Taking a Systems Approach to No-till and Soil Health

Paul Jasa, Nebraska Extension

Residue, Soil Biology, & Systems Approach

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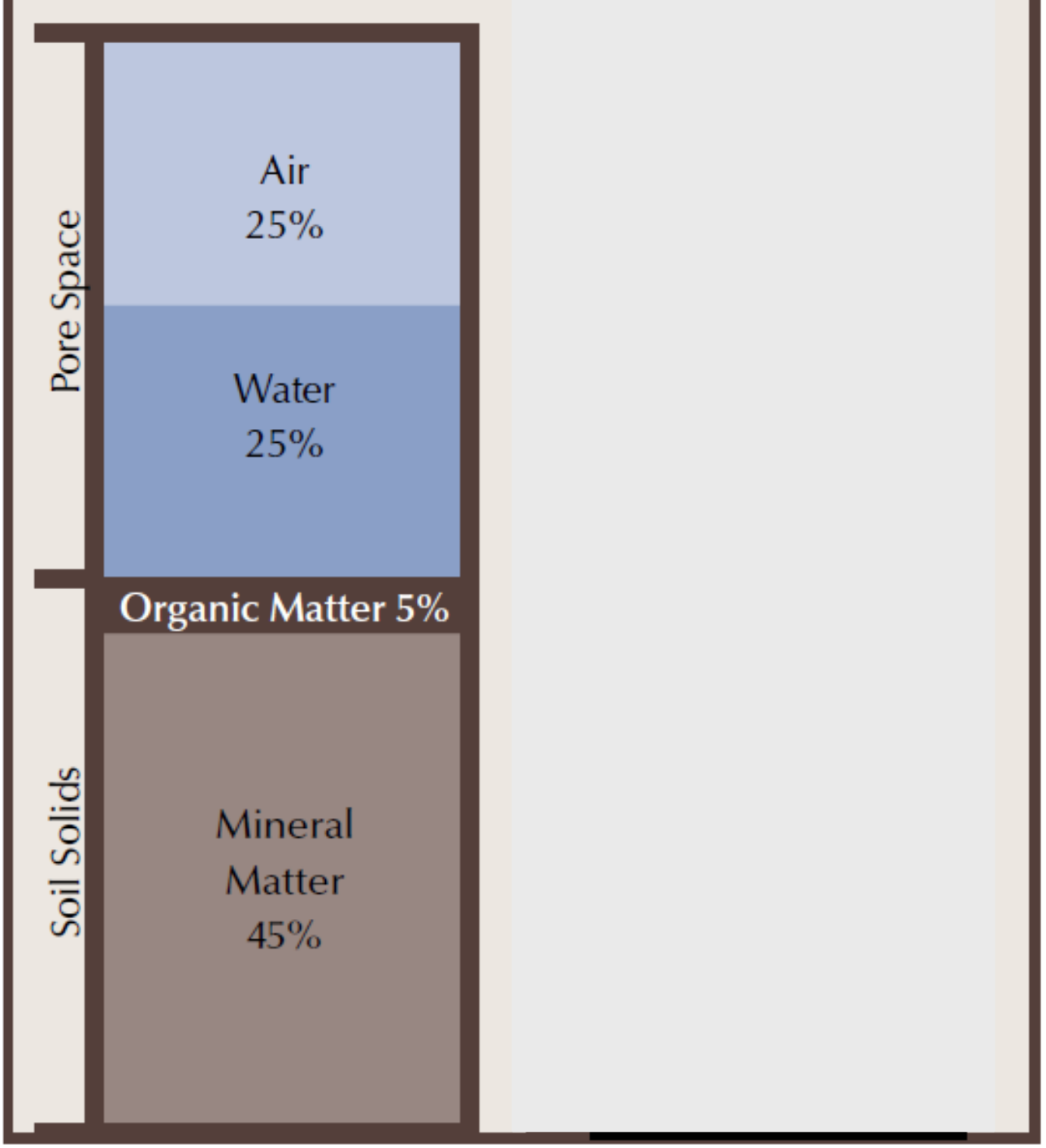
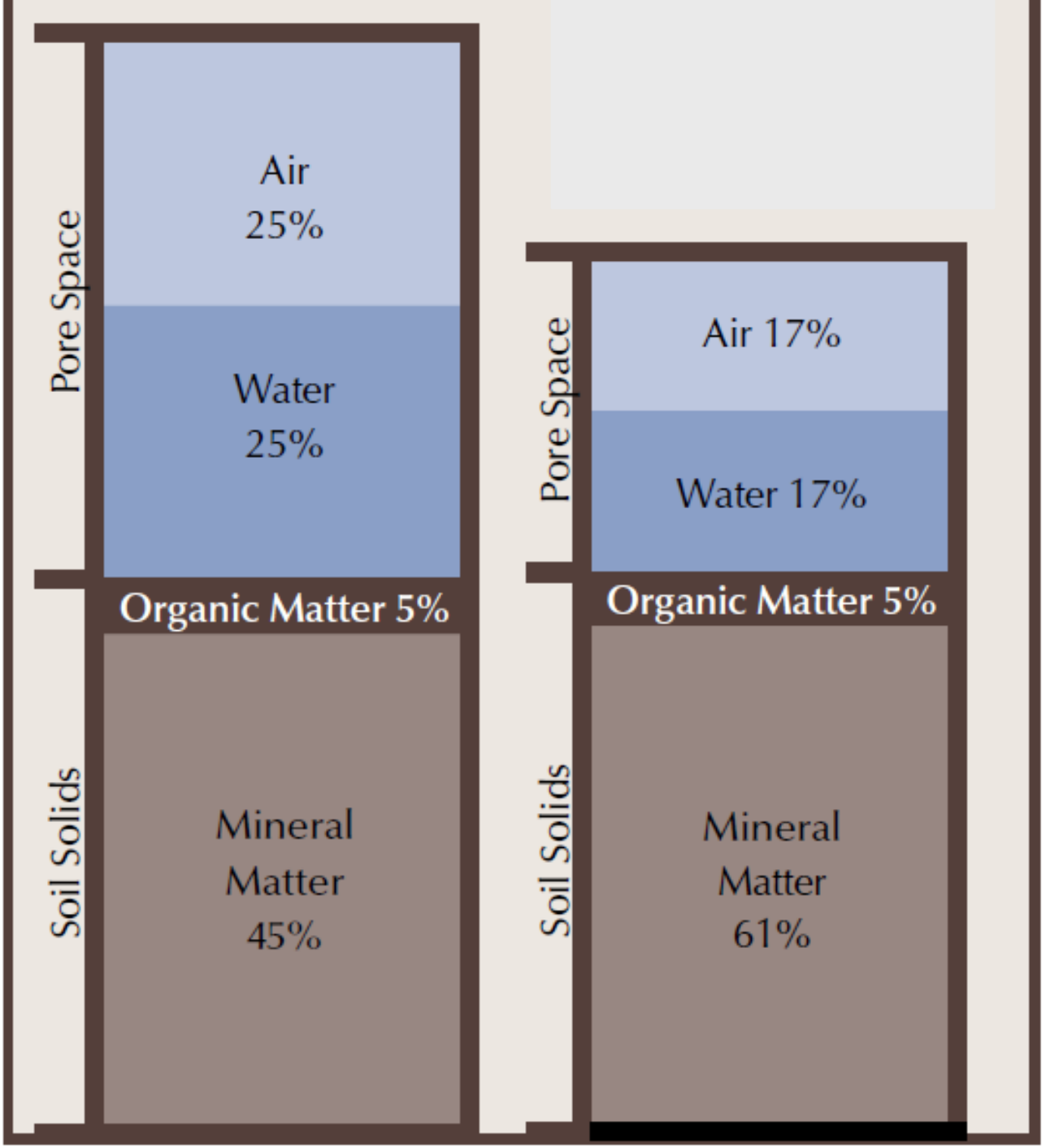

Pore Space
Air
25%
Water
25%
Organic Matter 5%
Soil Solids
Mineral
Matter
45%


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


JOHN DEERE

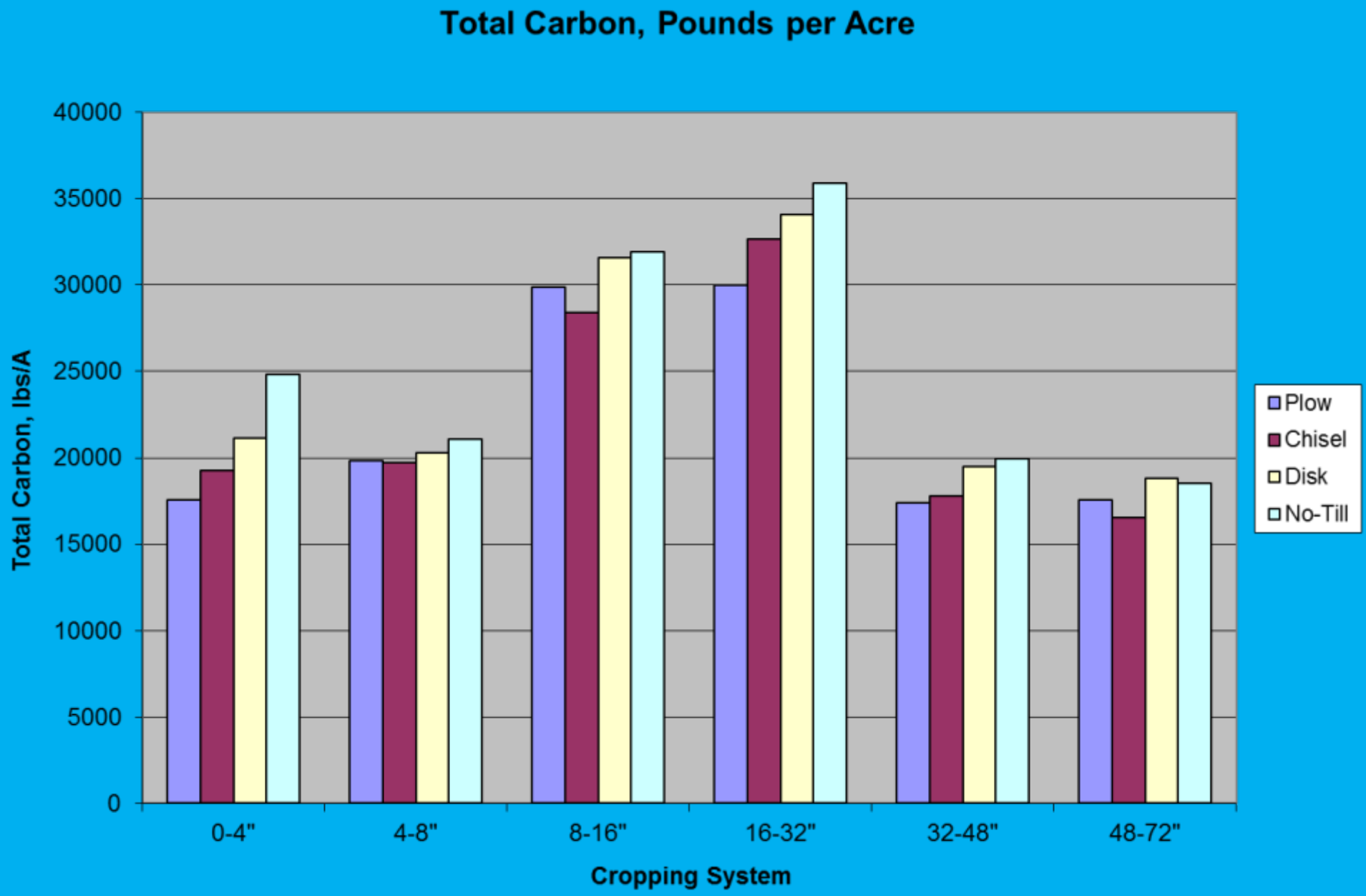

CAT


9660STS
JOHN DEERE
Shelbourne

Bulk Density, g/cc

	No-till	Disk
3 – 6 inch	1.11	1.39
6 – 9 inch	1.20	1.45

Rogers Memorial Farm


Total Carbon, Pounds per Acre
Total Carbon, lbs/A
40000
35000
30000
25000
20000
15000
10000
5000
0
0-4"
4-8"
8-16"
16-32"
32-48"
48-72"
Cropping System
Plow
Chisel
Disk
No-Till

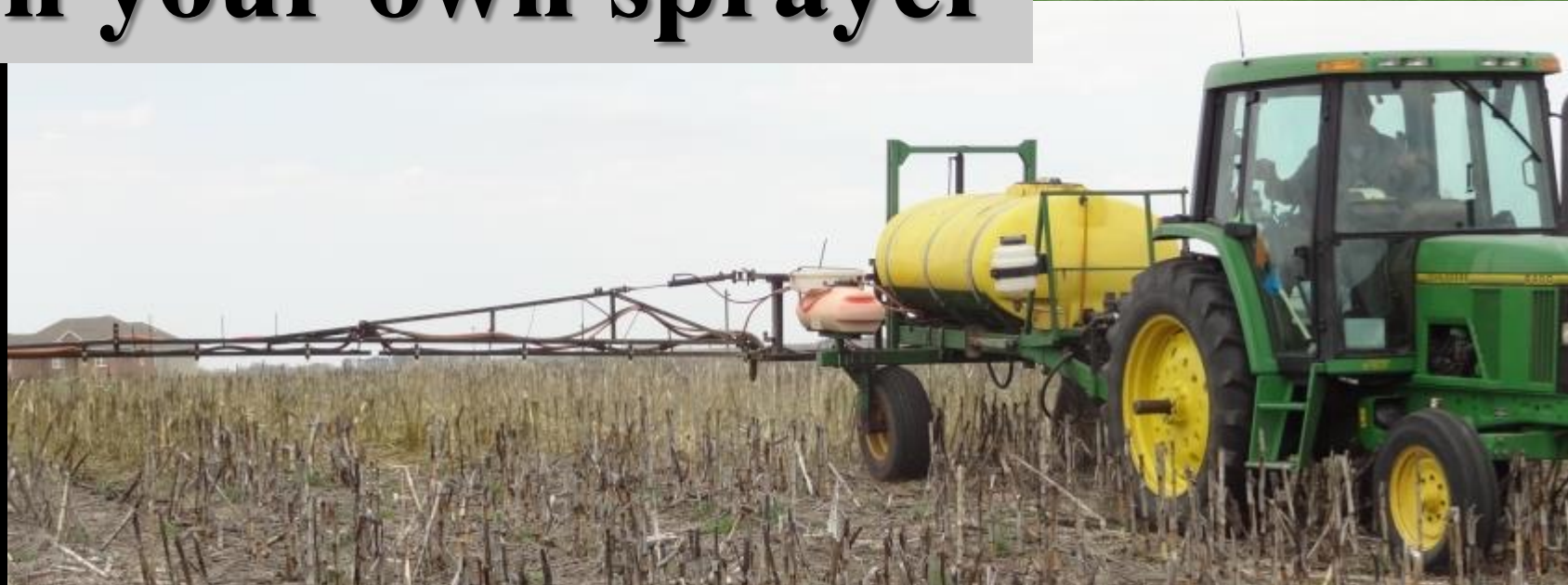

Organic Matter
Increases in Soil

Organic Matter, percent	Available Water Capacity, inches per foot		
	Sand	Silt Loam	Silty Clay Loam
1	1.0	1.9	1.4
2	1.4	2.4	1.8
3	1.7	2.9	2.2
4	2.1	3.5	2.6
5	2.5	4.0	3.0

Hudson, 1994


INTERNATIONAL

Own your own sprayer



No-till Water Savings, in

Tillage per trip 0.5-0.75

(Typically 0.75 gal/A)

(Custom Rate $15.00/A)

Estimated

Growing season evaporation from an irrigated soil surface, inches

No Crop		Crop Canopy	
Bare	Residue	Bare	Residue
15.1	8.5	7.6	3.8
14.6	9.4	8.5	5.7

Klocke, UNL WCREC, North Platte

Growing season evaporation from an irrigated soil surface, inches

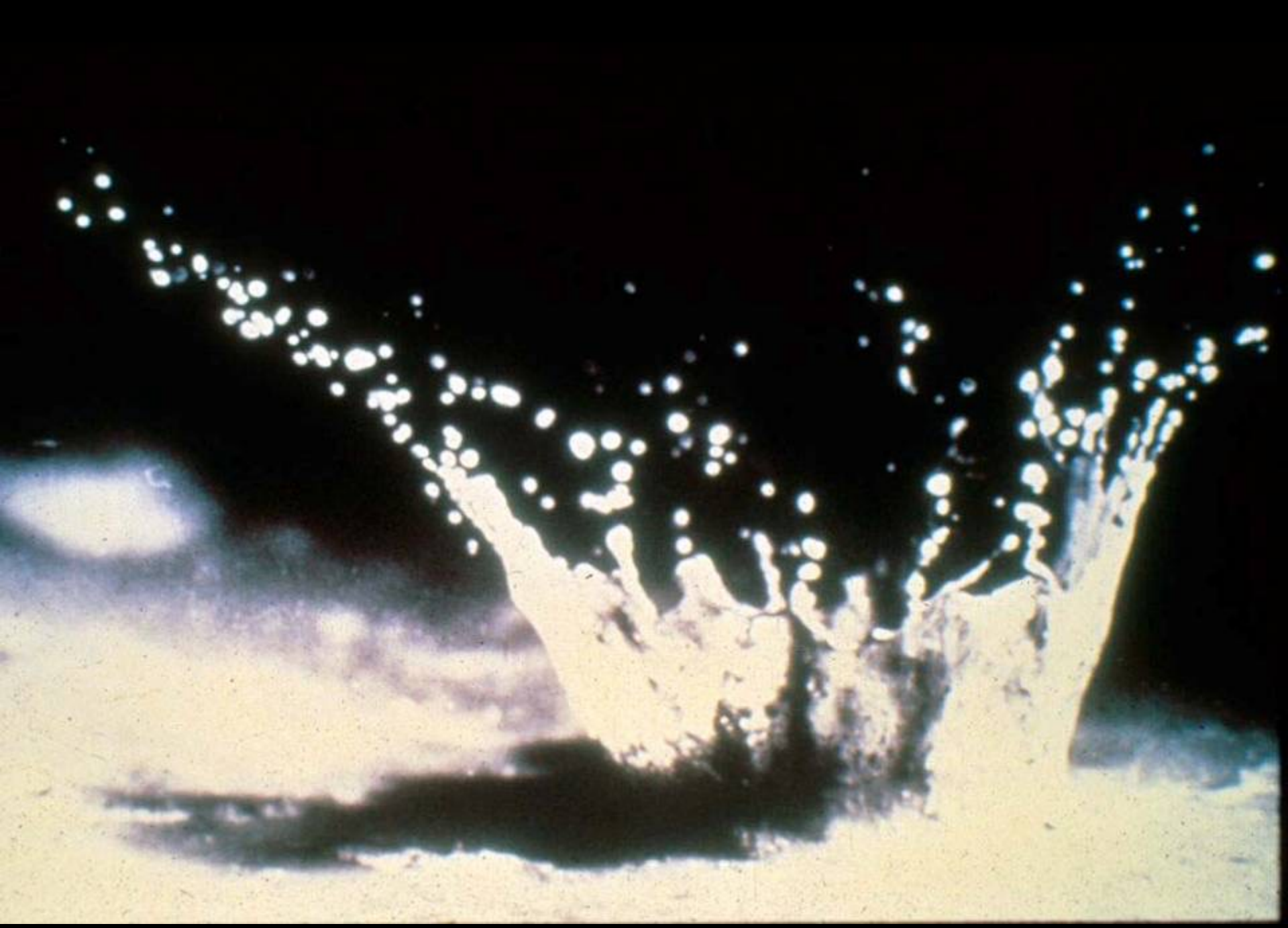
No Crop		Crop Canopy	
Bare	Residue	Bare	Residue
15.1	8.5	7.6	3.8
14.6	9.4	8.5	5.7

Klocke, UNL WCREC, North Platte

No-till Water Savings, in

Tillage per trip	0.5-0.75
Evaporation	2.5 - 5.0

Estimated



Saturated Infiltration, in/hr

	Wheel Track	Soft Middle
Tilled	0.2	0.4

Rogers Memorial Farm

Saturated Infiltration, in/hr

	Wheel Track	Soft Middle
Tilled	0.2	0.4
No-till	0.6	4.0

Rogers Memorial Farm

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

No-till Water Savings, in

Tillage per trip	0.5-0.75
Evaporation	2.5 - 5.0
Infiltration	2.0 - 6 ?

Estimated


No-till 47.7 bu/A
Tilled 23.2 bu/A
Rogers Memorial Farm 2000


No-till 121 bu/A Tilled 61.2 bu/A
Rogers Memorial Farm 2000


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

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

Rogers Memorial Farm

2022 Yields, bu/A

	Corn	Soybeans
No-till	139.4	50.0
NT w/CC	145.2	49.8
DD w/CC	132.5	49.0
Disk-Disk	132.5	46.4
Chisel-D	130.2	43.4
Plow-D-D	131.4	45.2

Rogers Memorial Farm


2022 cover after wheat

2023 Yields, bu/A

	Corn	Soybeans
No-till	127.9	47.8
NT w/CC	117.5	35.9
DD w/CC	95.6	33.8
Disk-Disk	110.6	37.8
Chisel-D	111.8	36.1
Plow-D-D	102.6	29.9

Rogers Memorial Farm


Corn/Soybean/Wheat
Corn/Soybean


C/S 120 bu/A


C/S/W 180 bu/A

No-till Water Savings, in

Tillage per trip	0.5-0.75
Evaporation	2.5 - 5.0
Infiltration	2.0 - 6 ?
Total Savings	**5.0 - 12 ?**

Estimated

Soil water evaporation
from partial surface cover

Residue Cover	Avg E in/day	Percent of bare
Bare	0.08	-
Corn 25%	0.07	95
Corn 50%	0.07	93
Corn 75%	0.07	97
Corn 100%	0.05	69

Klocke, KSU

Saving 5 inches is worth at least:

Irrigation Costs about $20/A-in: $100 +

Saving 5 inches is worth at least:

Corn responds about 12 bu/A-in: 60 bu/A +

Beans respond about 3.5 bu/A-in: 17.5 bu/A +

Cover crops provide carbon biomass to protect and build the soil

(From Rolf Derpsch, Paraguay)

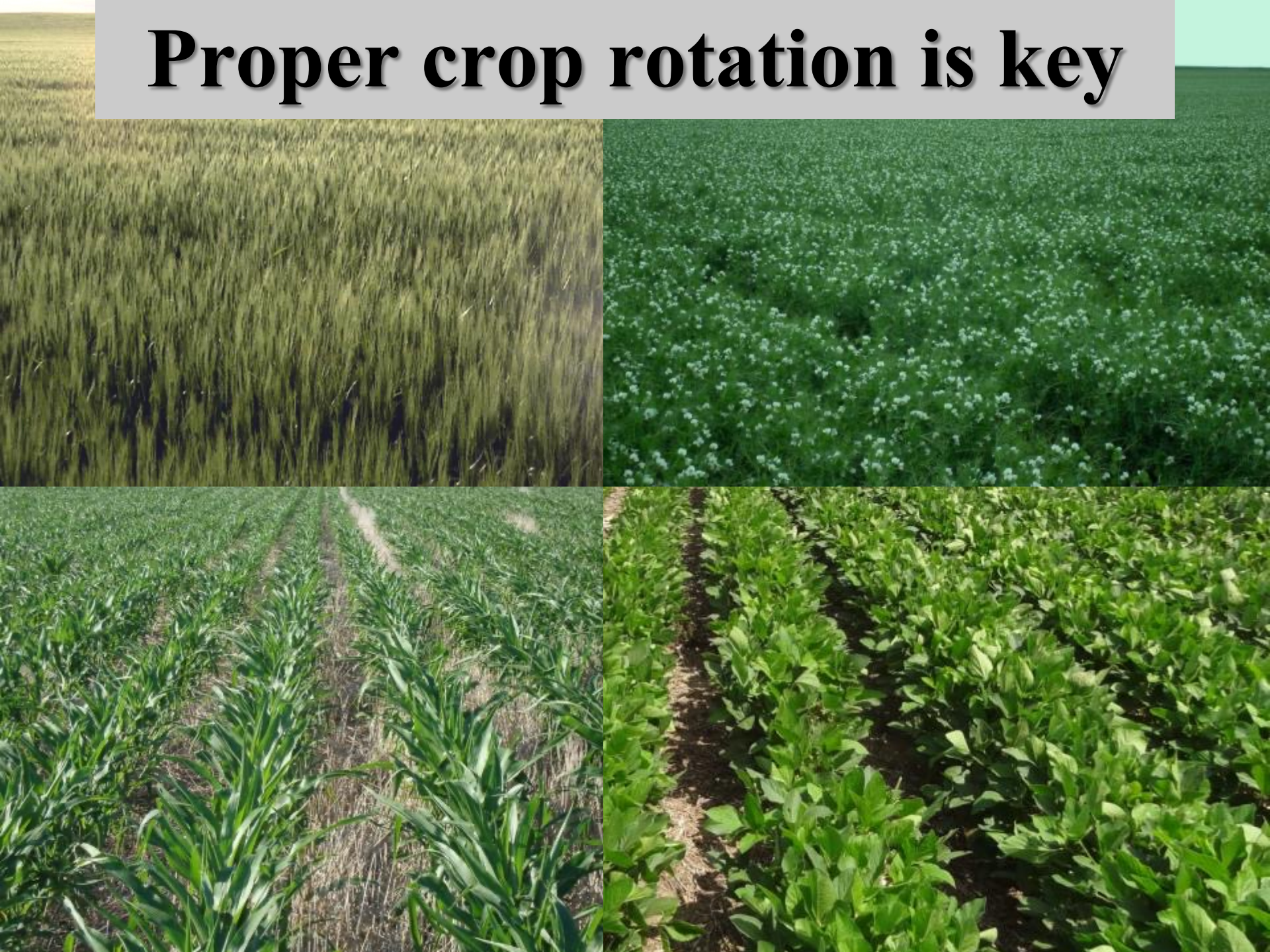
This is how a long term no-till soil looks

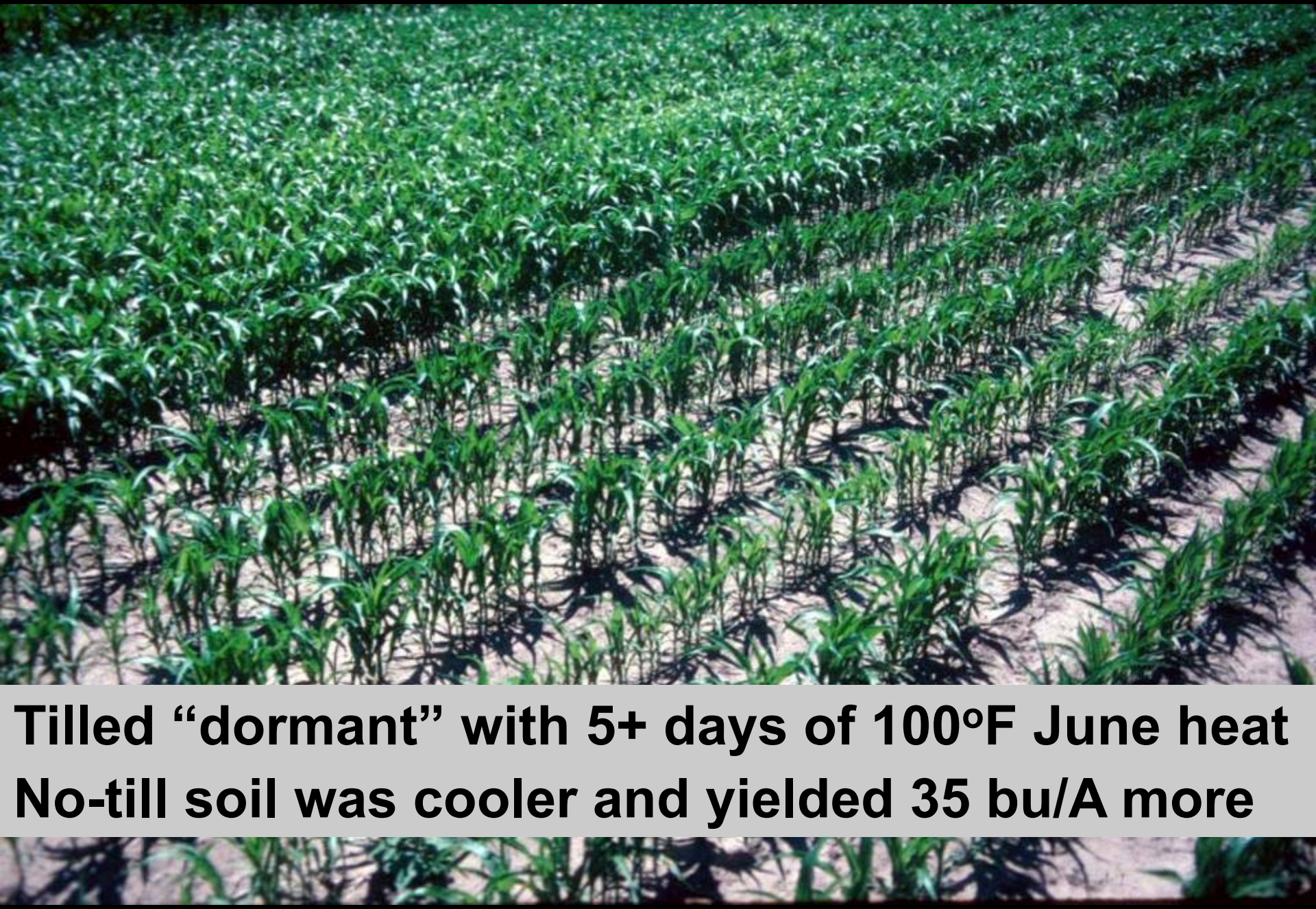
(Derpsch, 2005)


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


CrustBuster
CrustBuster

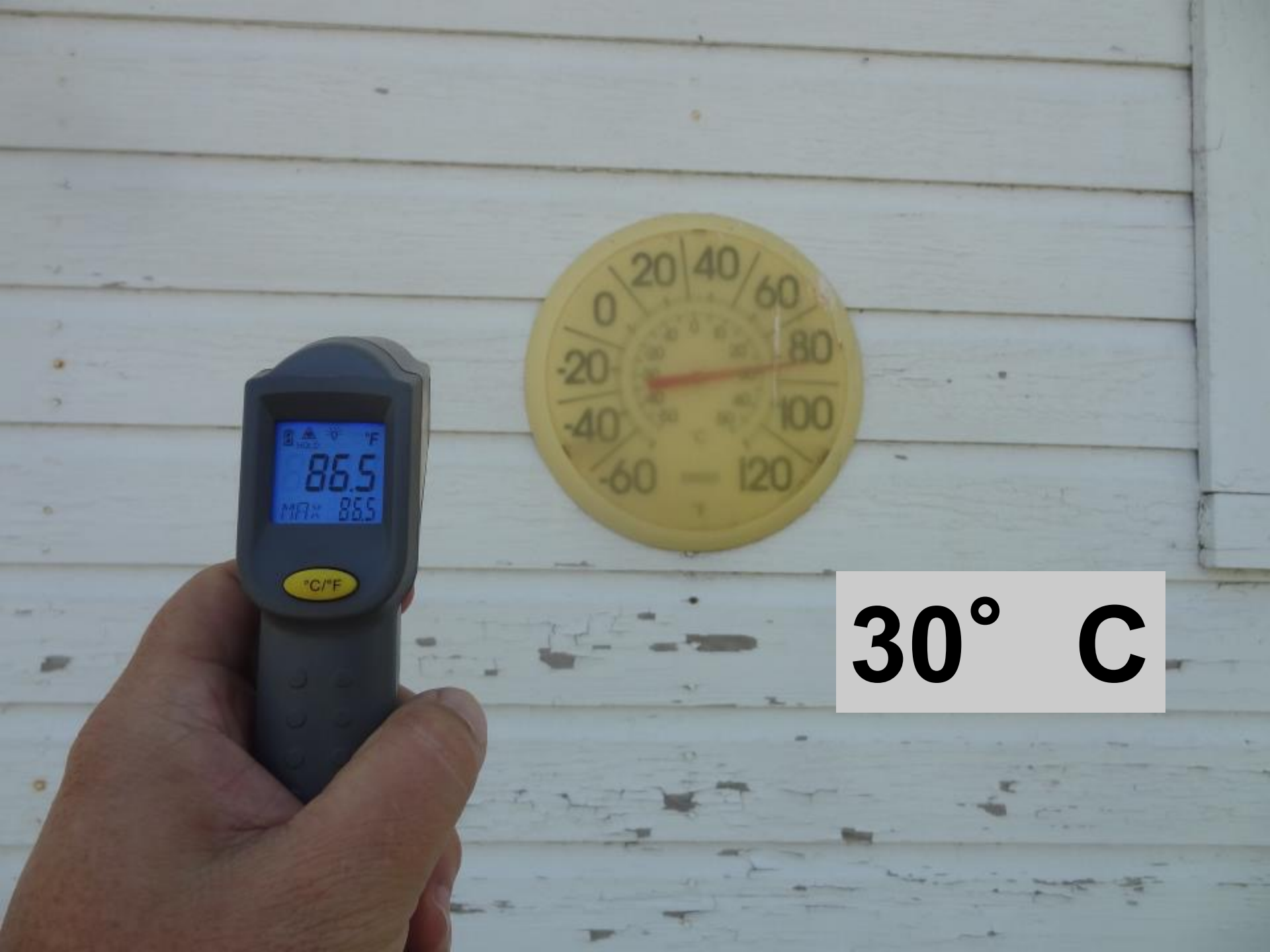
Proper crop rotation is key





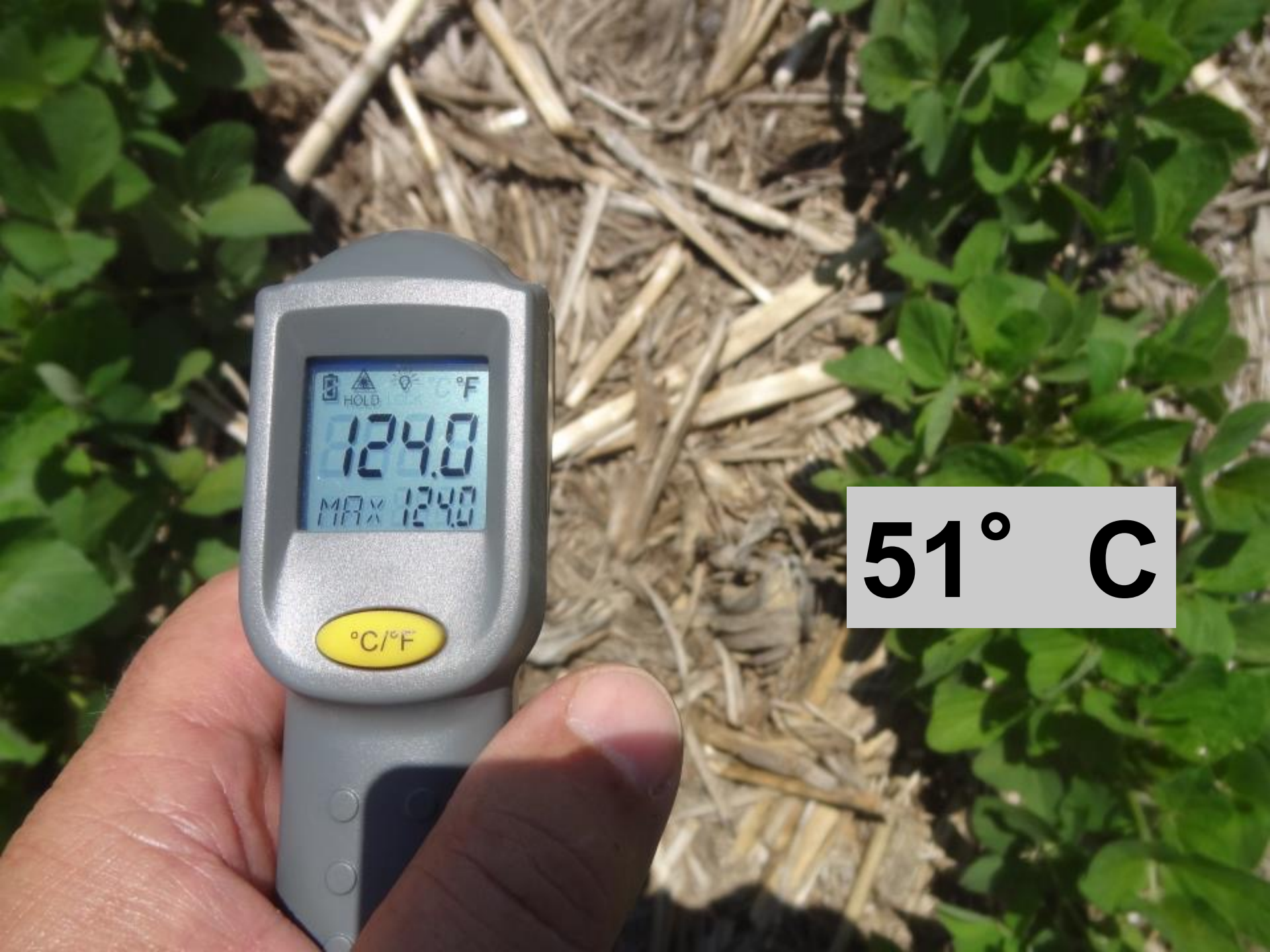
Tilled “dormant” with 5+ days of 100°F June heat

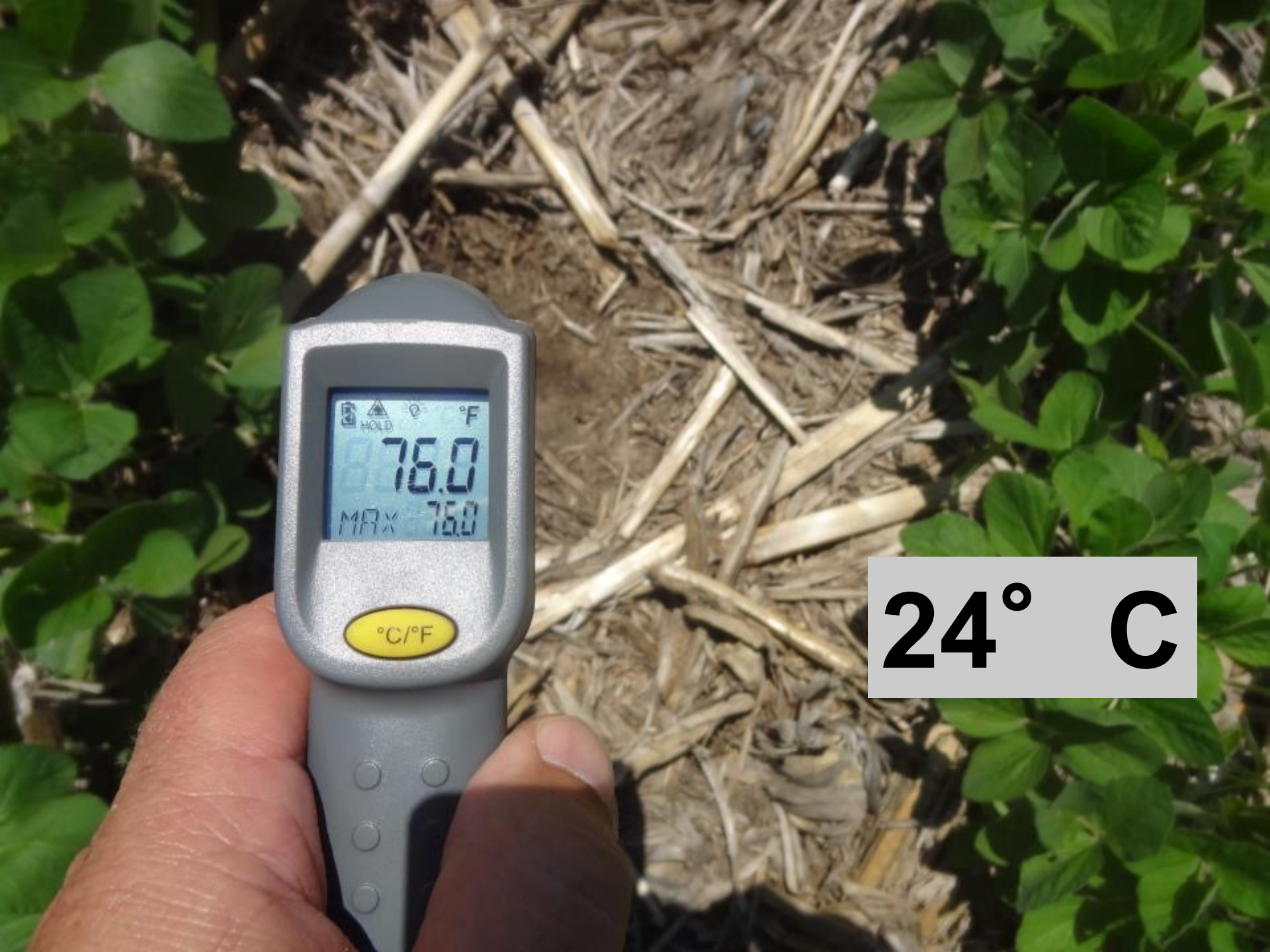
No-till soil was cooler and yielded 35 bu/A more


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


°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


°F
HOLD
76.0
MAX 76.0
°C/°F
24° C

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


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For the sake of the future,
improve soil health now.
Thank You

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