



TerraMax^{Inc.}

Maximizing Earth's Potential

Mission Statement

Through scientifically developed technologies we create and produce innovative natural products that enhance productivity, benefiting producers, consumers and the environment.

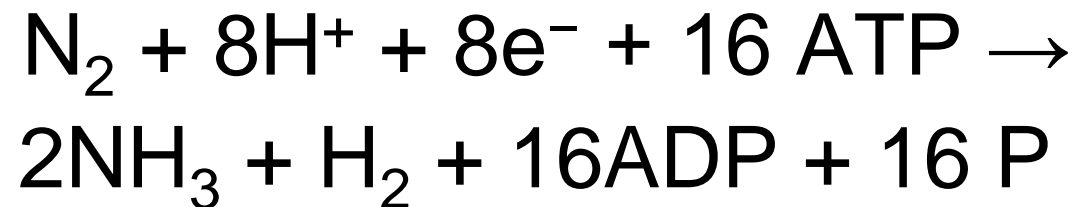
Our Innovative Approach: Delivering Improved Microorganisms

- **IDENTIFY** microbial strains
 - Nutrition
 - Plant Protection
- **SELECT** for specific activity
- **STABILIZE** for longevity
- **DELIVERY** of stabilized microbes ensuring function

Azospirillum

Azospirillum

- Fixes Nitrogen for use by cereal crops, grasses and tuber plants
- Biological Nitrogen Fixation (**BNF**) occurs when atmospheric nitrogen is converted to ammonia by a pair of bacterial enzymes called nitrogenase. The formula for BNF is:



Benefits of *Azospirillum*

- Naturally occurring
- Stimulate plant growth directly
- Increases the numbers of root hairs on each root.
- Greater root mass leads to increases in water and nutrient absorption
- Substantial yield increases have been reported for various wheat crops after inoculation with *Azospirillum* strains
- Cost effective nitrogen fertilizer



The Bacteria *Azospirillum*

- Naturally occurring
- Found on many plant species
- Close to the roots (Rhizoplane) and attached to the roots
- Not a nodulator





History

- The first species of the genus, originally named *Spirillum lipoferum*, was isolated from soil in the Netherlands in 1925.
- *Azospirillum* was 'rediscovered' in the 1970s during a search for associative nitrogen fixers in the rhizosphere of *Digitaria* and *Zea mays* in Brazil.
- Since then, isolation of azospirilla from roots of numerous wild and cultivated plants and from different soil types has been reported from all over the world.

To date 7 species have been identified
within the genus *Azospirillum*

- *A. brasilense*
- *A. lipoferum*
- *A. amazonense*
- *A. halopraeferans*
- *A. irakense*
- *A. largimobile*
- *A. doebereineriae*

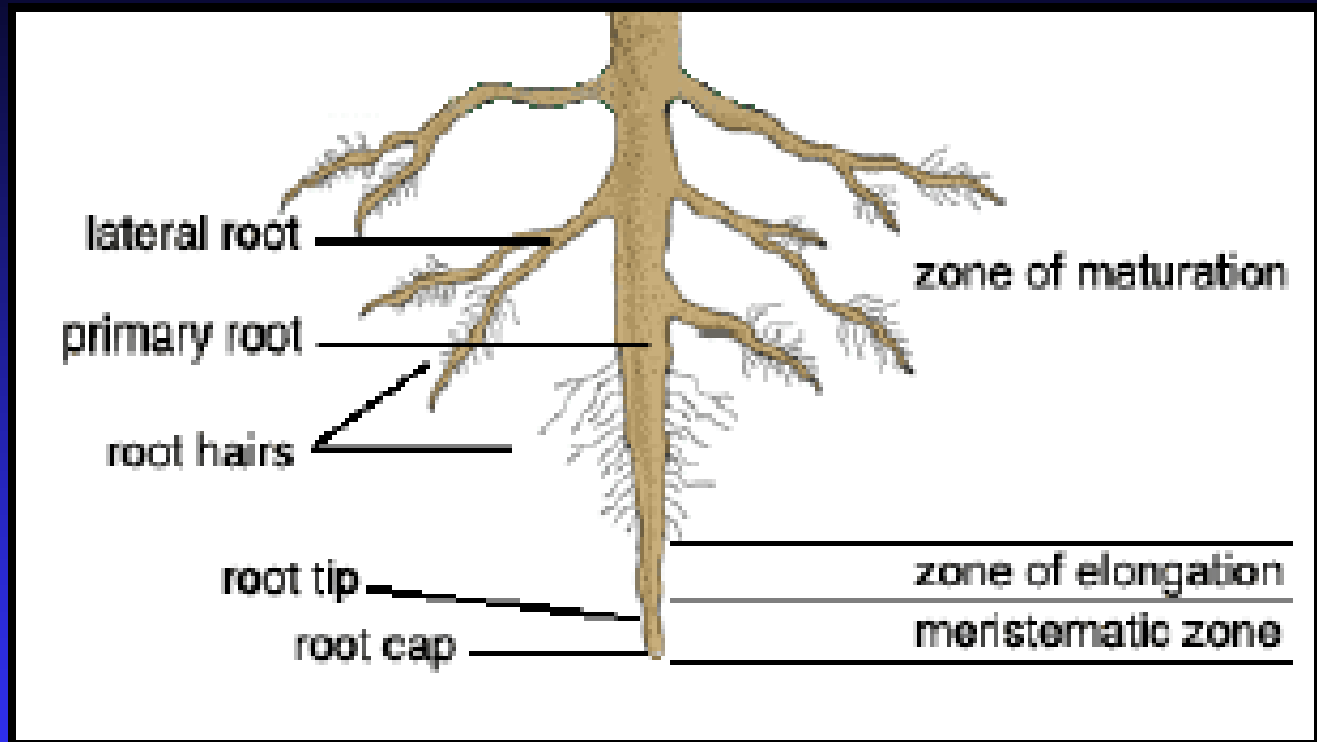
Azospirillum Colonization

- The first step (the adsorption step), consists of a rapid, loose, and reversible binding of *Azospirillum* to the root.
- The second step (the anchoring phase), the bacteria become irreversibly bound to the root surface.

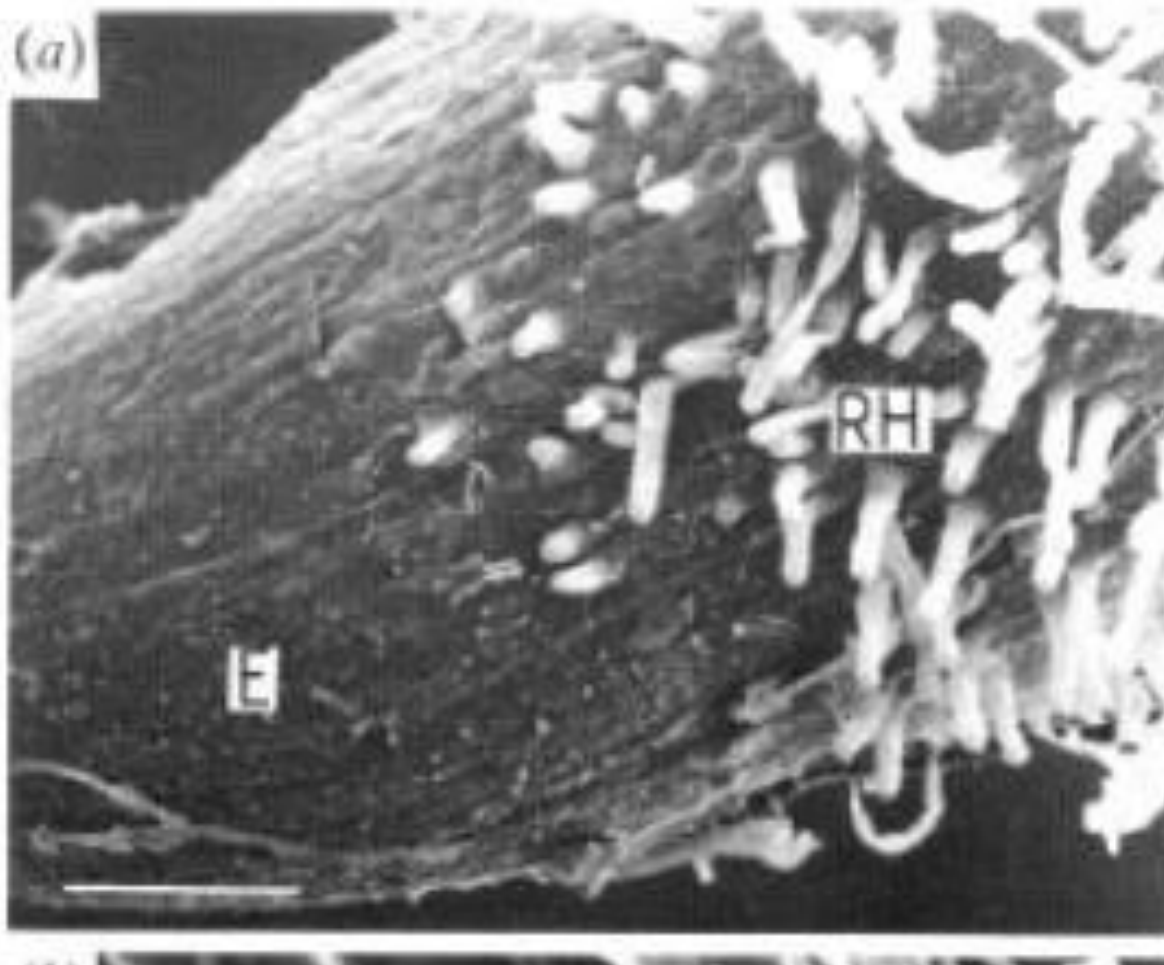
Where?

- During the first days of the association, *Azospirillum* specifically colonizes the sites of lateral root emergence and the root hair zones of the primary as well as the secondary roots.

Root Structure Diagram

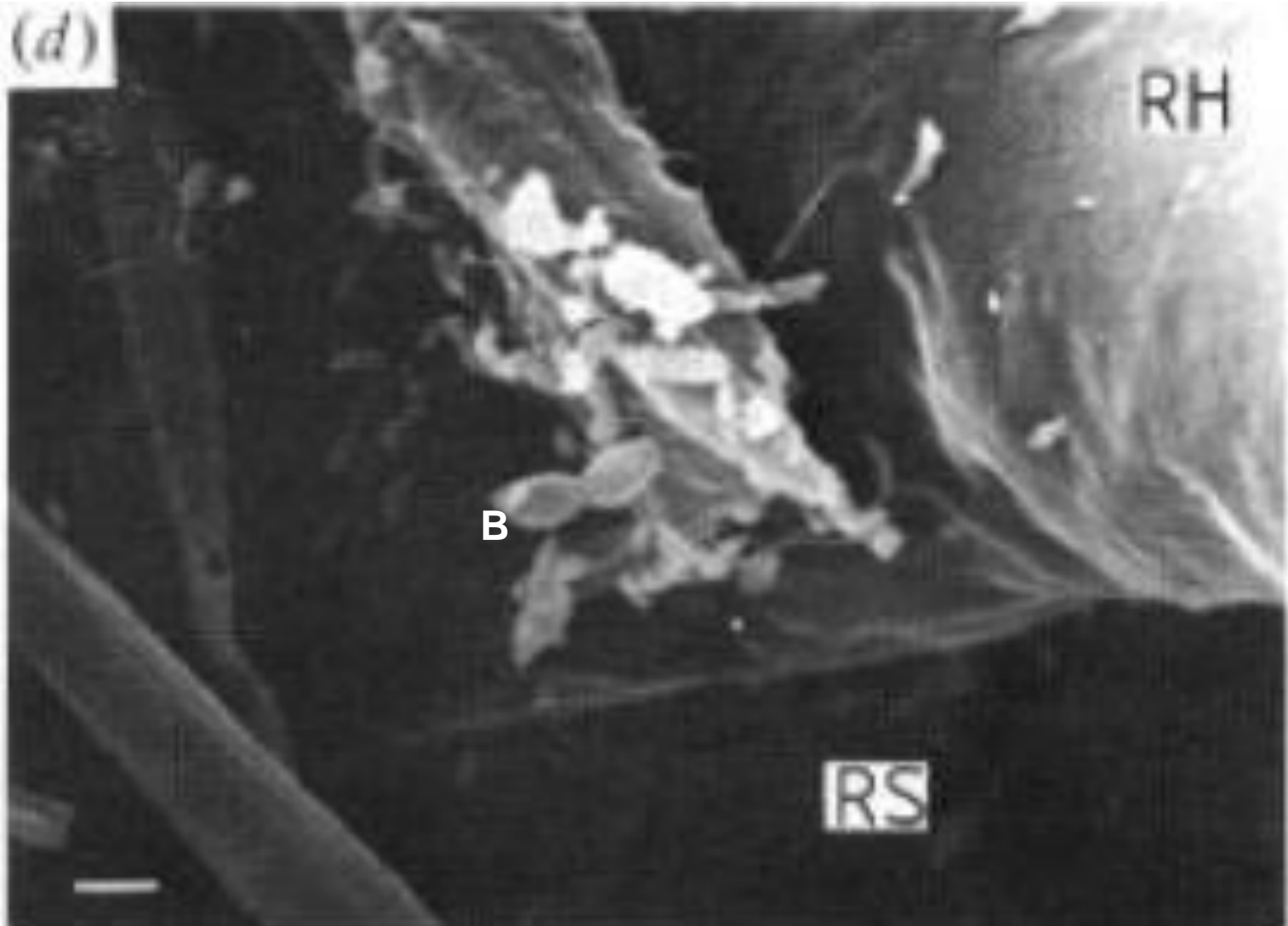


Azospirillum and root interaction, E = Zone of elongation, RH = Root Hairs



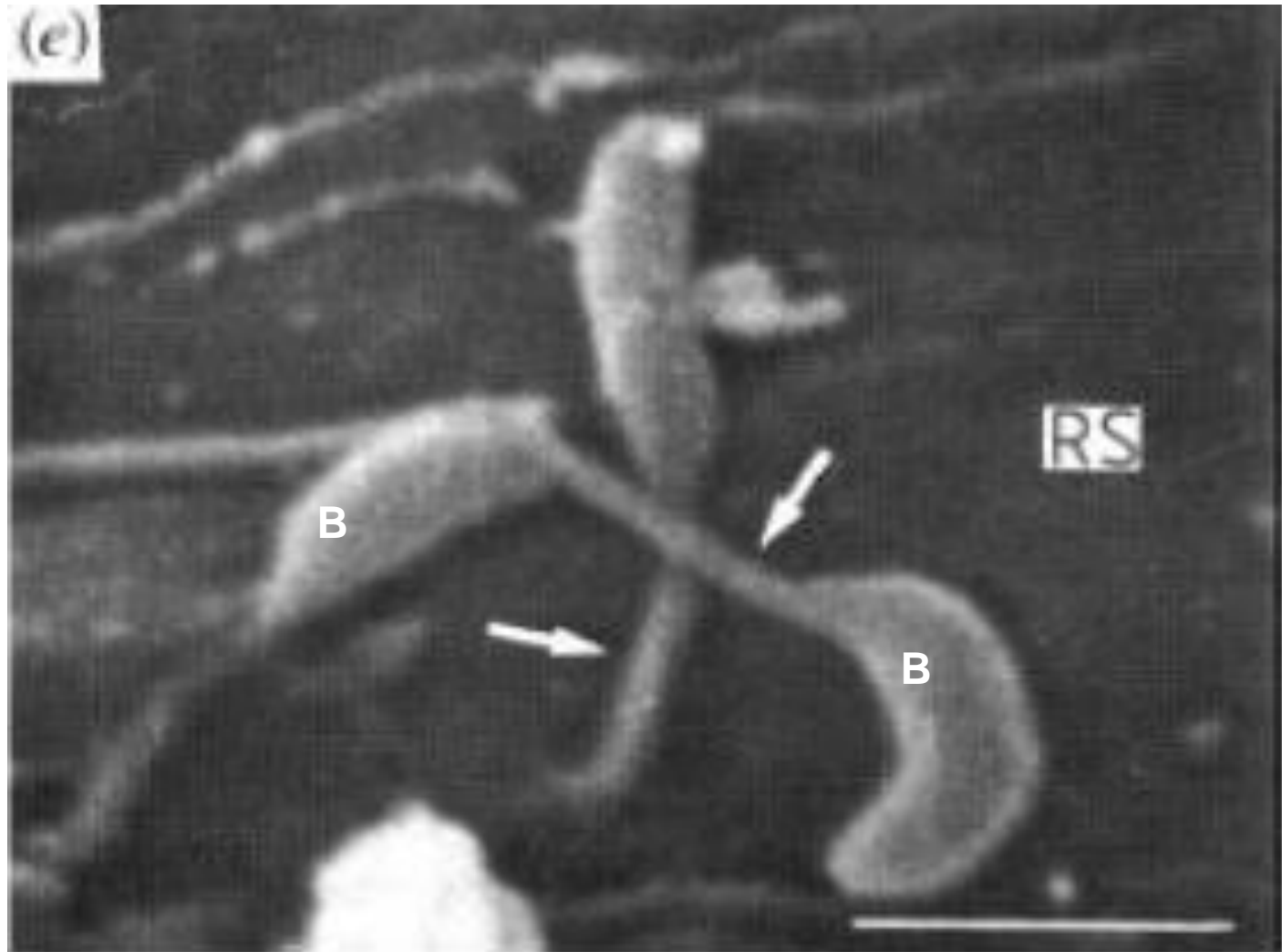


RH = Root Hair, RS = Root Surface, B = Unattached Azospirillum Bacteria





Bacterial Attachment



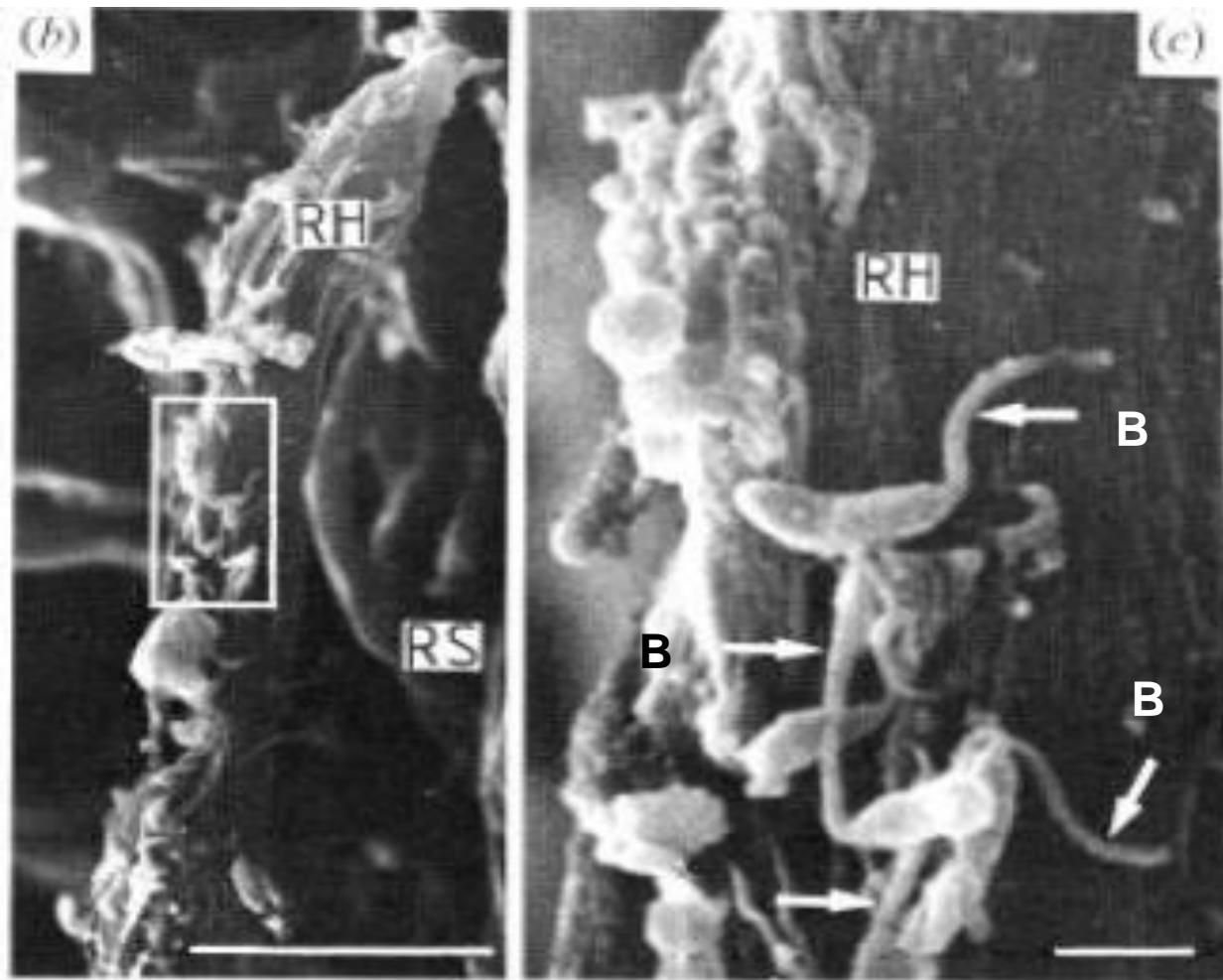
**RS = Root
Surface**

**B = Attached
Azospirillum
Bacteria**



Bacterial Attachment

RH = Root
 Hair, RS =
 Root Surface,
 B = Attached
 Azospirillum
 Bacteria



MicroAZ™

Shelf Stability

Inoculants are historically short lived

- Average survival of other azospirillum products is four to six months.
- TerraMax's formulations have two year shelf life.
- This allows the confident use of these products through normal distribution channels.

Why is Stability Important?

Bacteria can be sensitive to environmental conditions like pH, heat and moisture. Unprotected from these elements, they may die before they are applied or benefit the crop. Not so with **MicroAZ**

In A Word - SURVIVAL

MicroAZ™ Products

Formulations

- **MicroAZ-ST Dry - Powder Seed treatment**
- **MicroAZ-IF – In Furrow**
- **MicroAZ-ST Liquid – Liquid Seed treatment**

MicroAZ-ST™ - Dry

Seed Treatment

MicroAZD™ Field Studies

TerraMax, Inc.

South Dakota 2004

Location

TerraMax tested a microbial treatment designed to stimulate germination, rooting and growth in winter wheat. The test site was near Faulkton, South Dakota and conducted by a TerraMax distributor. The product is a dry formulation that contained two strains of the bacterial genus *Azospirillum*.

Description

MicroAZD™ was applied to the seed before planting on September 11, 2003. Stand establishment was evaluated on May 3, 2004. The number of plants per foot were counted at several field locations, treated and control.

Treatment – 2003

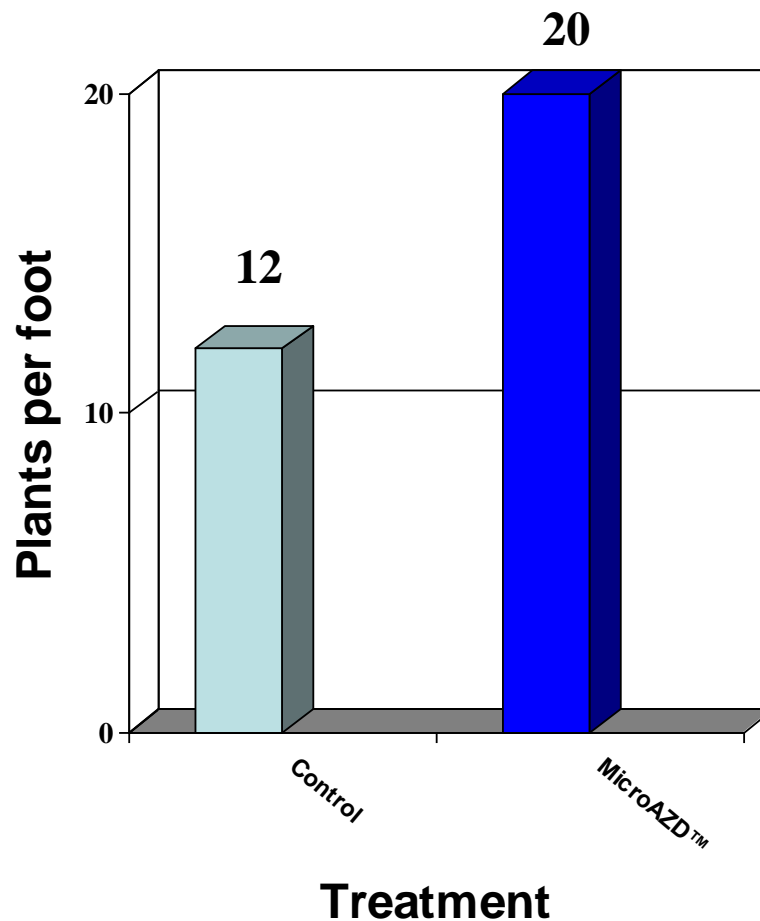
Product: **MicroAZD™**

Application rate: 0.5 pounds per acre

Crop: Winter wheat

Gain over control: 40% increase in stand establishment

Stand Establishment in Winter Wheat



MicroAZD™ Field Studies

TerraMax, Inc.

South Dakota 2004

Location

TerraMax tested a microbial treatment designed to stimulate germination, rooting and growth in winter wheat. The test site was near Faulkton, South Dakota and conducted by a TerraMax distributor. The product is a dry formulation that contained two strains of the bacterial genus *Azospirillum*.

Description

MicroAZD™ was applied to the seed before planting on September 11, 2003. Harvest was on August 22, 2004. The protein in treated wheat was 1 percent higher than control. This was not enough of an increase to qualify for a premium.

Treatment – 2003

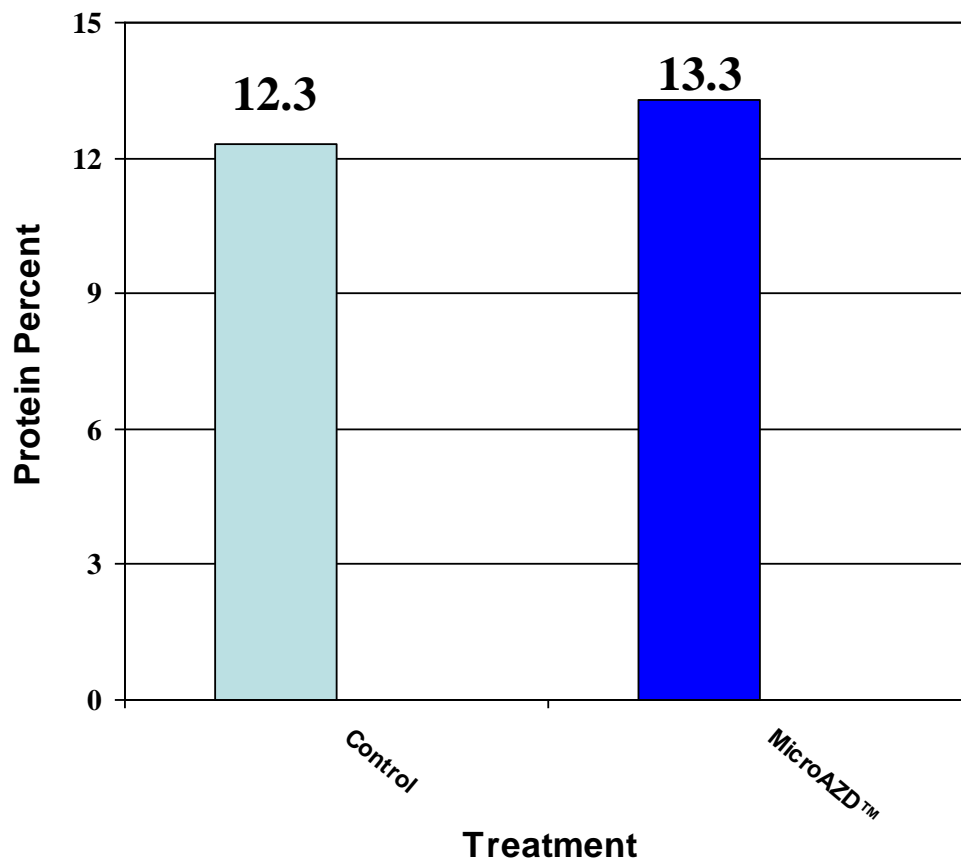
Product: **MicroAZD™**

Application rate: 0.5 pounds per acre

Crop: Winter wheat

Gain over control: 1% increase in protein over control

Protein Level in Winter Wheat



MicroAZD™ Field Studies

TerraMax, Inc.

South Dakota 2004

Location

TerraMax tested a microbial treatment designed to stimulate germination, rooting and growth in spring wheat. The test site was near Hoven, South Dakota and conducted by a TerraMax distributor. The product is a dry formulation that contained two strains of the bacterial genus *Azospirillum*.

Description

MicroAZD™ was applied to the seed before planting on April 7, 2004. Stand establishment was evaluated on May 13, 2004. The number of plants per foot were counted at ten field locations, treated and control.

Treatment

Product: **MicroAZD™**

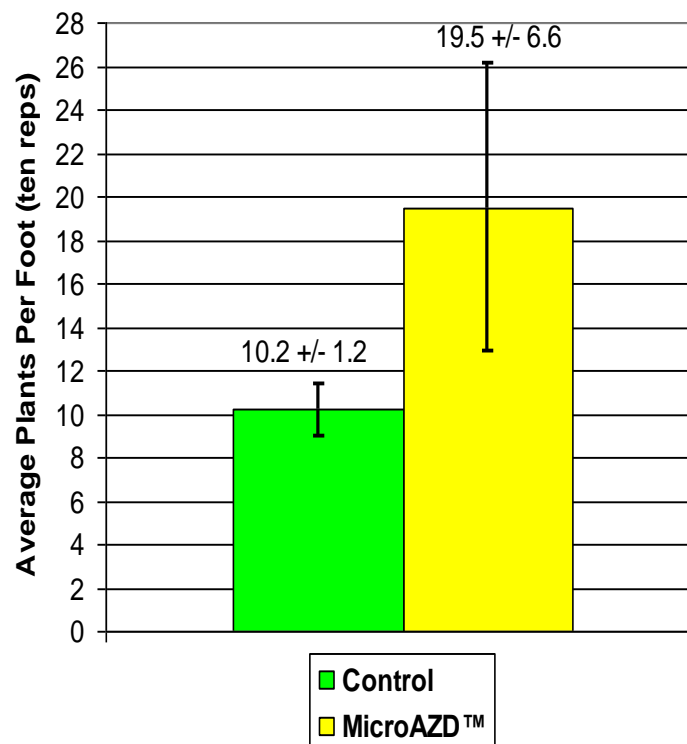
Application rate: 0.5 pounds per acre

Crop: Hard Red Spring wheat variety Briggs

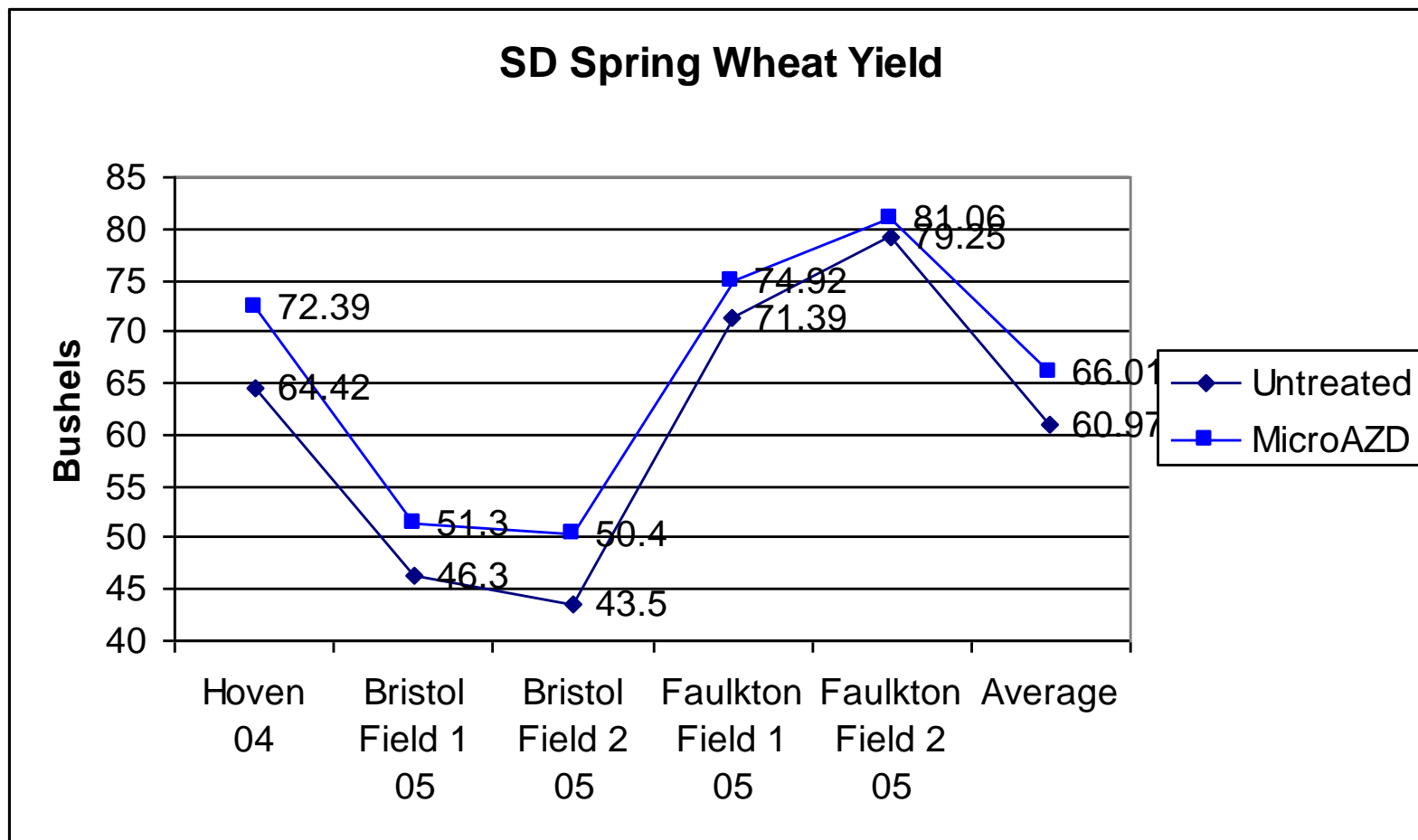
Gain over control: 48% increase in stand

establishment over control

Stand Establishment in Spring Wheat

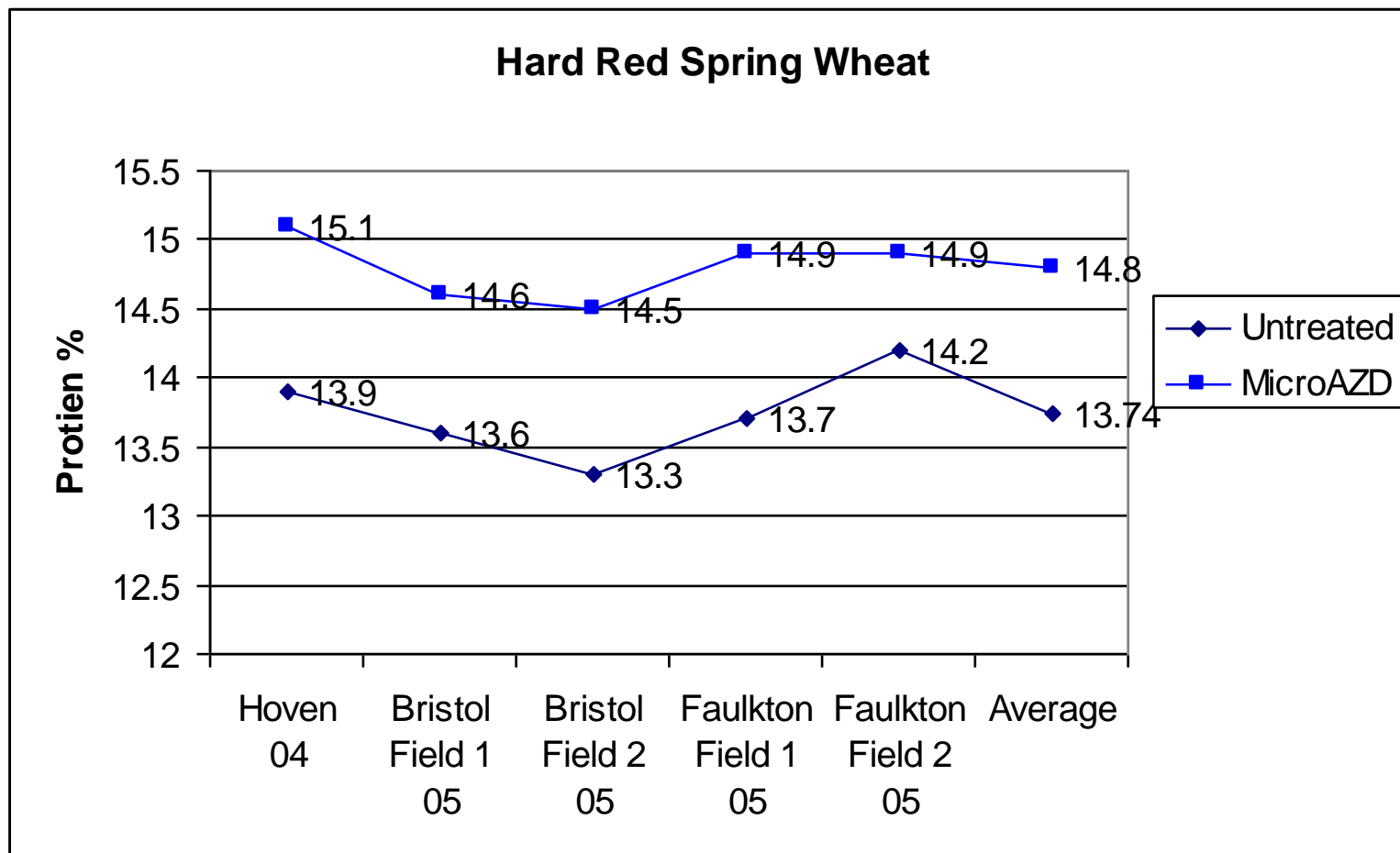


Hard Red Spring Wheat Yield



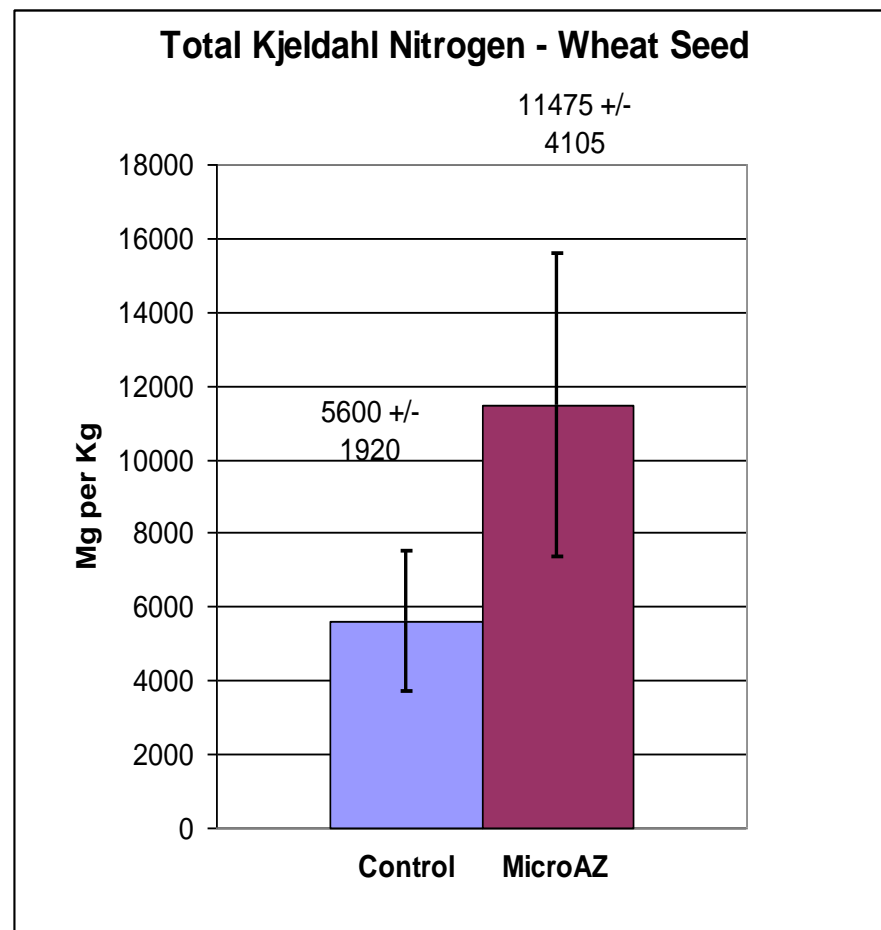
Protein Increase

South Dakota 2004 & 2005

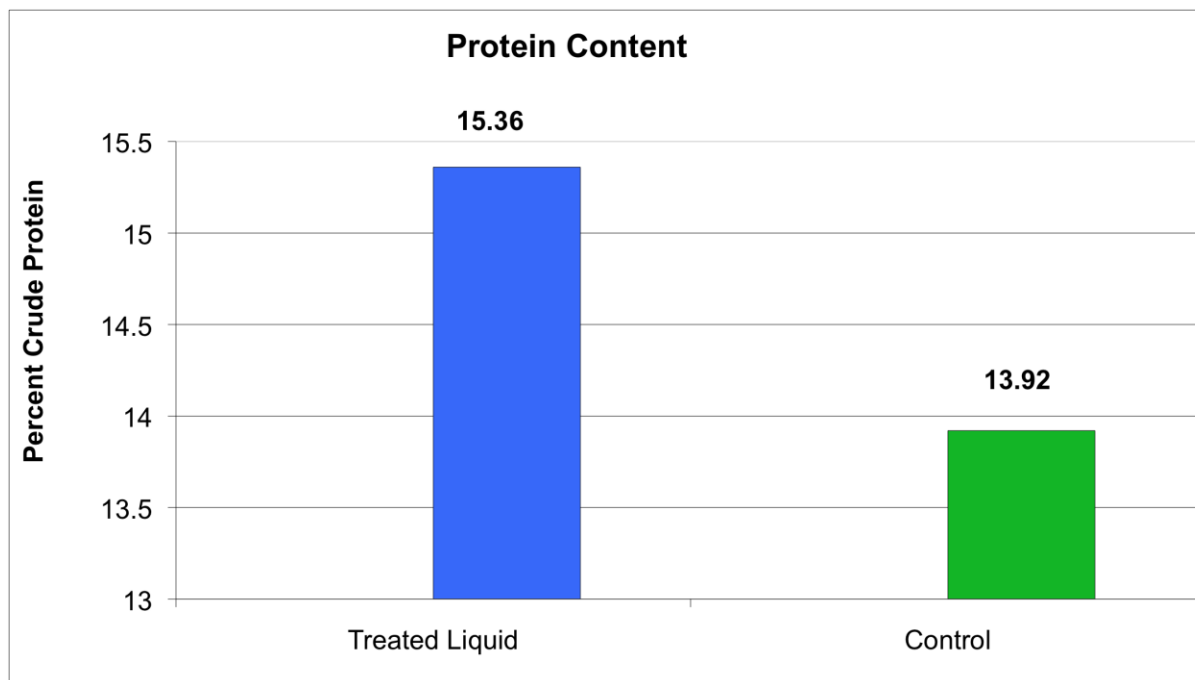


MicroAZ Seed Treatment Nitrogen Fixation in Wheat

- Done in Central Minnesota
- Same variety hard red spring wheat
- Same fertilization
- Treated was double the nitrogen content
- 5.8 grams per kg increase
- This reflects an increase of nitrogen of 20.8 pounds per acre calculated at 60 bu/ac yield. If calculated on the basis of the plant residue (100 pounds per bushel production) would indicate 34.8 pounds of nitrogen fixed per acre.



Azospirillum Liquid Seed Treatment on Organic Wheat



AZGreen-ST Liquid™

Seed Treatment For Wheat

- **Organic production**
- **Wyndmere, ND**
- **Hard Red Spring Wheat – Glen**
- **Planted May 8, 2008, Harvested August 17, 2008**
- **Treated plot size ~ 52,000 square feet**

	Control	Treated
Yield (BU)	30.42	38.07
Protein %	10.9	12.1
Test Wt	62.6	63.9
Moisture %	14.5	14

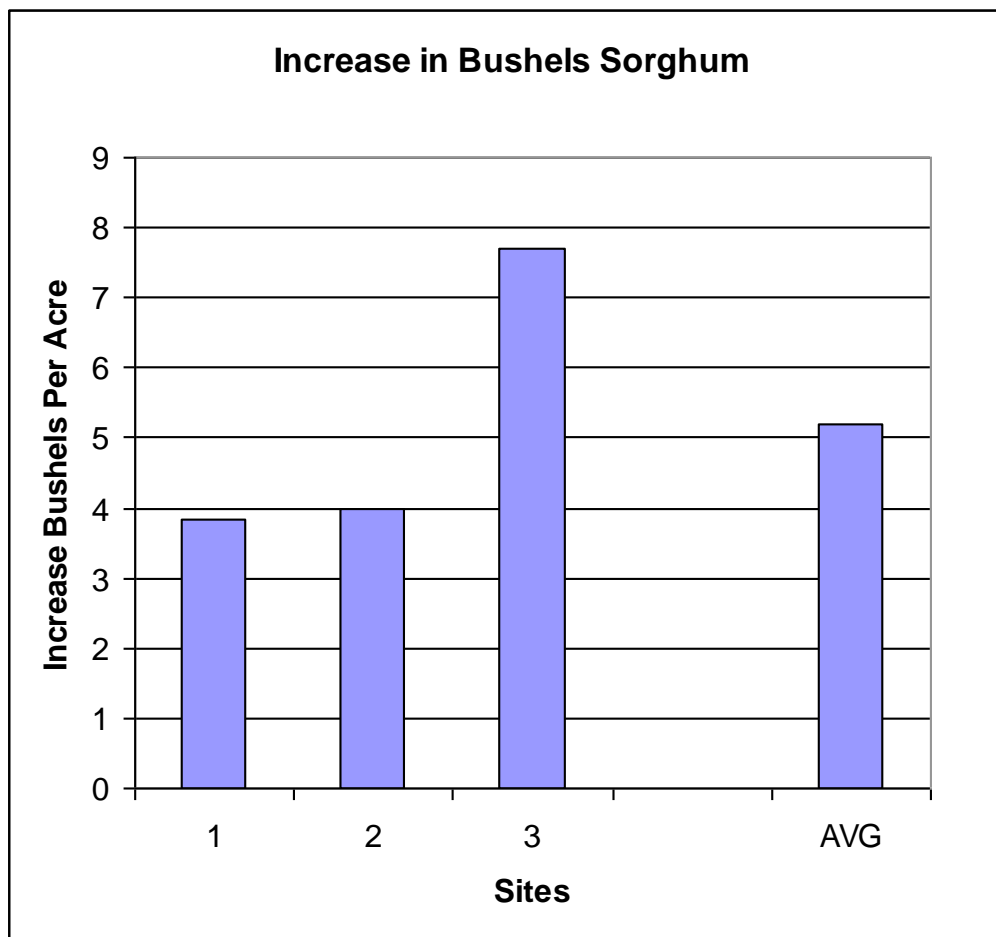
MicroAZ-ST Liquid™

Seed Treatment For Wheat

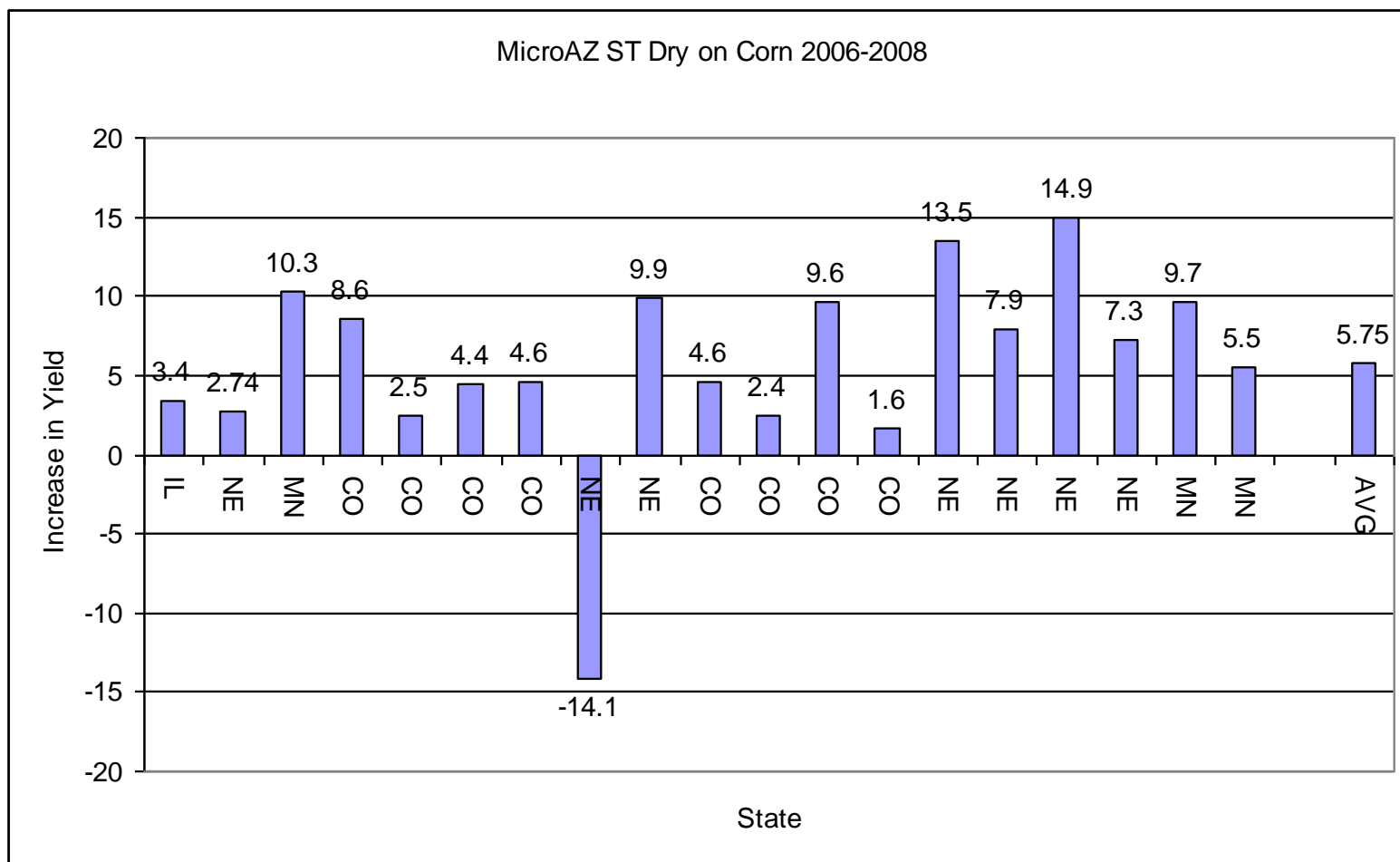
- Conventional production
- Carrington, ND
- Hard Red Spring Wheat – Glen
- Planted April 29, 2008
- 80 lbs actual N (NH₃), 40 lbs 11-52-0
- Treated plot size ~ square feet

	Control	Treated
Yield (BU)	60.53	63.49
Protein %	12.6	13
Test Wt	64.4	64.4
Moisture %	13.01	13.01

Summary of MicroAZ-ST Dry Seed Treatment - Sorghum



Summary of MicroAZ-ST Dry Seed Treatment 2006 – 2008 Corn



2007 Colorado and Nebraska Skip Row vs. Full Row Dryland Corn Variety Trial

CSU Crop Testing, Alex Pavlista, Glen Frickel, Robert Klein, and Jeffrey Golus

All dryland variety trials are more variable than irrigated trials and dryland corn variety trials are more variable than most dryland crop trials. Skip row yield trends indicate that at Akron and Dailey (lower yield environments in 2007), the plant-2-skip-2 configuration increased yields on the average by 16%. At Sidney and North Platte (higher yield locations), conventional full row configuration plots out-yielded the skip row configuration by 17%. Skip row planting appears to be advantageous in lower-yielding environments and disadvantageous in high yielding environments.

At Akron, where the skip row yield advantage was most remarkable, all varieties yielded higher under skip row than under full row, with increases varying from 5% to 60%. At North Platte, where full row yield advantage was most remarkable, all varieties yielded higher under full row, with specific variety yield increases varying from 8% to 27%.

Hybrid (alphabetical)	Akron, CO ¹		Dailey, CO ²		North Platte, NE ³		Sidney, NE ⁴	
	Skip Row Yield ⁵	Full Row Yield ⁵	Skip Row Yield ⁵	Full Row Yield ⁵	Skip Row Yield ⁵	Full Row Yield ⁵	Skip Row Yield ⁵	Full Row Yield ⁵
	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
DEKALB DKC52-63 (RR2/YGCB)	53.1	50.5	83.0	83.8	115.6	145.6	100.6	106.7
DEKALB DKC58-16 (VT3)	43.8	35.9	75.5	65.9	108.5	133.9	101.6	121.0
DEKALB DKC58-16 (VT3)+Micro-AZ ⁶	48.4	38.3	85.1	67.5	123.4	141.2	115.1	128.9
DEKALB DKC58-16 (VT3)+Myconate ⁷	62.3	46.9	74.0	75.2	120.6	138.2	114.6	115.8
Dyna-Gro 53P87 (RR2/YGCB)	33.1	29.9	83.3	68.0	97.6	133.5	90.6	119.3
Dyna-Gro 54T42 (RR2/HXI)	37.6	23.5	77.9	69.1	122.0	147.4	103.5	104.1
Dyna-Gro 55B65 (RR2/YGPL)	57.5	45.0	74.2	71.6	98.7	115.2	100.8	114.1
Dyna-Gro 55P79 (RR2/YGCB)	49.4	32.0	77.5	72.4	115.0	125.6	98.2	111.1
Dyna-Gro 57P69 (RR2/YGCB)	47.1	43.4	86.7	78.2	119.2	130.8	102.8	118.6
Dyna-Gro 57P93 (RR2/YGCB)	47.9	30.4	73.3	63.5	123.1	145.7	108.4	115.3
LG Seeds LG 2475 (BT/RR)	47.6	37.5	75.5	75.1	103.0	121.8	95.2	108.9
LG Seeds LG 2514 (BT/RR)	48.2	36.9	78.8	71.2	95.5	126.6	87.9	109.6
Average	48.0	37.5	78.7	71.8	111.9	133.8	101.6	114.4
LSD _(0.30)	11.4	14.1	7.1	9.5	5.3	9.8	8.2	11.4

¹Trial conducted at the Central Great Plains Research Station.

²Trial conducted on the Mark and Neil Lambert farm.

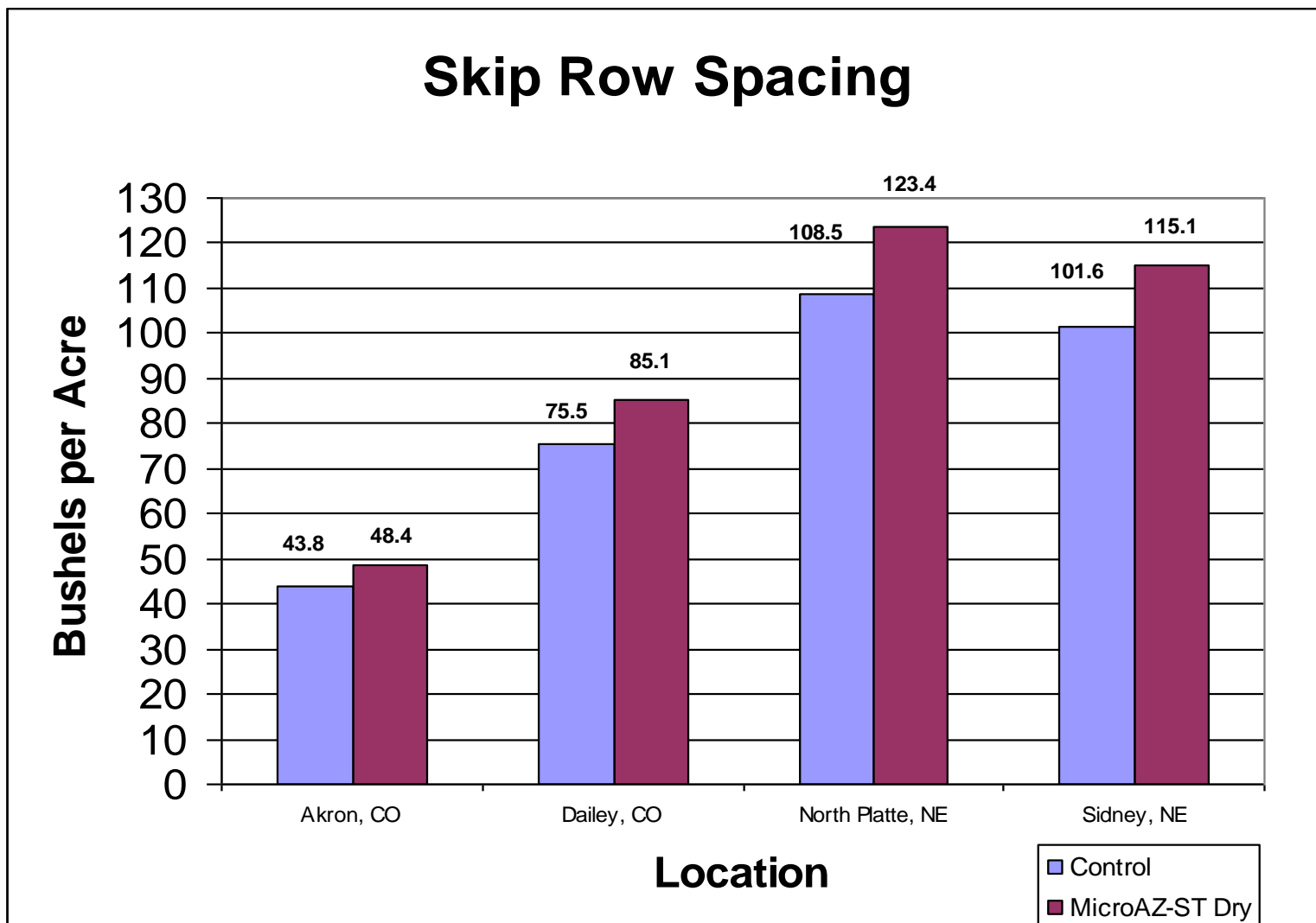
³Trial conducted at the University of Nebraska West Central Research and Extension Center.

⁴Trial conducted at the University of Nebraska High Plains Ag Lab.

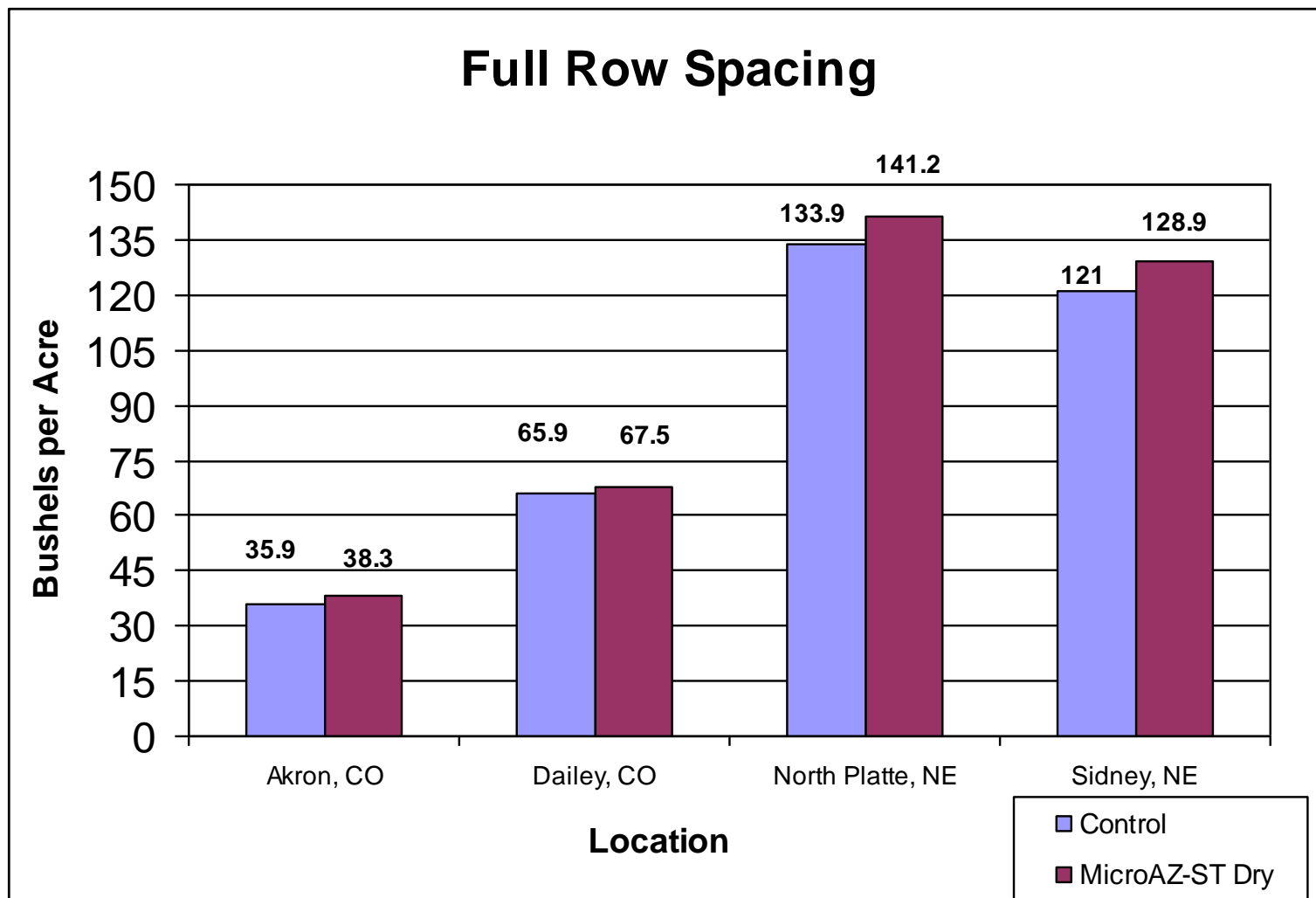
⁵Yields corrected to 15.5% grain moisture.

⁶**Micro-AZ**: TerraMax's Micro-AZ is a stabilized formulation of two beneficial micro-organisms, Azospirillum brasilense and lipoferum, in a nutrient blend that increases shelf life and bacteria survivability. This product, available in both liquid and dry formulations, is intended to stimulate root growth and enhance the germination process in grasses, for increased root mass, stand and yield. The organisms in Micro-AZ are naturally occurring and will not harm the environment. TerraMax can be reached at 651-458-4401, or www.terramaxag.com.

Colorado State University & University of Nebraska – Lincoln 2007 Variety DKC58-16

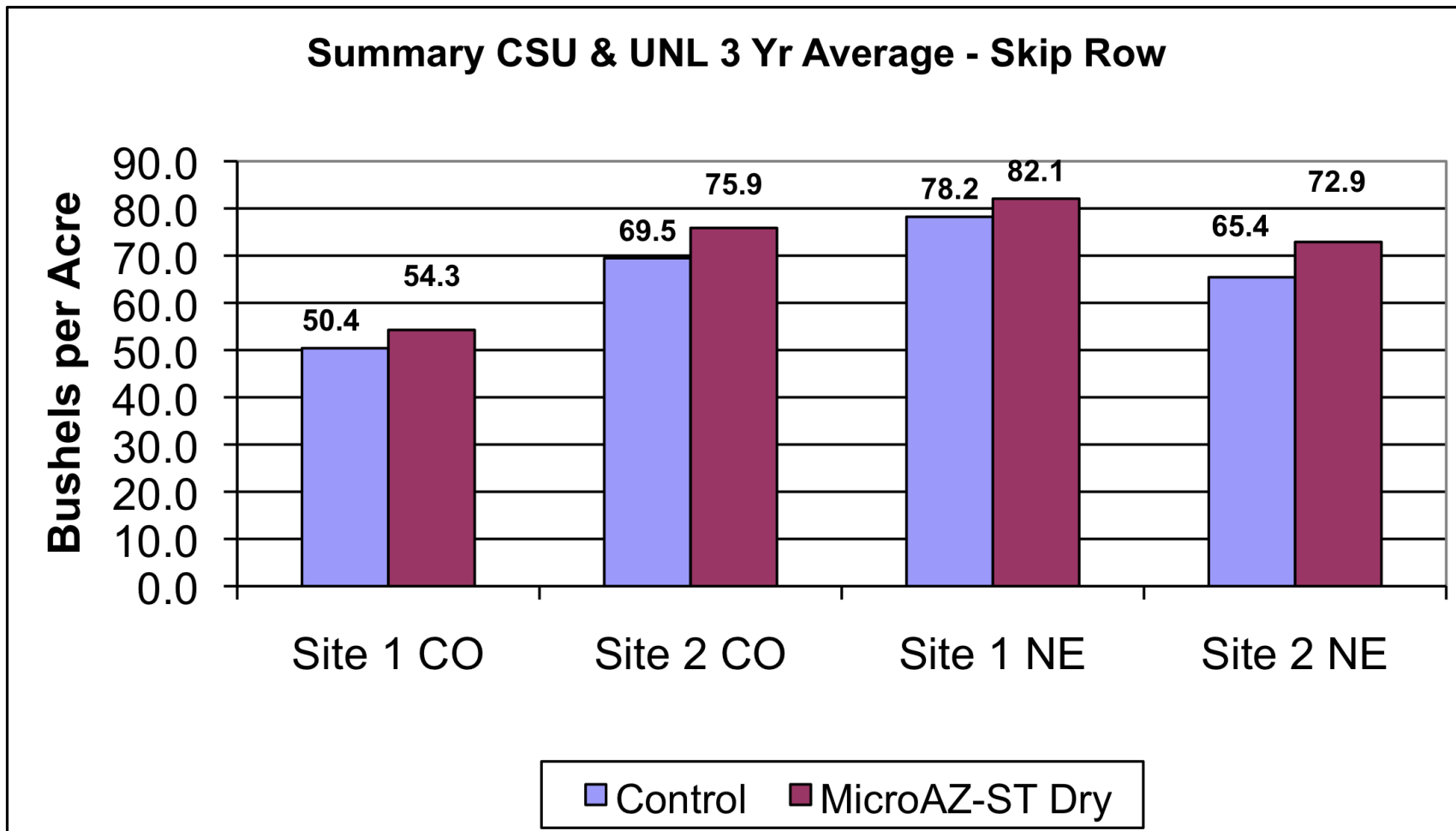


Colorado State University & University of Nebraska – Lincoln 2007 - Variety DKC58-16



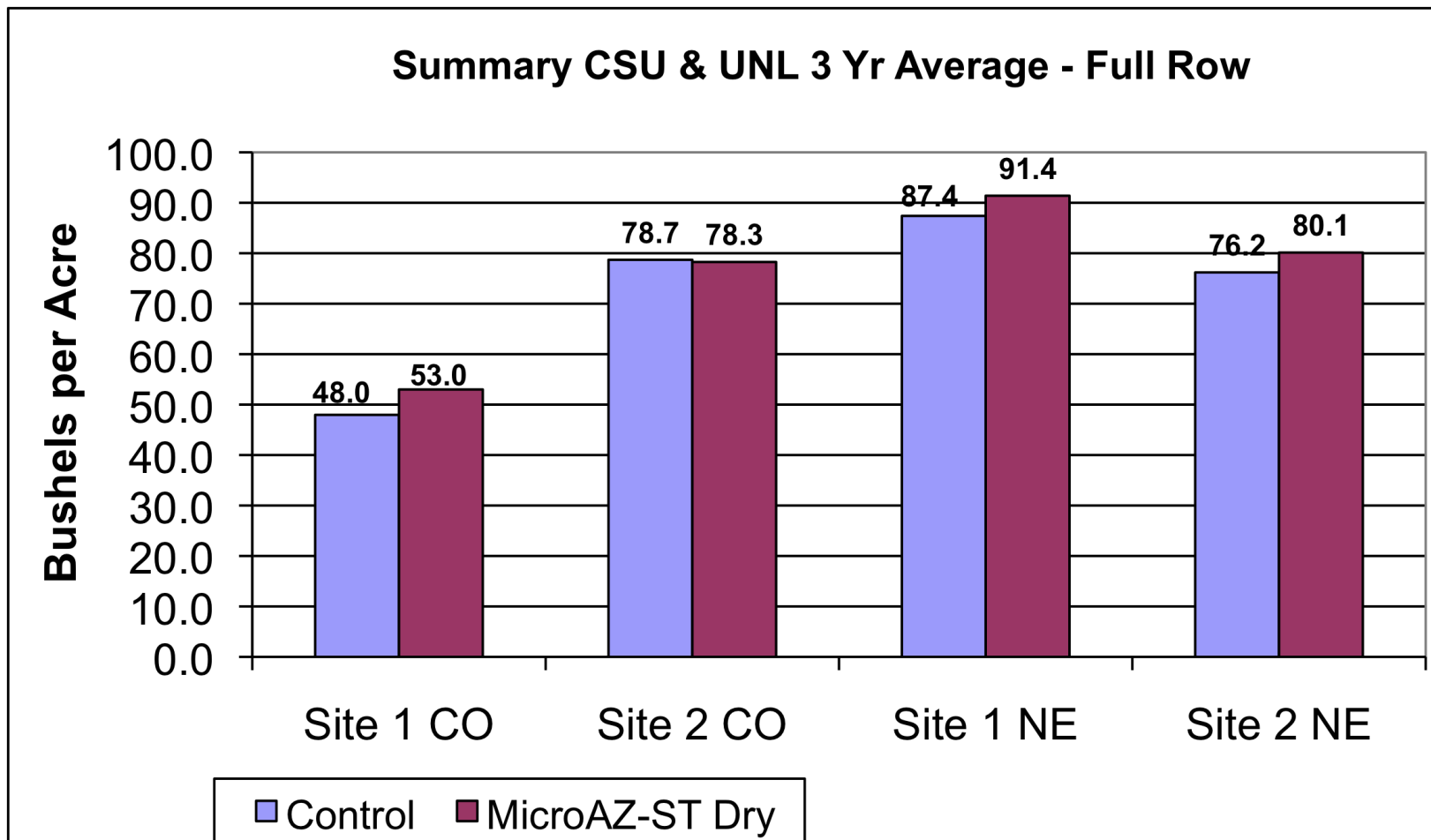
Summary Colorado State and Nebraska Lincoln Universities

2006-2008 Dryland Corn Trials, Population ~ 15,000/ac

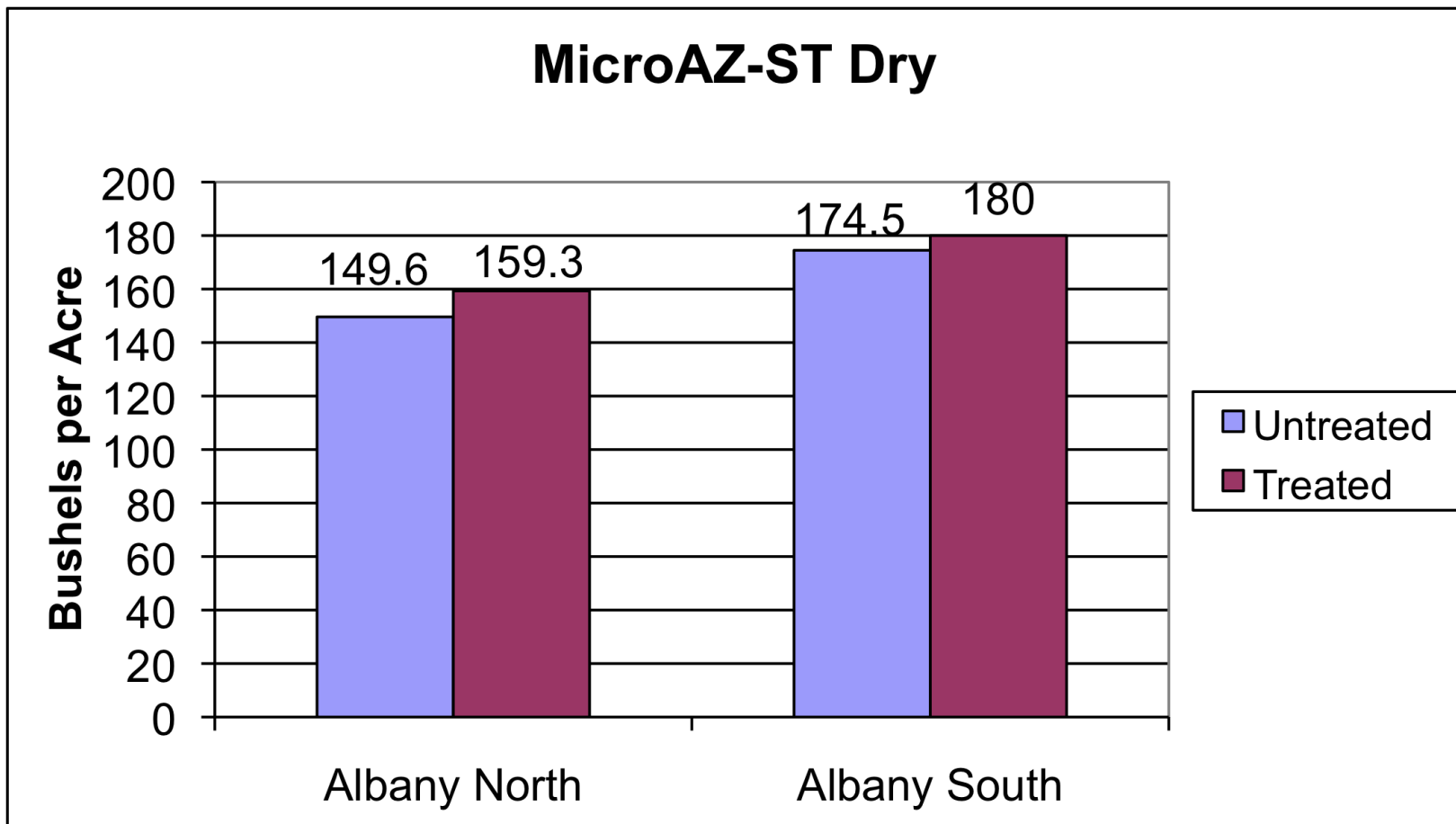


Summary Colorado State and Nebraska Lincoln Universities

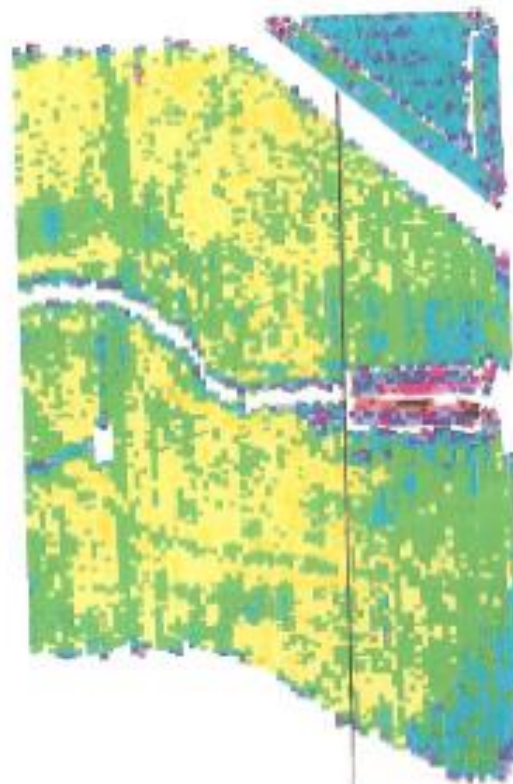
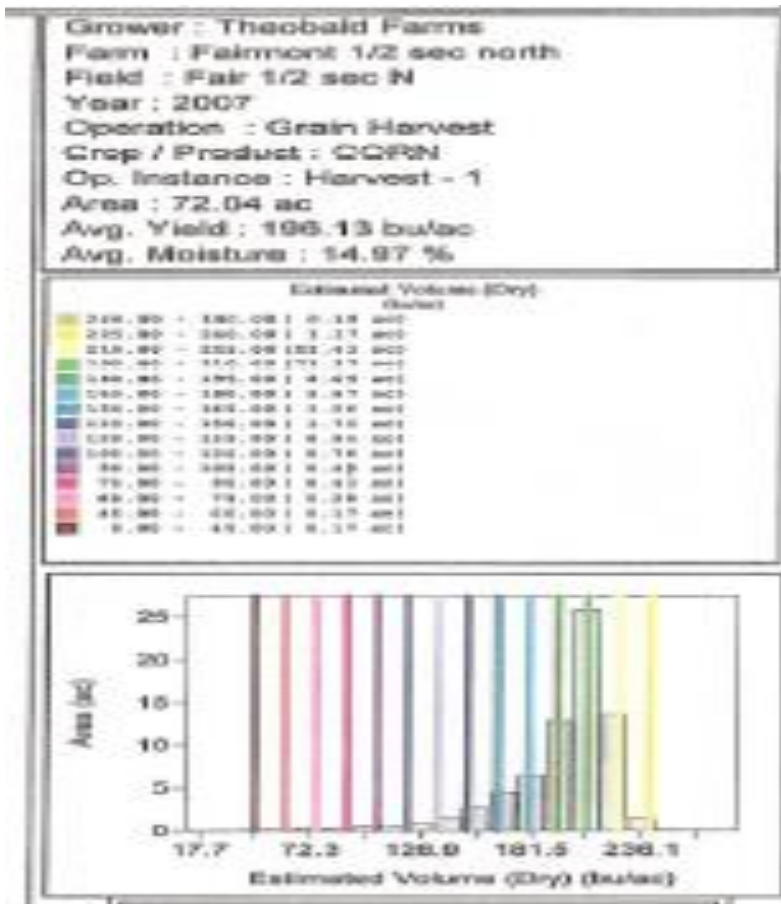
2006-2008 Dryland Corn Trials , Population ~ 15,000/ac



Field Trial Results Corn Albany, MN 2008



Nebraska 2007



used A2
5.0 bu Increase

Nebraska 2007



DISPLAY PLOT PLANTING AND HARVEST REPORT



PAGE _____ of _____

CROPPER (First) Mike (Last) Hynek

ADDRESS _____

CITY Gardner STATE NE ZIP _____

COUNTY _____ PHONE _____

PLANTING SEQUENCE STARTING FROM: N S E W (Signature of Weight Weight Operator) _____ (Date) _____

I hereby authorize RENZE HYBRIDS and its representatives to use this information, my name and photo for promotional purposes. _____ (Signature) _____ (Date)

I certify that the information recorded is accurate. _____ (Signature) _____ (Date)

CROP <input checked="" type="checkbox"/> CORN <input type="checkbox"/> SOYBEANS	PLANTING DATE <u>5/14/07</u>	HARVEST DATE <u>10-21-07</u>	ROW WIDTH <u>30'</u>	PLANTING RATE <u>29,700</u>	TILLAGE METHOD <input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> NO TILL <input type="checkbox"/> MINIMUM TILL	IRRIGATION <input type="checkbox"/> FLOOD <input checked="" type="checkbox"/> PIVOT	
FERTILIZER APPLIED	N	P ₂ O ₅	K ₂ O	ANHYDROUS	NITROGEN YES <input type="checkbox"/> STABILIZER NO <input type="checkbox"/>	PREVIOUS CROP	CURRENT INSECTICIDE
STARTER (LBS. ACTUAL) <u>100^{gal}</u>				28% LIQUID	MEANURE YES <input checked="" type="checkbox"/> APPLICATION NO <input type="checkbox"/>	<input checked="" type="checkbox"/> CORN <input type="checkbox"/> SOYBEANS <input type="checkbox"/> ALFALFA	PREVIOUS INSECTICIDE
* BROADCAST (LBS. ACTUAL)				FALL PREPLANT <input type="checkbox"/> POSTPLANT <input type="checkbox"/>			PREVIOUS INSECTICIDE
CURRENT HERBICIDE <u>Bicep II / RR</u>	RATE <u>1/2</u>	APPLICATION	PREVIOUS HERBICIDE <u>Same</u>	RATE	APPLICATION		
		<input type="checkbox"/> PREPLANT <input type="checkbox"/> PREEMERGE <input type="checkbox"/> POSTEMERGE			<input type="checkbox"/> PREPLANT <input type="checkbox"/> PREEMERGE <input type="checkbox"/> POSTEMERGE		

Control

+MicroAZ

#	C H K	BRAND NAME	HYBRID	% Hvst. Moist.	Lbs. Harvested Net Weight	Row Length	# Rows Hvst.	Hvst. Pop. (#00%)	% Root Lodge	% Stalk Lodge	Test Weight	Yield Per Acre 15% Mt.-Beans 35.5% Mt.-Corn	Misc. Traits & Notes
1		Pioneer	33H27	18.1	3780	469	12			14%	58.0	209.5	
2		Pioneer	33H27 ^{with} dust	17.8	6630	791	12			10%	58.0	211.4	

Data from a comparison plot Renze versus Pioneer, only the Pioneer was treated (w dust) MicroAZ ST Dry. Complete plot data available on request

Azospirillum Dry Seed Treatment on Organic Corn

Location

This work was done on a farm near Annadale, Minnesota. The OM of the soil was 4.6.

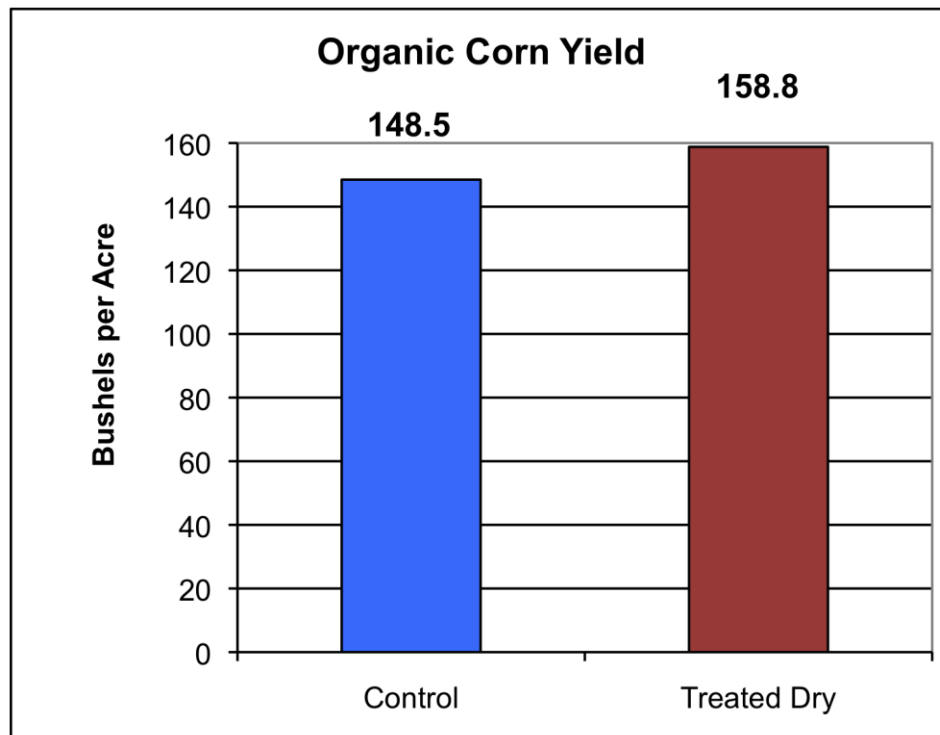
Description

This was a side by side plot of the organic formulation of a dry azospirillum seed treatment.

Treatment – Spring 2006

Products: Organic formulation of a dry seed treatment of azospirillum

Application rate: 2 ounces per unit of corn



MicroAZ-IF™

In furrow application for corn

MicroAZ-IF™ Field Studies

South Dakota 2004

Location

TerraMax tested a microbial treatment designed to stimulate rooting and growth in corn. The test site was near Hoven, South Dakota.

Description

MicroAZ™ was applied in furrow at planting on May 3, 2004. The grain was harvested November 8, 2004. Plant population was 29,000. The MicroAZ-IF™ was applied with 2 gallons of pop up fertilizer per acre with a “Regent” machine applicator. Yields calculated at 15% moisture.

Treatment – 2004

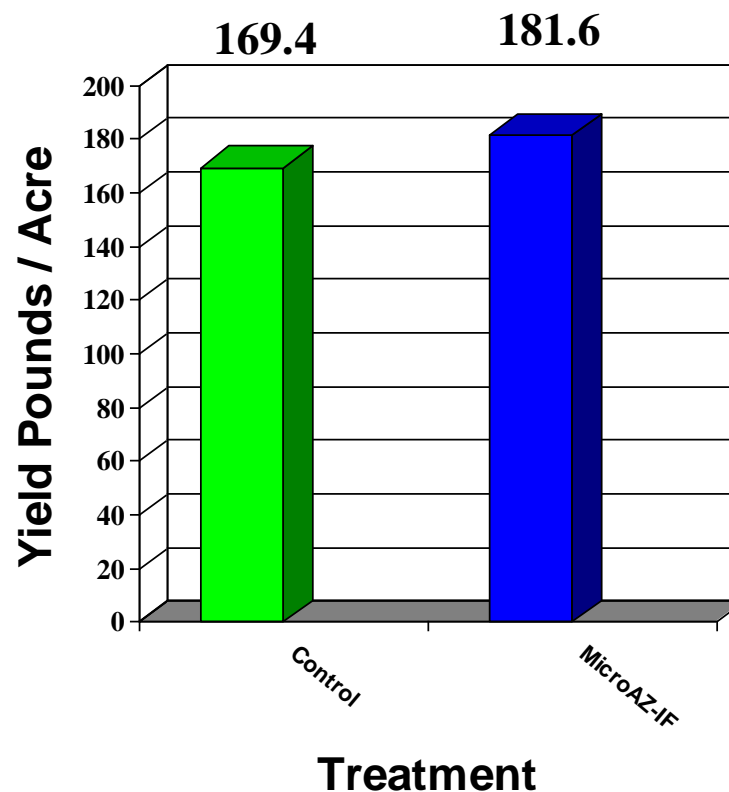
Product: **MicroAZ-IF™**

Application rate: 12.8 ounces per acre

Crop: Corn

Gain over control: 12.2 bushels / acre

Grain Yield





Hoven, SD 2004 – 12.8 ounces per Acre MicroAZ-IF Liquid

“Maximizing Earth’s Potential”

MicroAZ-IF™ Field Studies

Dodge, Nebraska 2005

Location

This work was done on a farm near Dodge, Nebraska. A TerraMax distributor coordinated the work.

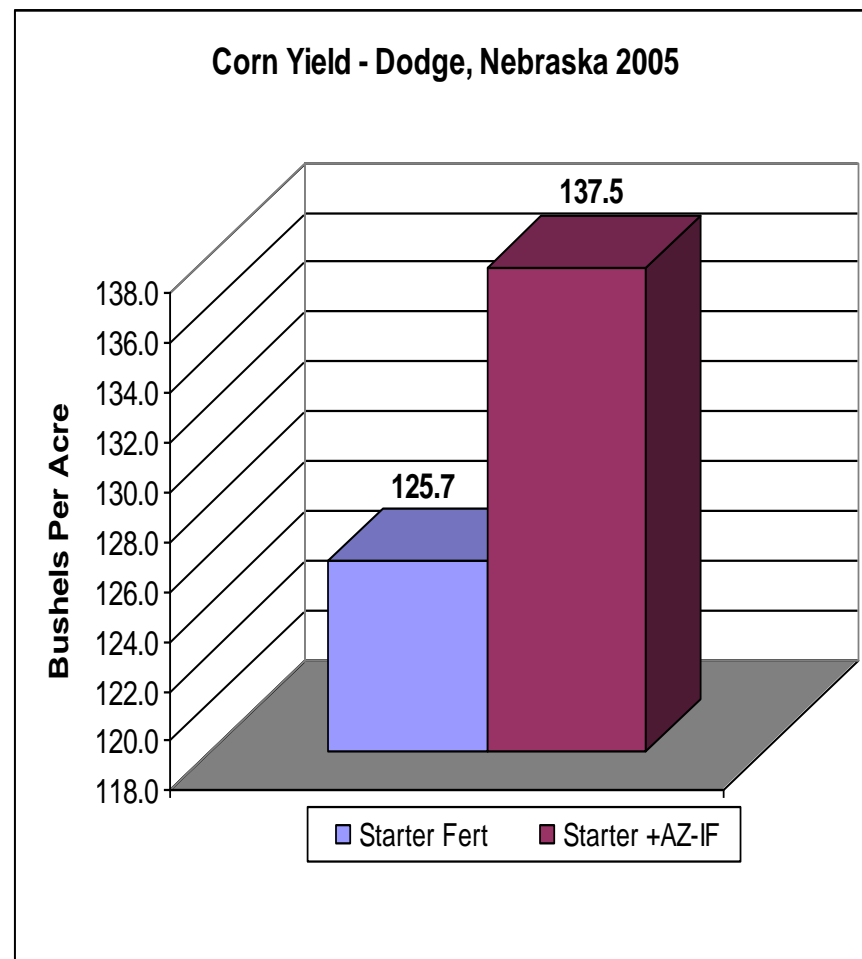
Description

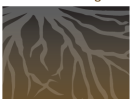
This was a side by side plot of eight rows per treatment.. MicroAZ-IF™ is an azospirillum product to stimulate rooting and fix nitrogen.

Treatment – Spring 2005

Products: MicroAZ-IF™

Application rate: 12.8 ounces AZ per acre in furrow at planting tank mixed with 10-34-0 with zinc and sulfur.





MicroAZ-IF™ Field Studies

Rushford, Minnesota 2005

Location

This work was done in Rushford, MN on the LP Acres farm. The distributor who coordinated the work was Steve Darrington

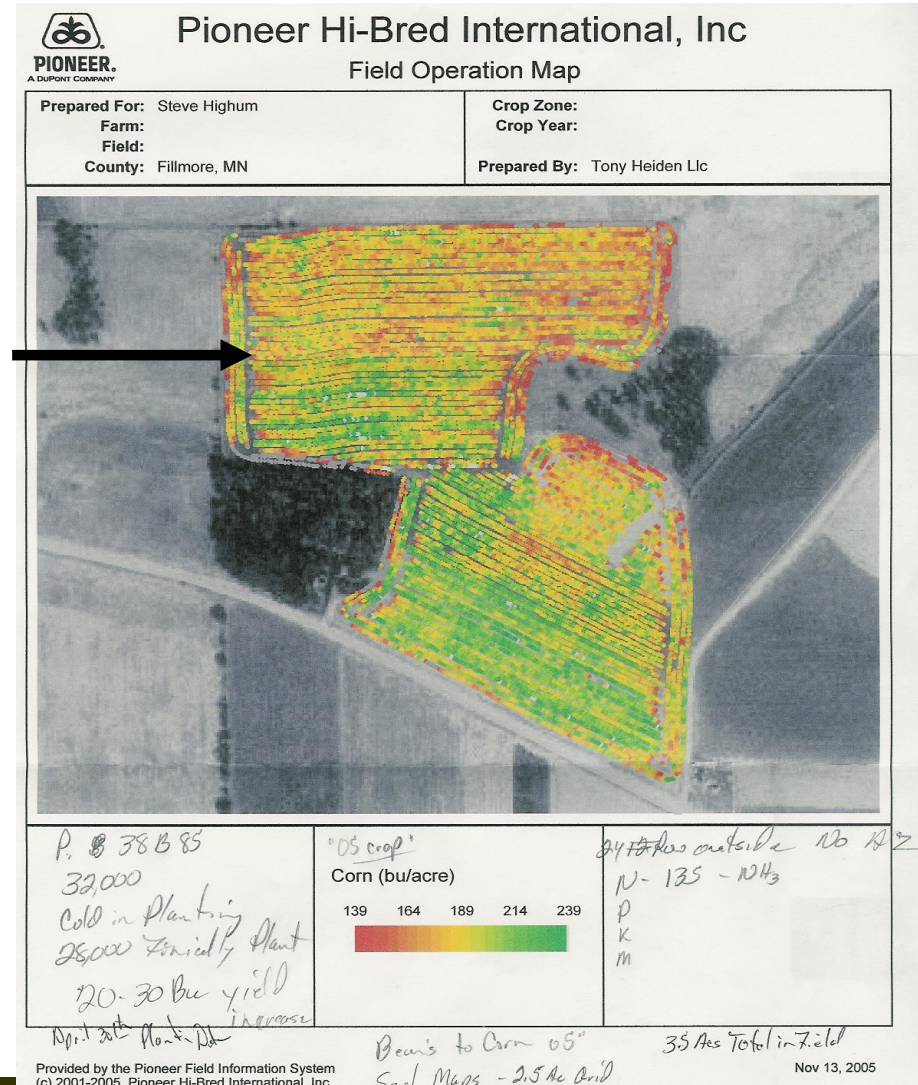
Description

The untreated part of the field is above the black arrow and the treated part is below the black arrow. Twenty four rows around the field were left as an untreated border. They saw a 20 to 30 bushel increase in yield.

Treatment – Spring 2005

Products: MicroAZ-IF™ in furrow

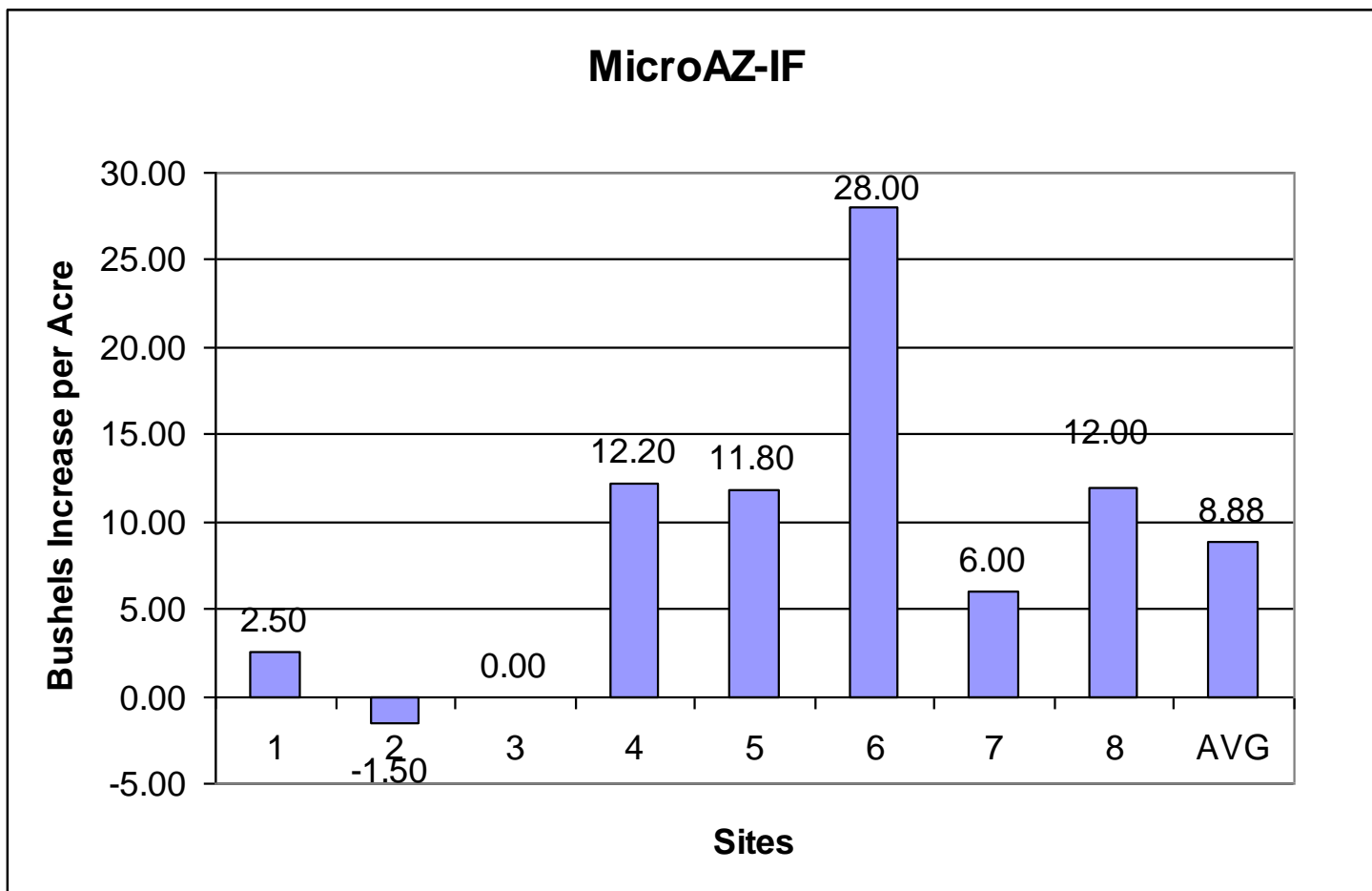
Application rate: 12.8 ounces AZ per acre in furrow at planting tank mixed with a 50/50 blend of 9-24-3 and 2-0-6 and a quart per acre of a micronutrient blend.



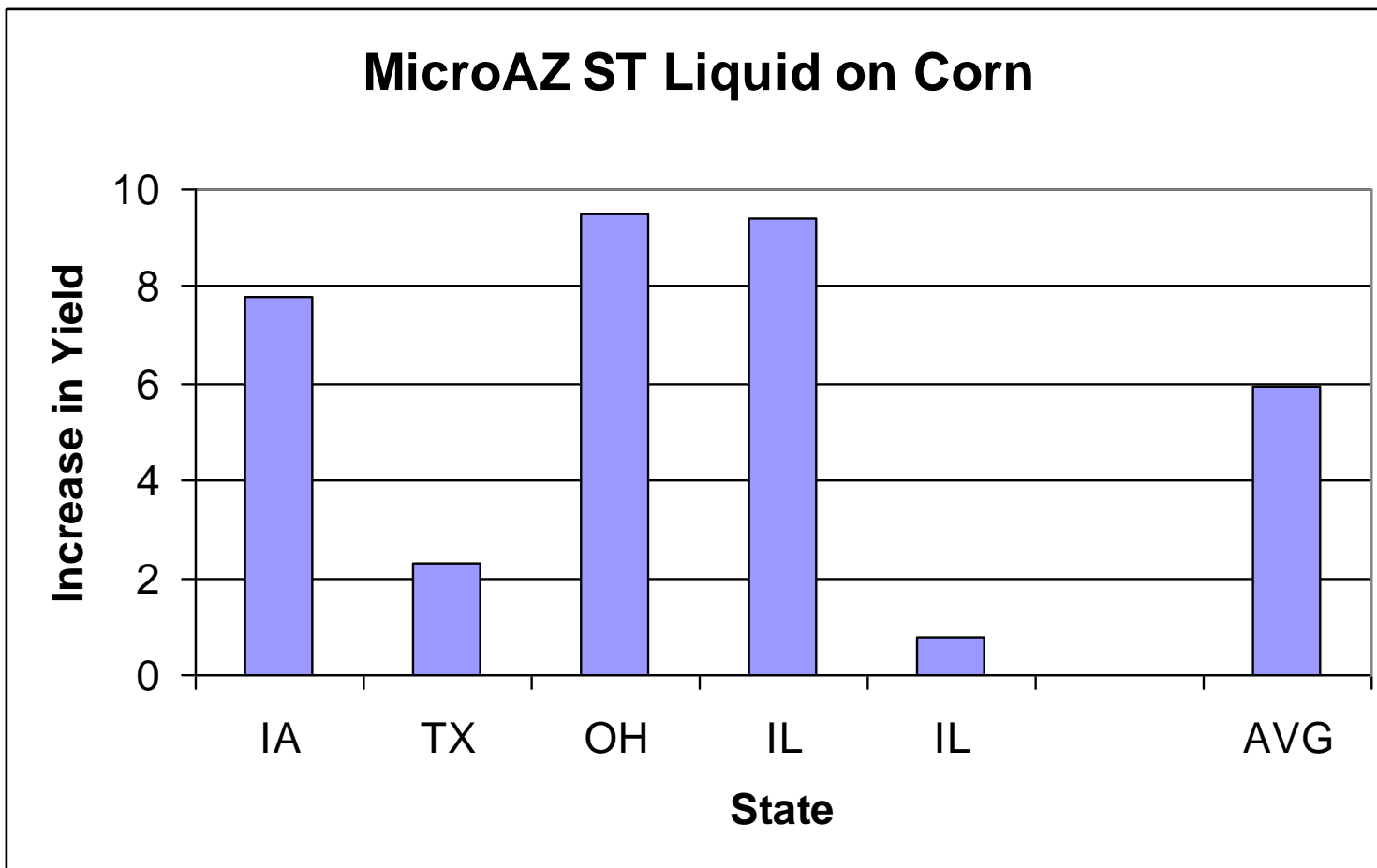
MicroAZ-IF – Irrigated Corn Geneva, Nebraska 2005



Summary of MicroAZ – IF In furrow corn treatment



Summary of MicroAZ-ST Liquid Seed Treatment on Corn 2006



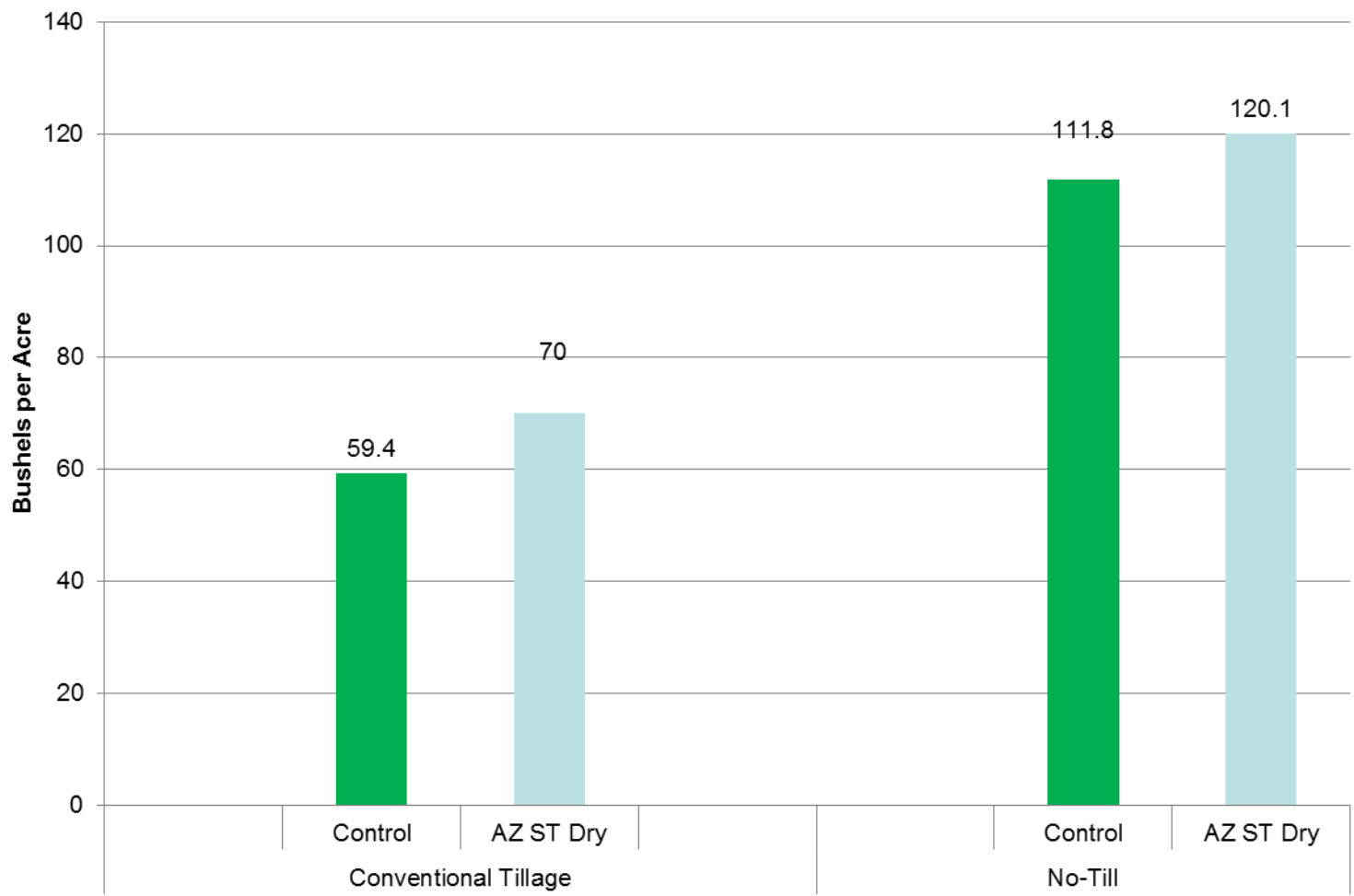
Work done by Tryon Group Madison, Wisconsin





“Maximizing Earth’s Potential”

Corn Yields Nebraska 2012 MicroAZ-ST Dry



2012 Field Results

City	St.	Crop	Variety	Treatment	Bu/Ac	Δ	Comments	Total return per Ac @ \$6/bu	Δ \$/Ac @\$6/bu	Net return / Ac Minus AZ & N*
Wahoo	NE	Corn	P1324H R	MicroAZ ST Dry	70	10.6	Dryland	420	\$63.60	\$58.60
				Control	59.4			356.4		
Wahoo	NE	Corn	P1324H R	MicroAZ ST Dry	120.1	8.3	Dryland	720.6	\$49.80	\$44.80
				Control	111.8			670.8		
Fostoria	IA	Corn	UNK	MicroAZ ST Dry	182.67	7.38	No N	\$1,096.02	\$1,091.02	\$39.28
				Control	175.29			No N		
Fostoria	IA	Corn	UNK	MicroAZ ST Dry	215.79	10.84	70# N	\$1,294.74	\$1,244.24	\$60.04
				Control	204.95			70# N		
Fostoria	IA	Corn	UNK	MicroAZ ST Dry	221.73	-6.24	140# N	\$1,330.38	\$1,234.38	-\$42.44
				Control	227.97			140# N		

N costs @ .65 / unit

TRIALS Reporting	Location Summary Report		Experiment Local Experiment Tracking Name OFAC12025990_0001			
	Name N0rdstrom; Timothy Residence City Wahoo State NE Postal Code 68086 County Saunders		Business Partner ID 1010093923			
Crop Corn Grain Previous Crop Soybeans Row Width 30 (in) Planting Date 5/14/2012 Harvest Date 10/11/2012	Trial Loc Lat 41.192090 Long -96.657890 State NE Postal Code 68086 County Saunders					
	Trial Type <input type="checkbox"/> Genetic <input checked="" type="checkbox"/> Agronomic <input type="checkbox"/> Courtesy Irrigation <input checked="" type="checkbox"/> None <input type="checkbox"/> Limited <input type="checkbox"/> Full		Tillage <input type="checkbox"/> Conservation <input type="checkbox"/> Strip <input type="checkbox"/> Ridge <input checked="" type="checkbox"/> Conventional <input type="checkbox"/> Mulch <input type="checkbox"/> No-Till			
	No. Rows Harvested 6		Weighing Device <input checked="" type="checkbox"/> Weighed <input type="checkbox"/> Yield Monitor			

Comments

PLOT 1 TJ MICROMIX
 PLOT 2 CHECK
 PLOT 3 TERRAMAX MICROAZO DRY

Additional Location Traits

Brittle Snap (y/n) No

	Brand	Product	Subprod/Seed Tmt	Planting Rate (n/.001a)	No Other Factors	Harvested			Weighed			Yield Monitor			Test Weight (lb/bu)	Harv Stand (n/.001a)
						not required for Yield Monitor			Yield (bu/a 56#)	MST %	AGI \$/A	Yield (bu/a 56#)	MST %	AGI \$/A		
WT. (lb)	Length (ft)	Width (in)														
1	Pioneer	P1324HR	FHND	28		745	730	180	55.0	11.7	330				59	
2	Pioneer	P1324HR	FHND	28		805	730	180	59.4	11.7	358				59	
3	Pioneer	P1324HR	FHND	28		950	730	180	70.0	11.8	420				58	

Market Price	Market Segment	Segment Price Adj.	Adjustment	Total Market Price
\$6.00	Standard	\$0.00	\$0.040	\$6.00

