)

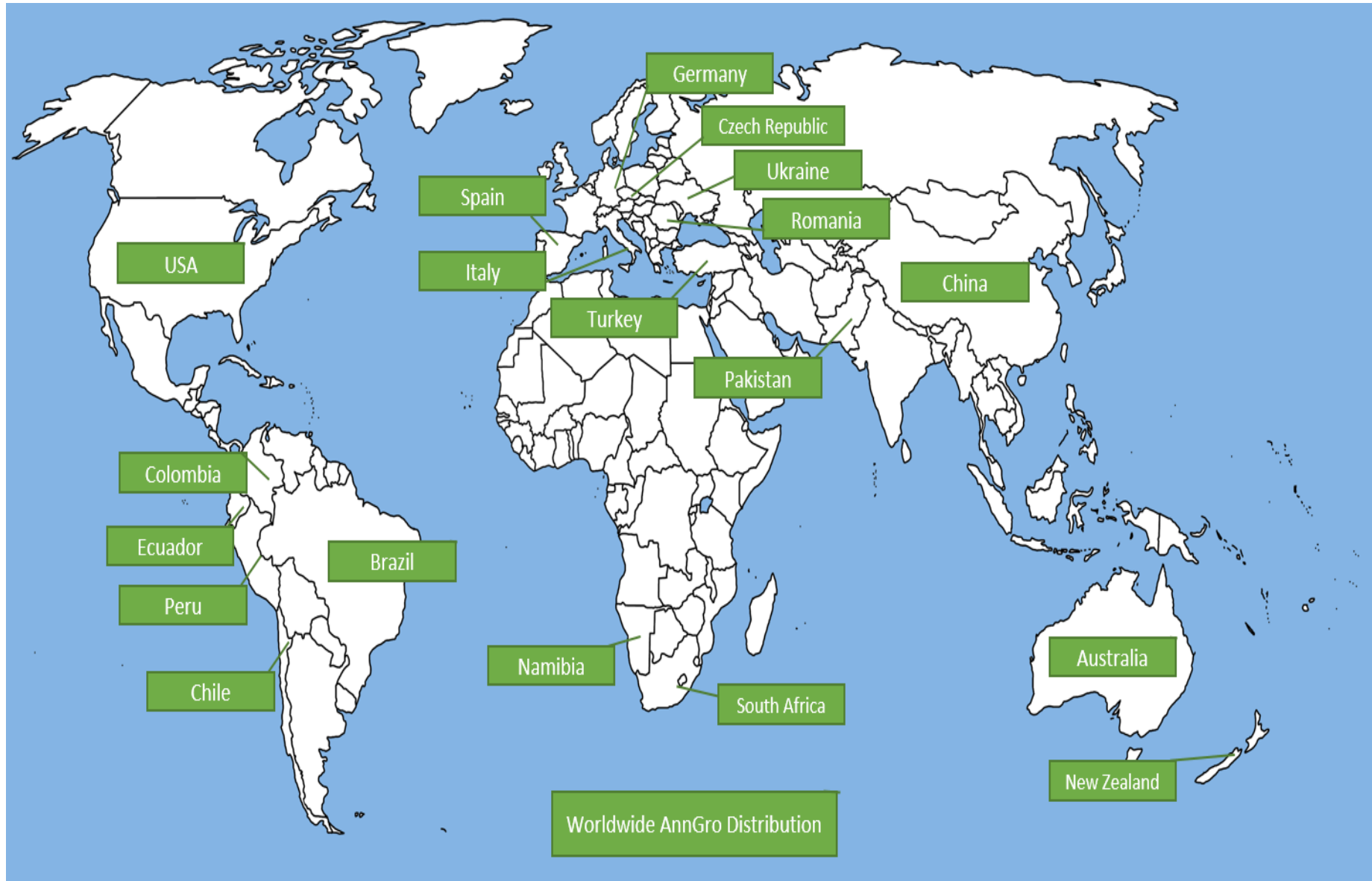
Abstract: AnnGro® is natural adjuvant investigated by Plum Agrochemical Consulting & Service Co., Ltd. In order to understand the synergistic effect of AnnGro® as adjuvant of 10% cyhalofop-butyl EC on barnyardgrass (*Echinochloa* spp.) and Asian sprangletop (*Leptochloa chinensis* (L.) Nees), as well as safety of rice, four treatments were conducted in greenhouse as following (1) domestic product: 10%

cyhalofop-butyl EC produced by Jiangsu kuaida Agrochemical Co. Ltd., (2) domestic product + AnnGro® 5000 times dilution, (3) imported product: 10% cyhalofop-butyl EC produced by Dow AgroSciences, (4) imported product + AnnGro® 5000 times dilution. The treatments were applied at 2-3 leaf stage of the weeds. After the application, the symptoms of the two weeds and rice were observed. Visible injury estimation of plant damage was conducted at 5 d after the application using a scale of 0 (no control) to 5. The dosage dependence response curve of each treatment was constructed with Log-logistic dose response regression equations. The ED50 and ED90 value of each treatment was calculated. The results demonstrated that reaction speed to the two weeds was (4) >(2)>(3) >(1). Whatever domestic or imported product, the application with AnnGro® 5000 times dilution achieved the similar control effect to the two weeds earlier 1-2 days than that the application single 10% cyhalofop-butyl EC. For barnyard grass, ED50 of treatment (1) to (4) was 95.2, 70, 77.9, 62.5 ml/ha, respectively. For Asian sprangletop, ED50 of treatment (1) to (4) was 105.4, 75.4, 84.3, 67.6 ml/ha, respectively. Thus, the ED50 of the domestic and imported product reduced 375, 450ml/ha and 231, 250ml/ha by AnnGro® 5000 times dilution respectively. For barnyard grass, ED90 of treatment (1) to (4) was 181.8, 155.6, 165.2, 137.8 ml/ha, respectively. For Asian sprangletop, ED90 of treatment (1) to (4) was 206.5, 181, 191, 131.5 ml/ha, respectively. Thus, the dosage of the domestic and imported product reduced 383, 393ml/ha and 411, 1043 ml/ha by

AnnGro® 5000 times dilution respectively. Finally, the control efficacy was increased 10% and 32% by AnnGro® 5000 times dilution for domestic and imported product, respectively. The rice grew very well after applied by AnnGro® 5000 times dilution. In conclusion, as an adjuvant of cyhalofop-butyl, AnnGro® increased control effect, and was safe to rice.

Keywords: AnnGro®, 10% cyhalofop-butyl EC, barnyardgrass (*Echinochloa* spp.), Asian sprangletop (*Leptochloa chinensis* (L.) Nees), synergistic effect, safety

AnnGro & Marketing Activities



AnnGro & Marketing in China



THANK YOU FOR YOUR ATTENTION

Presented by: Dr Riaan Buitendag

Gratitude given to: Prof Anne Grobler,
North West University, South Africa



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