Sustainable Agronomy for Flood Recovery and Resiliency

Paul J. Jasa, Extension Engineer

University of Nebraska

American Society of Agronomy | SUSTAINABLE AGRONOMY CONFERENCE

Residue, Soil Biology, & Systems Approach

Paul J. Jasa
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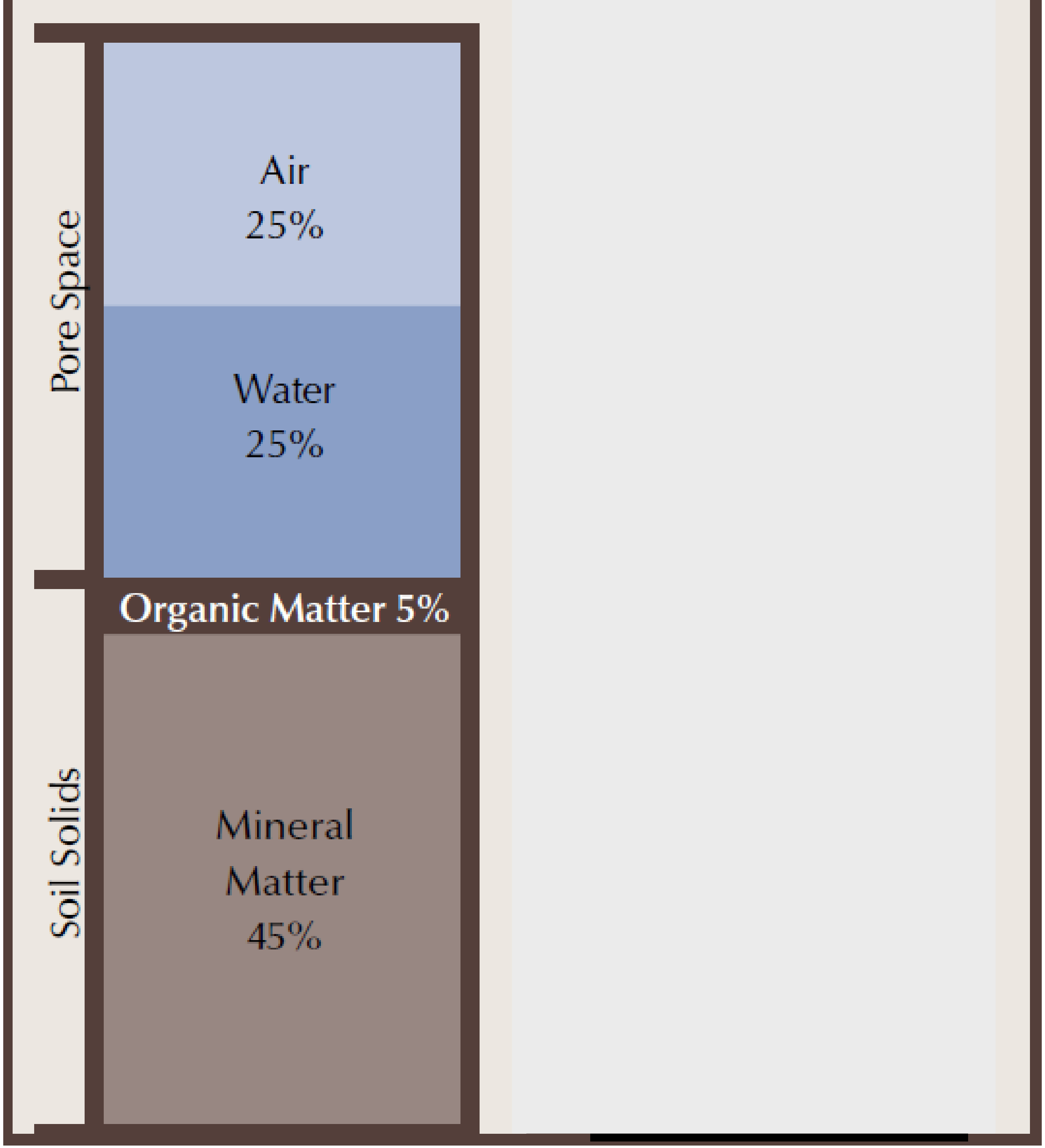
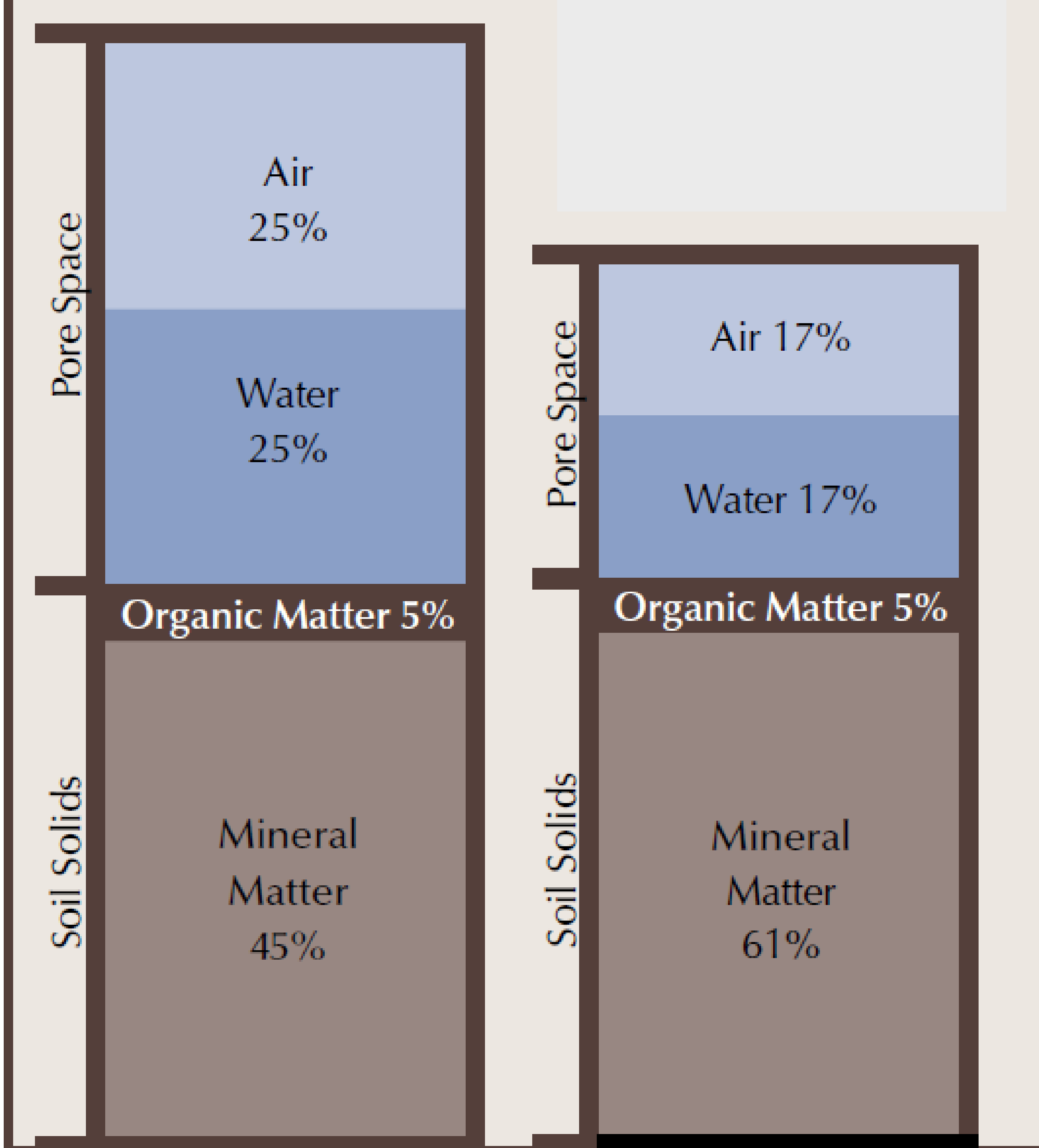
This is how a long term no-till soil looks

(Derpsch, 2005)



Pore Space
Air
25%
Water
25%
Organic Matter 5%
Soil Solids
Mineral
Matter
45%


Pore Space
Air
25%
Water
25%
Organic Matter 5%
Soil Solids
Mineral
Matter
45%
Pore Space
Air 17%
Water 17%
Organic Matter 5%
Soil Solids
Mineral
Matter
61%

NASA photo


Native Soil Structure

Conservation Agriculture & Soil Health Principles

- Minimal soil disturbance
- Keep the soil covered
- Diversity of plants
- Living roots in the soil
- Integrate livestock

2008-2011 Yields, bu/A

	Corn	Soybeans
No-till	216.9	52.0
NT w/CC	204.9	51.9
DD w/CC	204.2	49.1
Disk-Disk	204.5	49.4
Chisel-D	203.3	50.7
Plow-D-D	204.2	49.8

Rogers Memorial Farm

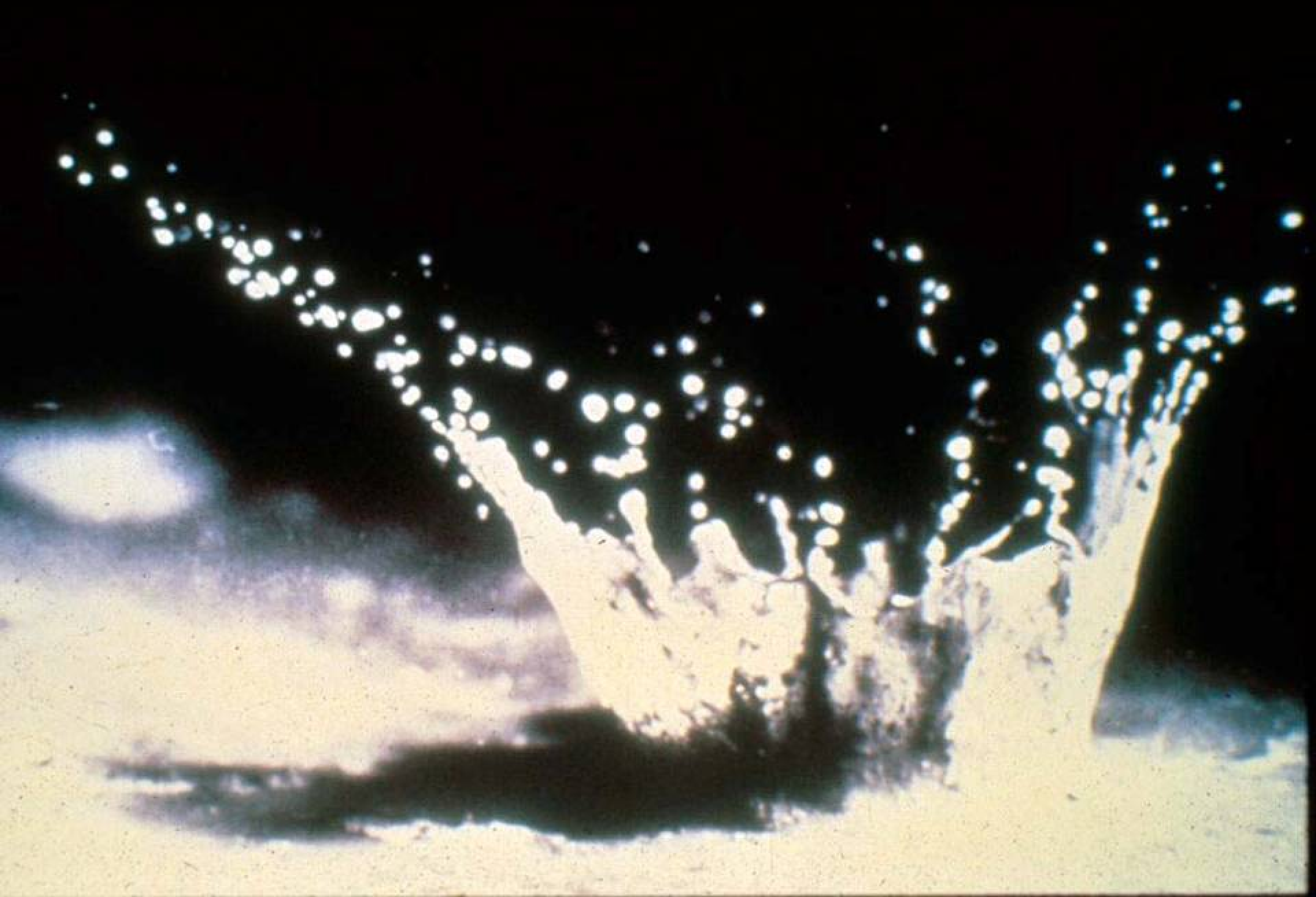
2015 Yields, bu/A

	Corn	Soybeans
No-till	223.4	60.0
NT w/CC	207.0	58.4
DD w/CC	203.7	55.1
Disk-Disk	206.7	55.3
Chisel-D	182.6	53.5
Plow-D-D	186.5	56.7

Rogers Memorial Farm

2018 Yields, bu/A

	Corn	Soybeans
No-till	224.7	49.2
NT w/CC	232.8	48.2
DD w/CC	208.6	49.2
Disk-Disk	215.5	44.7
Chisel-D	216.6	47.7
Plow-D-D	207.4	50.9

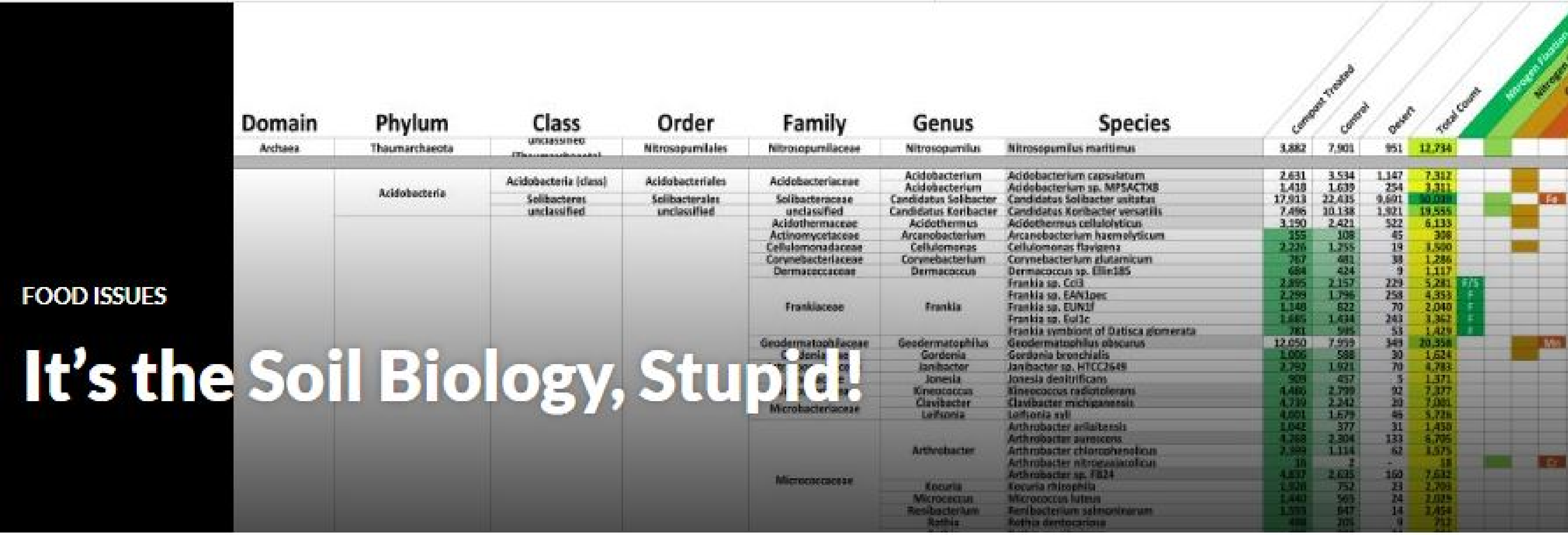


SW Nebraska - 6 inch rain June 12-13
Crusting, runoff, & terraces overtopped

Adjoining field - 6 inch rain June 12-13
Established no-till, little runoff


Tilled Yield
210 bu/A
No-till Yield
237 bu/A
Rogers Memorial Farm 2009


Increase biological diversity
Put new crops in the rotation
Put forages in the rotation
Use cover crops



FOOD ISSUES

It's the Soil Biology, Stupid!

MARCH 25, 2018

LA CHEFS

##BIOLOGY, ##CLIMATE, ##FOOD, ##REGENERATIVE, ##SOIL

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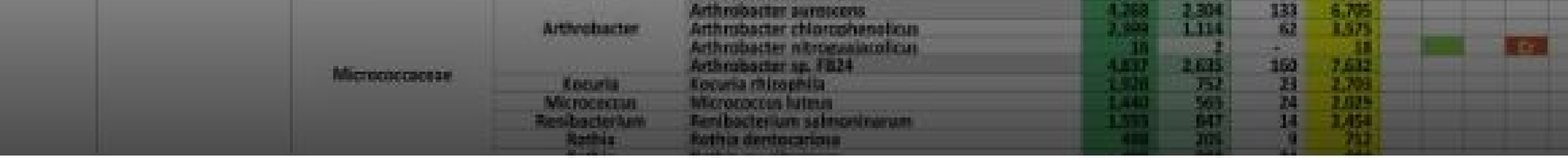
*"In soil/natural ecosystems, microorganisms including bacteria and fungi exist in a very large number and **play a very crucial role in maintaining major biogeochemical cycles, plant nutrition, plant health, soil fertility, soil structure, and degrading organic pollutants and remediation of toxic metals. Therefore, microorganisms are key players in important ecological processes, such as carbon, nitrogen, phosphorous, and sulfur biogeochemical cycle, and directly influence all lives on Earth.** It is noted*



Micrococcaceae	Arthrobacter	Arthrobacter aurescens	4,268	2,304	133	6,705
		Arthrobacter chlorophenolicus	2,399	1,114	62	3,575
		Arthrobacter nitroguajacolicus	16	2	-	18
		Arthrobacter sp. FB24	4,837	2,635	160	7,632
	Kocuria	Kocuria rhizophila	1,920	752	23	2,703
	Micrococcus	Micrococcus luteus	1,440	563	24	2,025
	Renibacterium	Renibacterium salmoninarum	1,553	847	14	3,454
	Rothia	Rothia dentocariosa	498	205	9	752

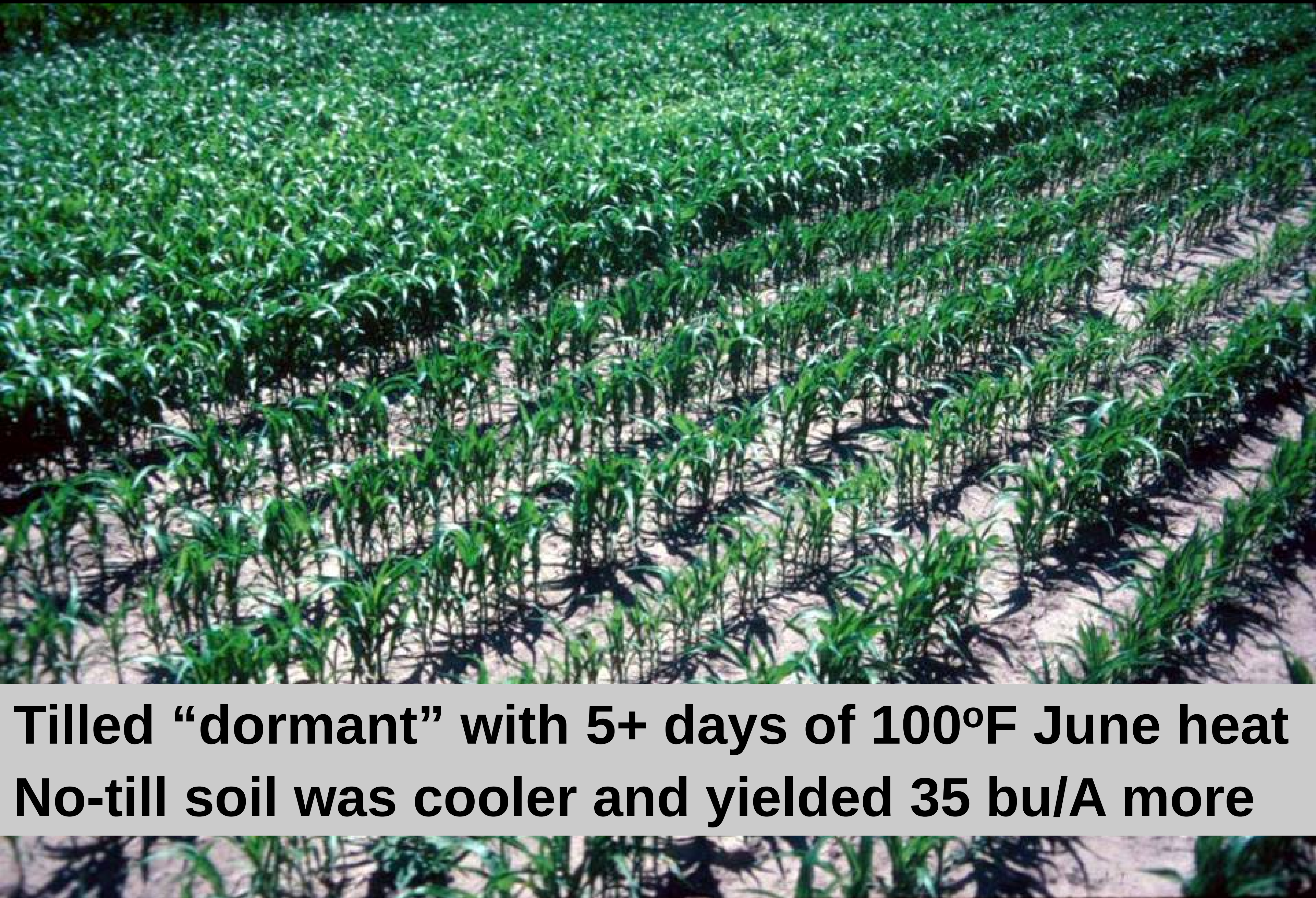
"*In soil/natural ecosystems, microorganisms including bacteria and fungi exist in a very large number and* ***play a very crucial role in maintaining major biogeochemical cycles, plant nutrition, plant health, soil fertility, soil structure, and degrading organic pollutants and remediation of toxic metals. Therefore, microorganisms are key players in important ecological processes, such as carbon, nitrogen, phosphorous, and sulfur biogeochemical cycle, and directly influence all lives on Earth.*** *It is noted that 1 gm of soil/sediment may contain 10 to the 9th* learning more about what soil microbes do individually as well as collectively (in quorems), soil scientists are better understanding the huge role soil microbes play especially in nutrient cycling, carbon/nitrogen/phosphorus utilization, carbon sequestration, methane mitigation, soil fertility, and plant nutrient density.

Current research has shown microbes help build soil organic matter [SOM] through decomposition and the carbon pathway (Liang et al 2017), that is root exudates . Roots exude carbon that feed microbes, and soil organic matter is, in part, formed by microbes eating one another, pooping and dying, that is microbial waste and necromass. Thus carbon capture and utilization is driven by soil microbes (Kallenbach et al 2016). The more plant diversity above ground, the more microbial diversity


CrustBuster
CrustBuster

Proper crop rotation is key

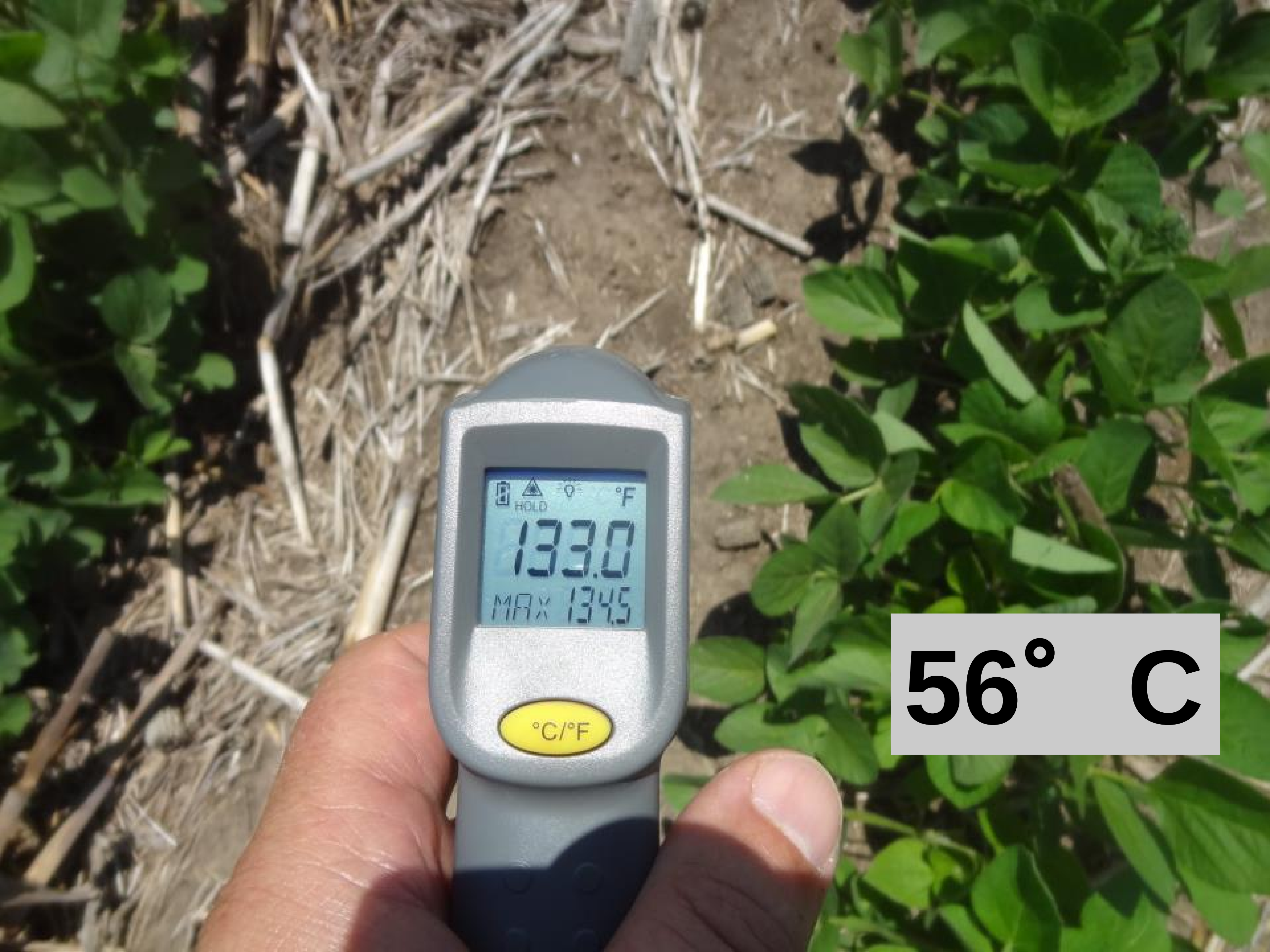

Photos from Liz Haney's post

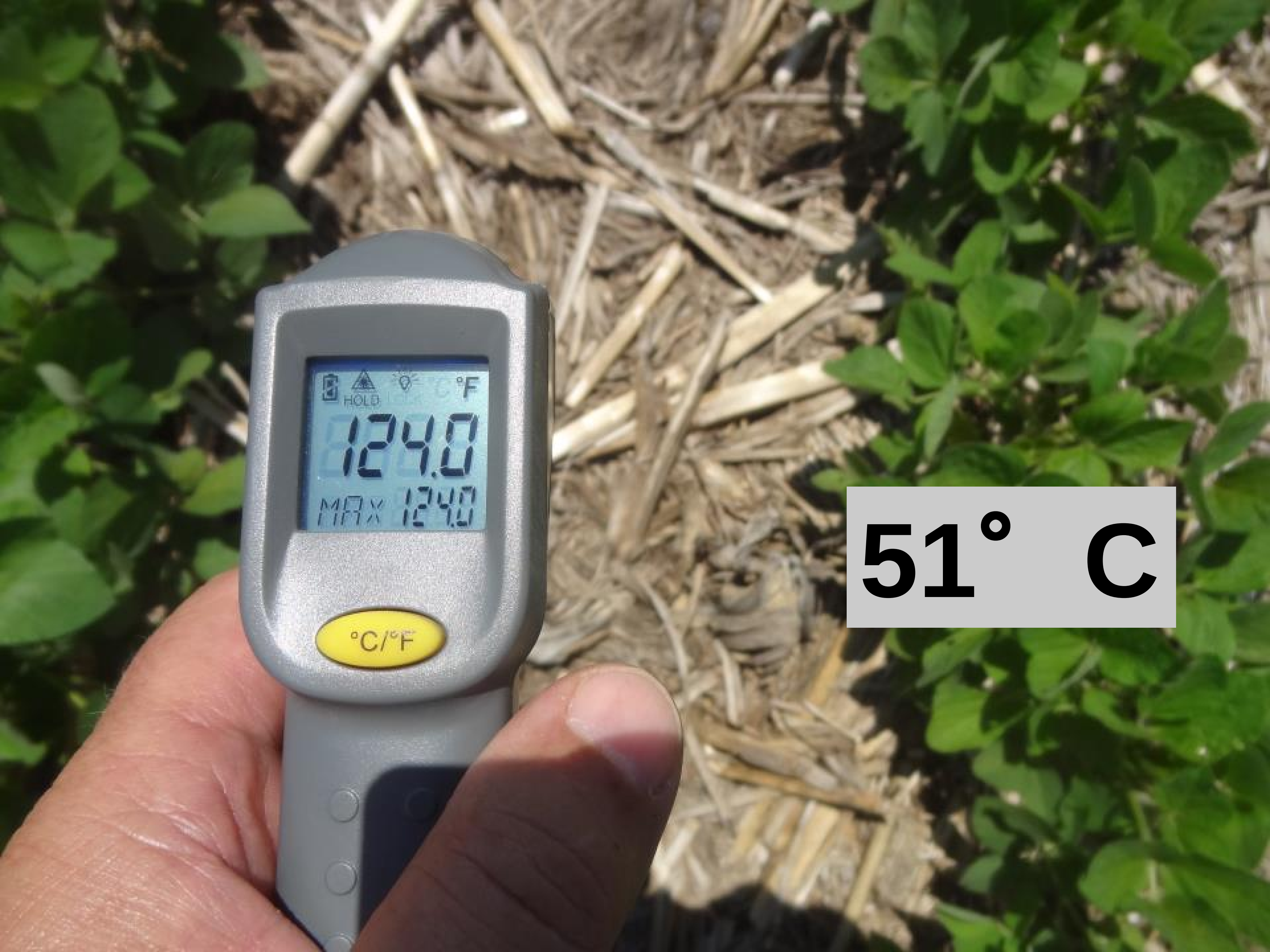


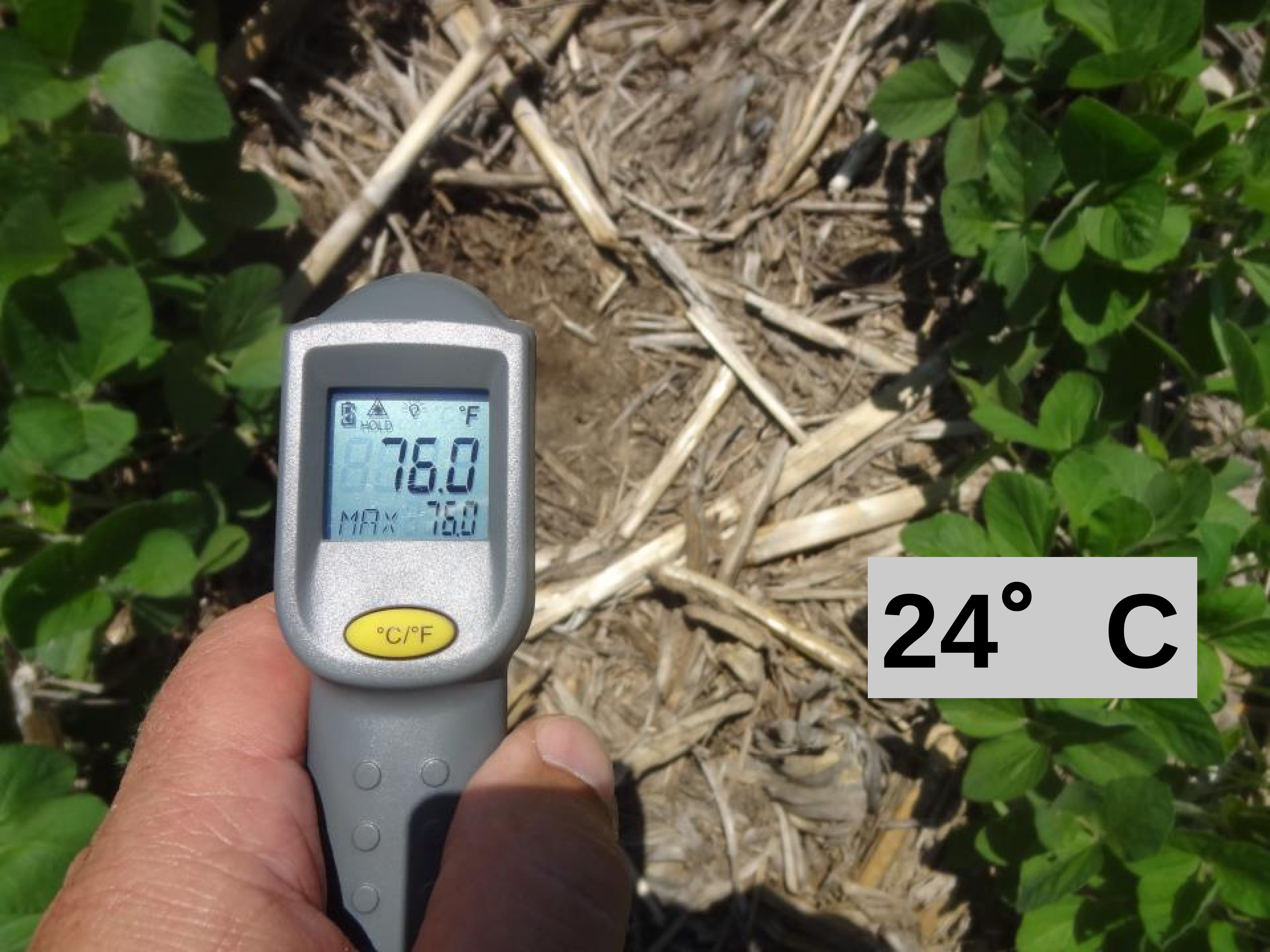
Tilled “dormant” with 5+ days of 100ºF June heat
No-till soil was cooler and yielded 35 bu/A more


°F
86.5
MAX 86.5
°C/°F
20 40
0 60
-20 80
-40 100
-60 120
30° C

HOLD
°F
76.5
MAX 76.5
°C/°F
25° C


HOLD
°F
133.0
MAX 134.5
°C/°F
56° C


HOLD
°F
124.0
MAX 124.0
°C/°F
51° C


HOLD
°F
76.0
MAX 76.0
°C/°F
24° C


ADERSTAD

Flood Recovery for cropland

Cover Crops for Soil Health

Paul Jasa, Extension Engineer, University of Nebraska–Lincoln

As the Missouri River's water recedes from fields, producers may need to do some field repairs, dealing with sedimentation, eroded or scoured areas, deposited debris, and still standing water. As harvest of their remaining 2011 crop nears, this work may not seem pressing. However, establishing a cover crop as soon as possible on these fields will aid in recovering and rebuilding the soil.

Cover Crop Benefits

Cover crops can be used for a variety of purposes including protecting the soil, improving soil structure, fixing nitrogen, feeding soil biological life, and managing soil moisture. Fields that were flooded in summer 2011 need cover crops for all of these reasons since a crop wasn't grown in them this year. A key soil quality concept is that there should be something green and growing during as much of the year as possible. This is important to protect

Grasses provide the longest lasting residue cover because they have a higher carbon to nitrogen ratio in their biomass compared to non-grass species. In addition, they improve snow catch in the winter and reduce wind erosion in the spring compared to bare soil. Taller brassicas and broadleafs like rape, canola, Ethiopian cabbage, and sunflowers will also stand nicely to reduce wind erosion and catch snowfall, but they provide less residue.

With the saturated soil conditions during flooding, most of the residual nitrates in the soil were lost to either denitrification or leaching. A cover crop will scavenge any remaining residual nitrates for its growth, reducing further losses. However, if there are no residual nitrates, cover crop growth may be slow, with non-legumes showing nitrogen deficiencies. Some producers apply some nitrogen fertilizer to encourage cover crop growth which is later recovered as the cover crop residue breaks down. Producers should use legume cover crops to fix some nitrogen for the next sedimentation, eroded or scoured areas, deposited debris, and still standing water. As harvest of their remaining 2011 crop nears, this work may not seem pressing. However, establishing a cover crop as soon as possible on these fields will aid in recovering and rebuilding the soil.

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Rod Zessin Prevented Planting acres drilled August 19th

Missouri River Bottoms – Flooded 2011

Flooded Soil Syndrome

John Sawyer, Professor and Extension Soil Fertility Specialist
Antonio P. Mallarino, Professor, Soil Fertility Research and Extension
Mahdi Al-Kaisi, Associate Professor and Extension Soil Management/Environment Specialist
Department of Agronomy, Iowa State University

Fallow Syndrome is a condition where crops planted the year after an extended period with no plant growth exhibit reduced early growth and yield. On corn plants the syndrome exhibits classic phosphorus (P) deficiency symptoms, including slow-stunted early growth, purple coloration, and poorly developed roots. This effect is called Fallow Syndrome because it is observed in soils where, for moisture conservation, the land has been idled for a year and kept fallow with no crop or weed growth. This allows accumulation of moisture in the soil for the next cycle of crop production.

A similar syndrome can be observed after extensive flooding due to the lack of plant growth in submerged areas. This is sometimes called "Flooded Soil Syndrome." This beneficial fungi form important relationships with plant roots, particularly related to uptake of P and other nutrients with limited mobility in the soil. The AM fungi require a host plant, that is, active roots in the soil. They cannot be propagated in soil alone. In the year following flooding, AM colonization potential and activity are reduced. However, as the season and plant growth progress, AM root colonization can increase to levels similar to that in non-flooded soil. In addition to the AM issue, soil fluctuating anaerobic (flooded) to aerobic (non-flooded) conditions can reduce plant available P. In combination, reduced AM fungal populations and low plant available P reduce early season crop P uptake.

Another possible reason relates to increased strength of P retention by soil constituents. Reduced crop-availability of

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Ferrie: Combat Fallow Syndrome In Corn, Prevent Plant Acres

JULY 9, 2019 11:45 AM

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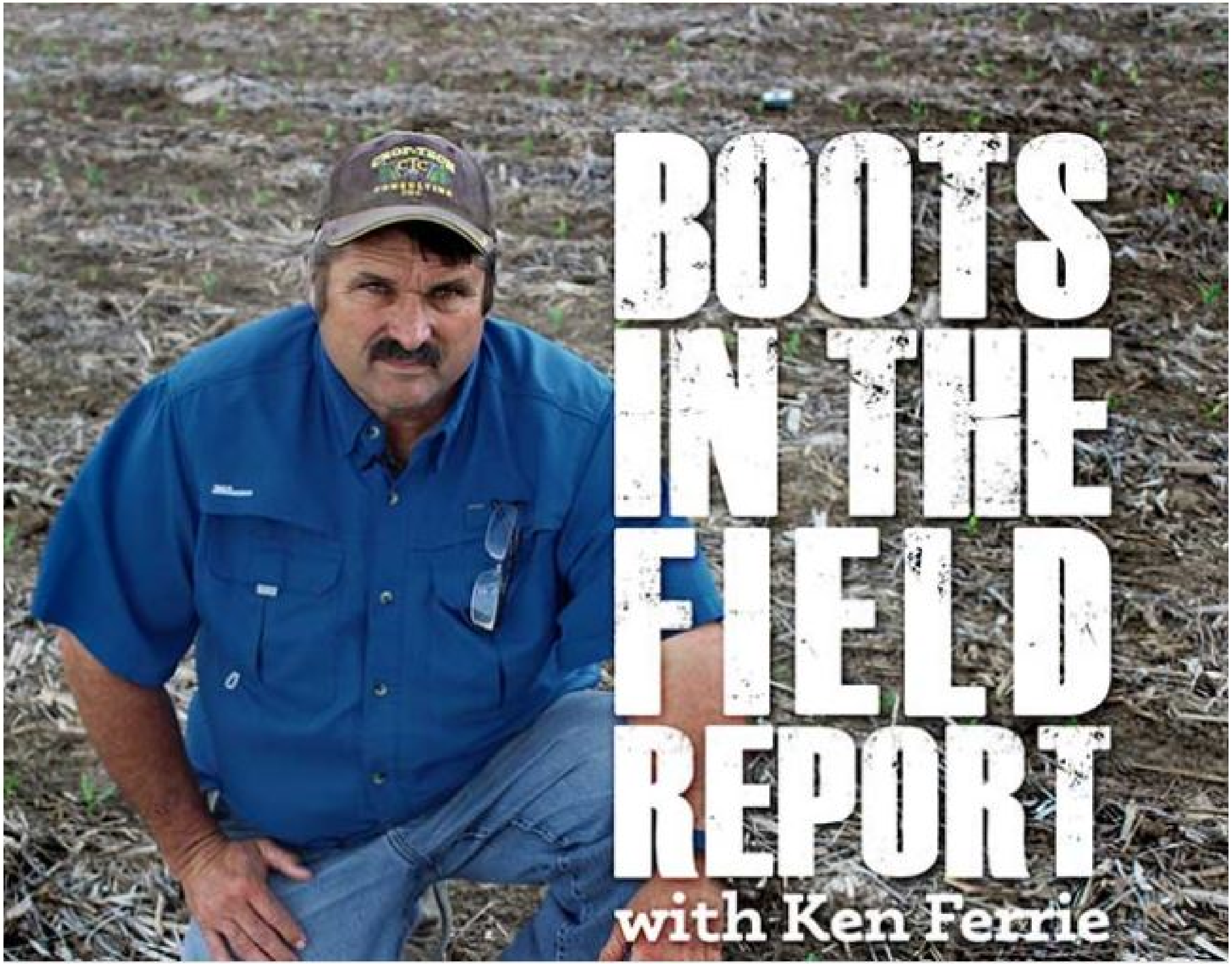

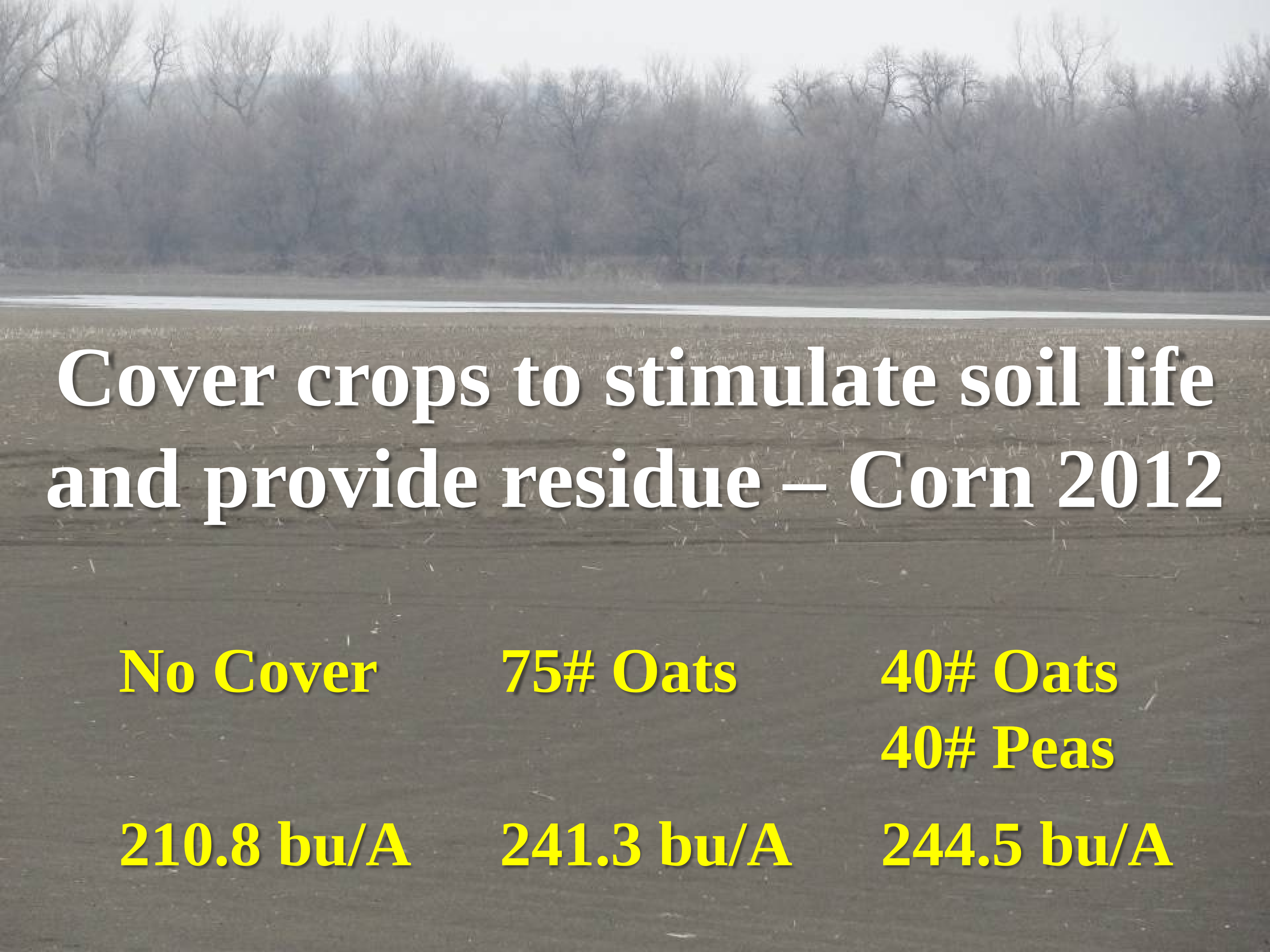

Cover crops to stimulate soil life and provide residue – Corn 2012

No Cover	75# Oats	40# Oats 40# Peas
210.8 bu/A	241.3 bu/A	244.5 bu/A


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Acknowledgements

Numerous Cooperating Farmers

Many International Hosts

University of Nebraska Rogers Memorial Farm

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