

33rd Annual NATIONAL NO-TILLAGE CONFERENCE

January 7-10, 2025 • Louisville, Ky.

We Have Been Here Before

Dwayne Beck DLRF-SDSU





Dakota Lakes Virtual Field Day

- The SDSU Dakota Lakes Research Farm hosted their summer field day virtually in 2020. The link to the videos is:

https://www.youtube.com/playlist?list=PLTZDoxH1GkisubbRzKxg2XA_PlzzPE8PM&fbclid=IwAR0Uh9zJRStUYIhgO7m6C5otm6q-qY1ZzX4f5_znMsmLWCX8JdcBQiRMECI





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NO RUNOFF WITH IRRIGATORS APPLYING 2 INCHES OF WATER IN 9 MINUTES



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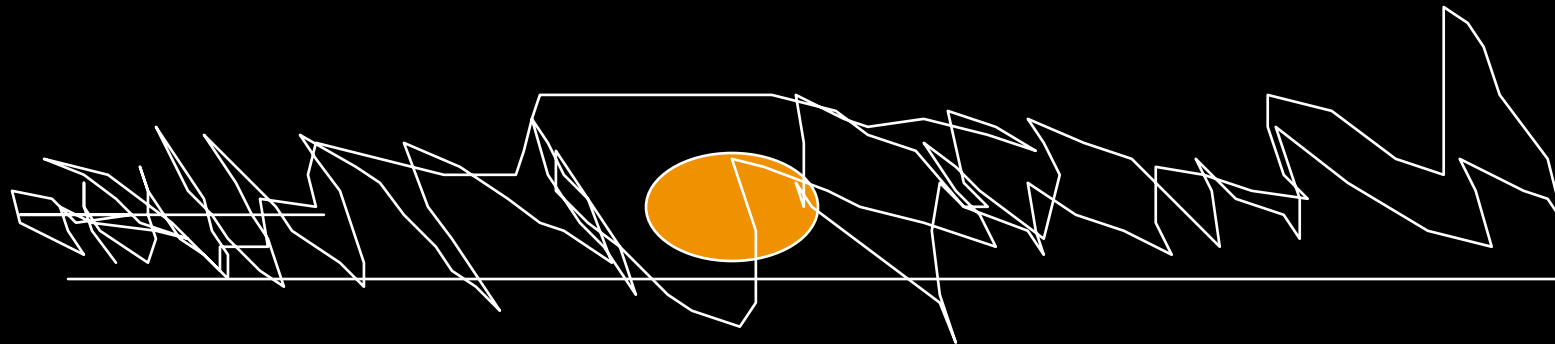
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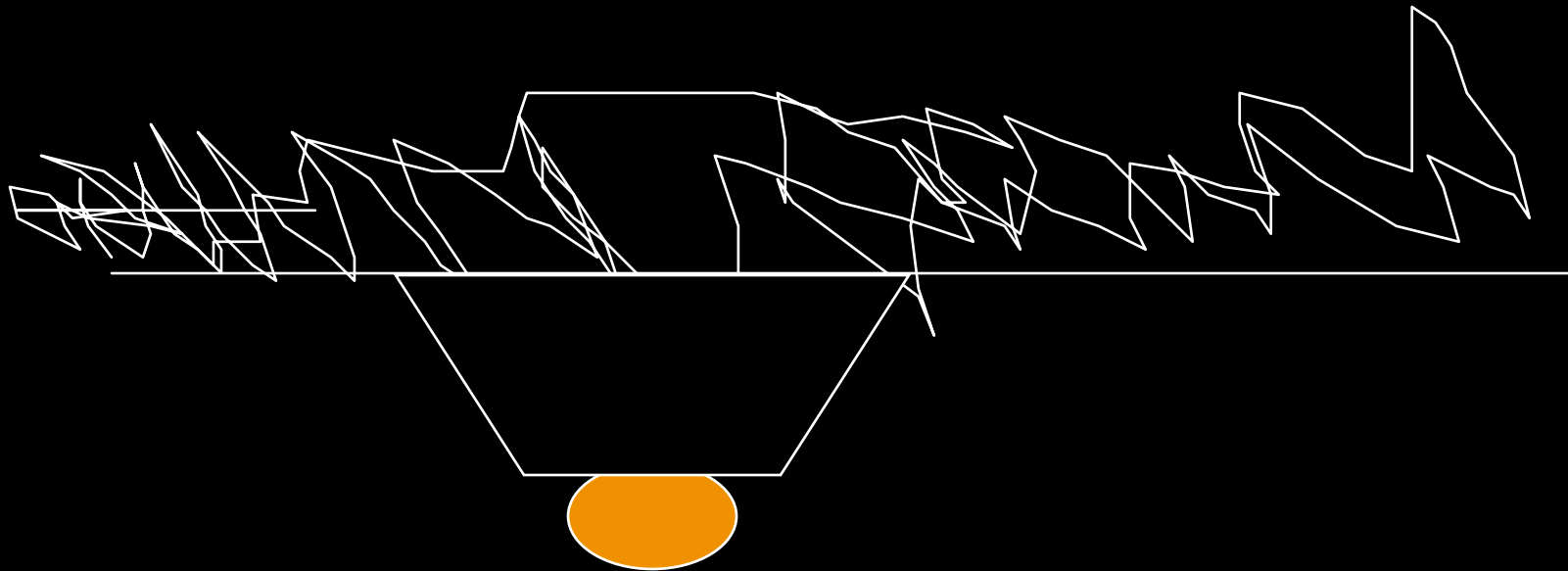
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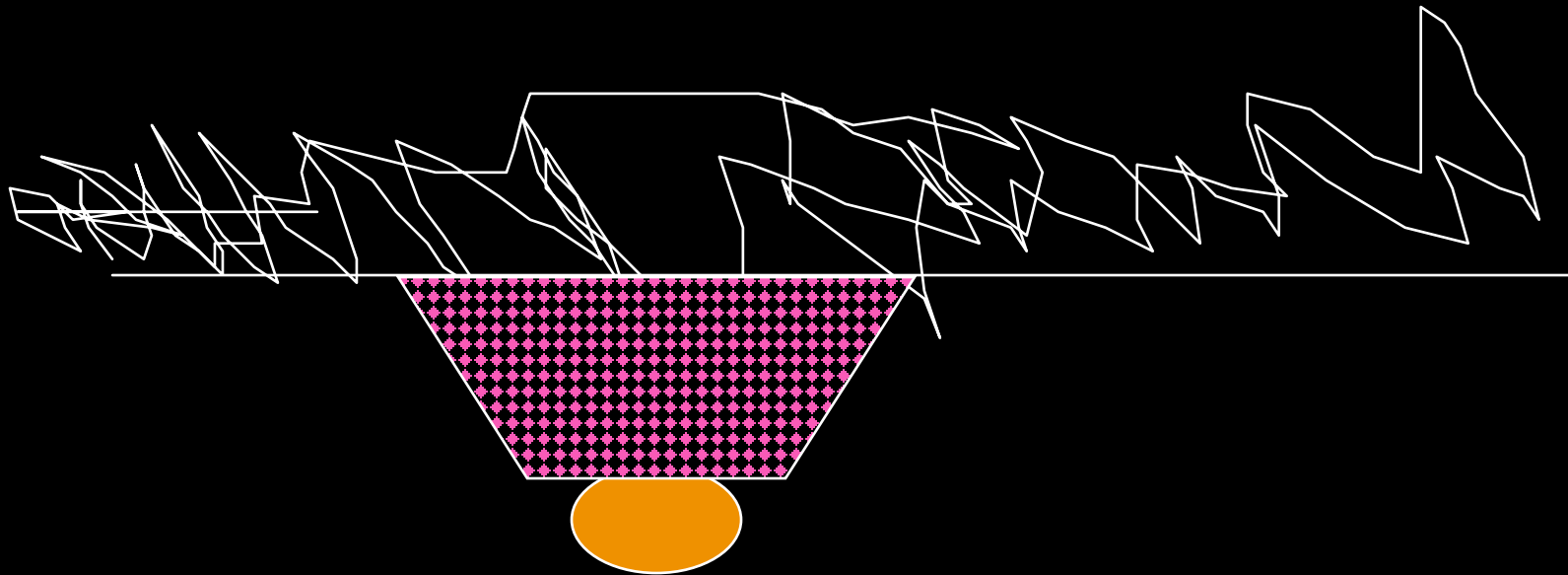
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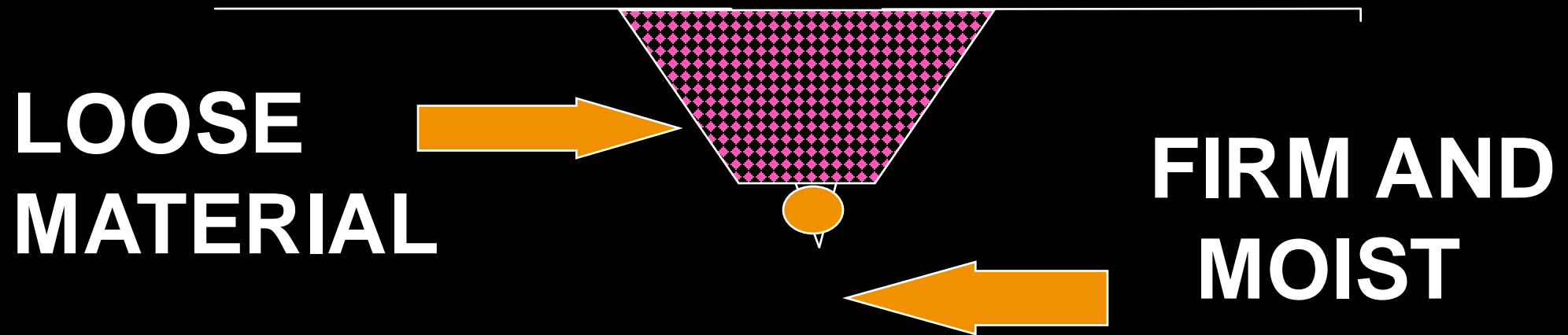
BUFFALO # 1



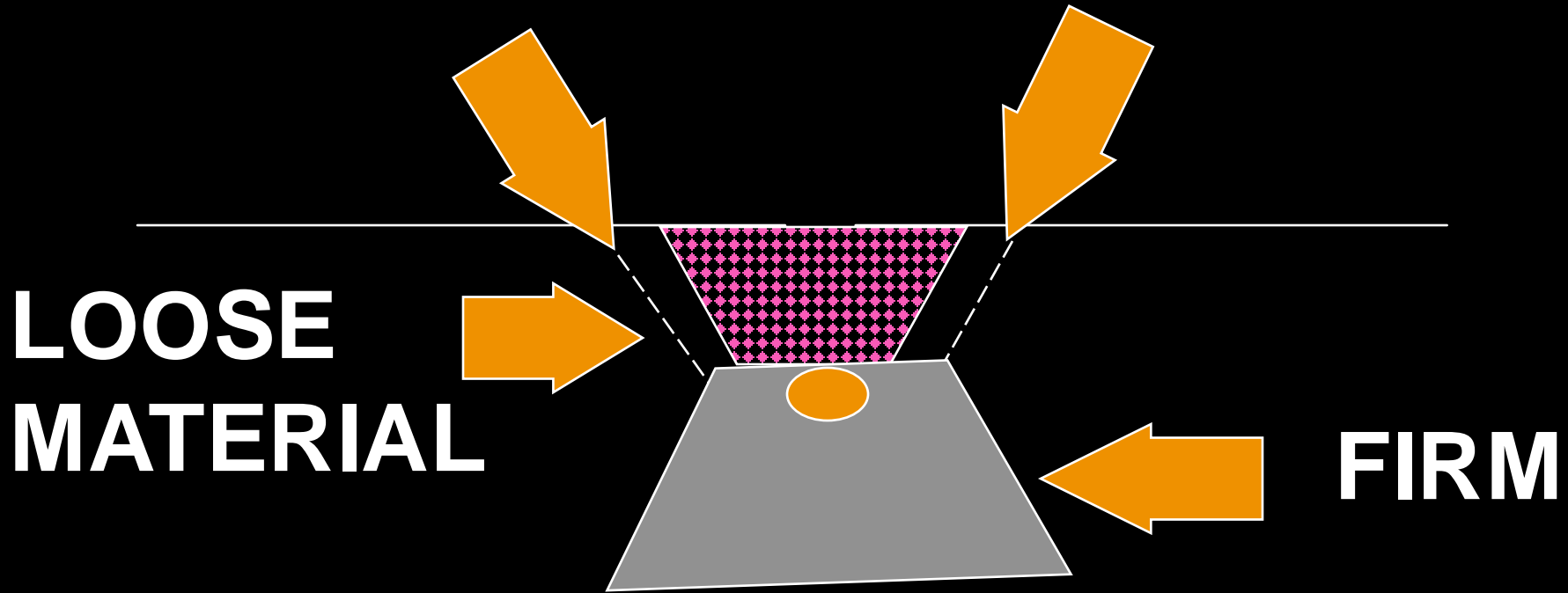
BUFFALO # 2



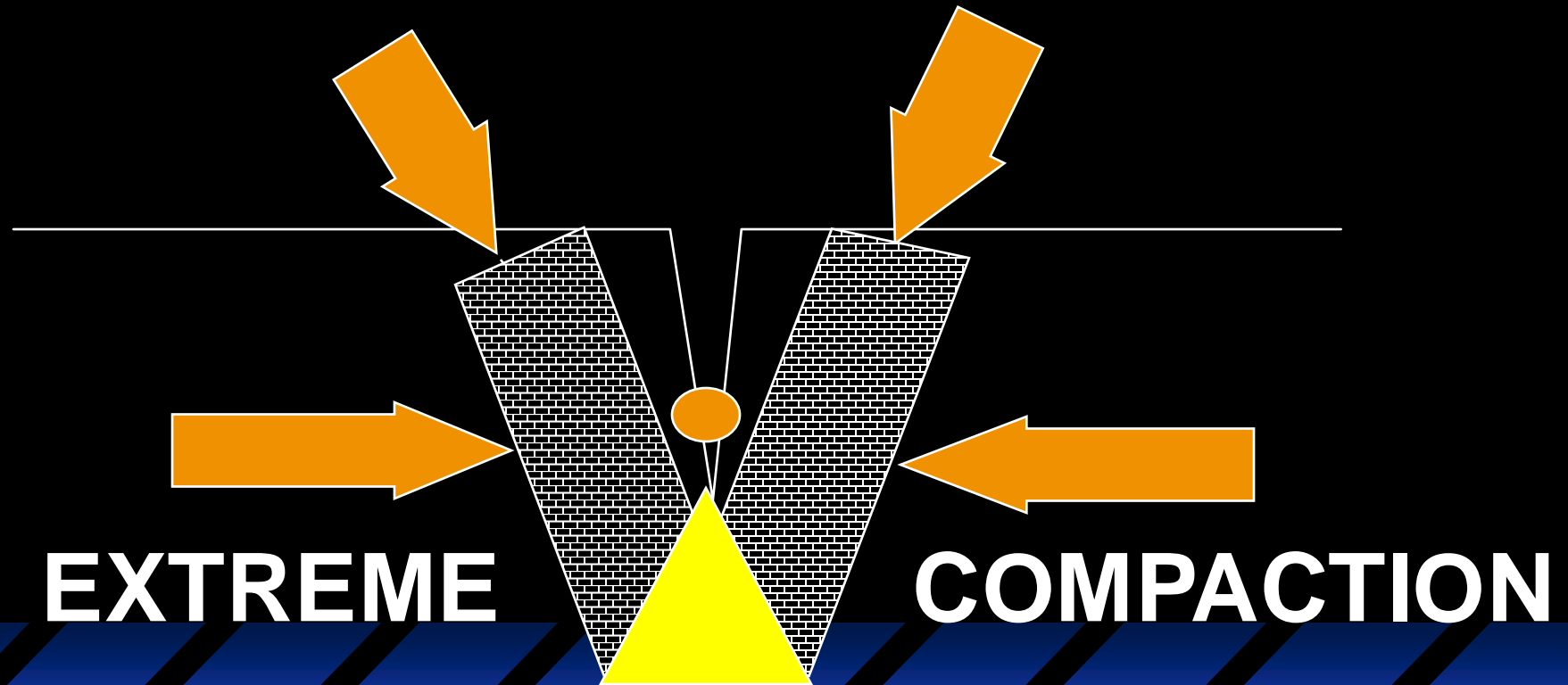
IDEAL CONDITIONS



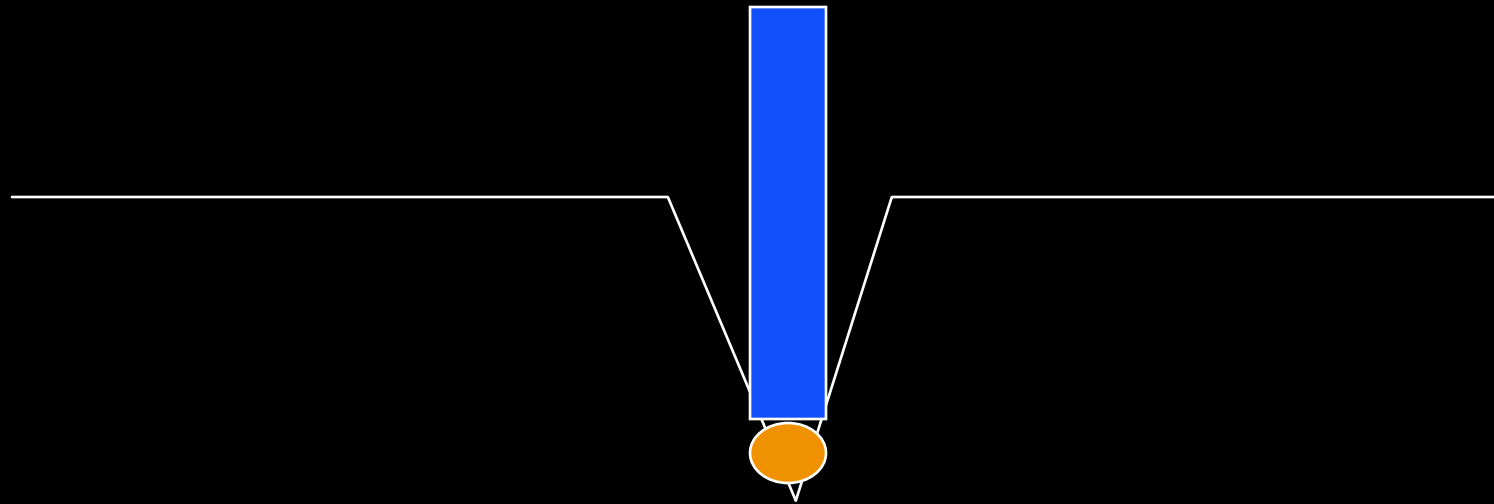
V WHEELS IN CONVENTIONAL TILL



V WHEELS IN WET NO-TILL SOILS

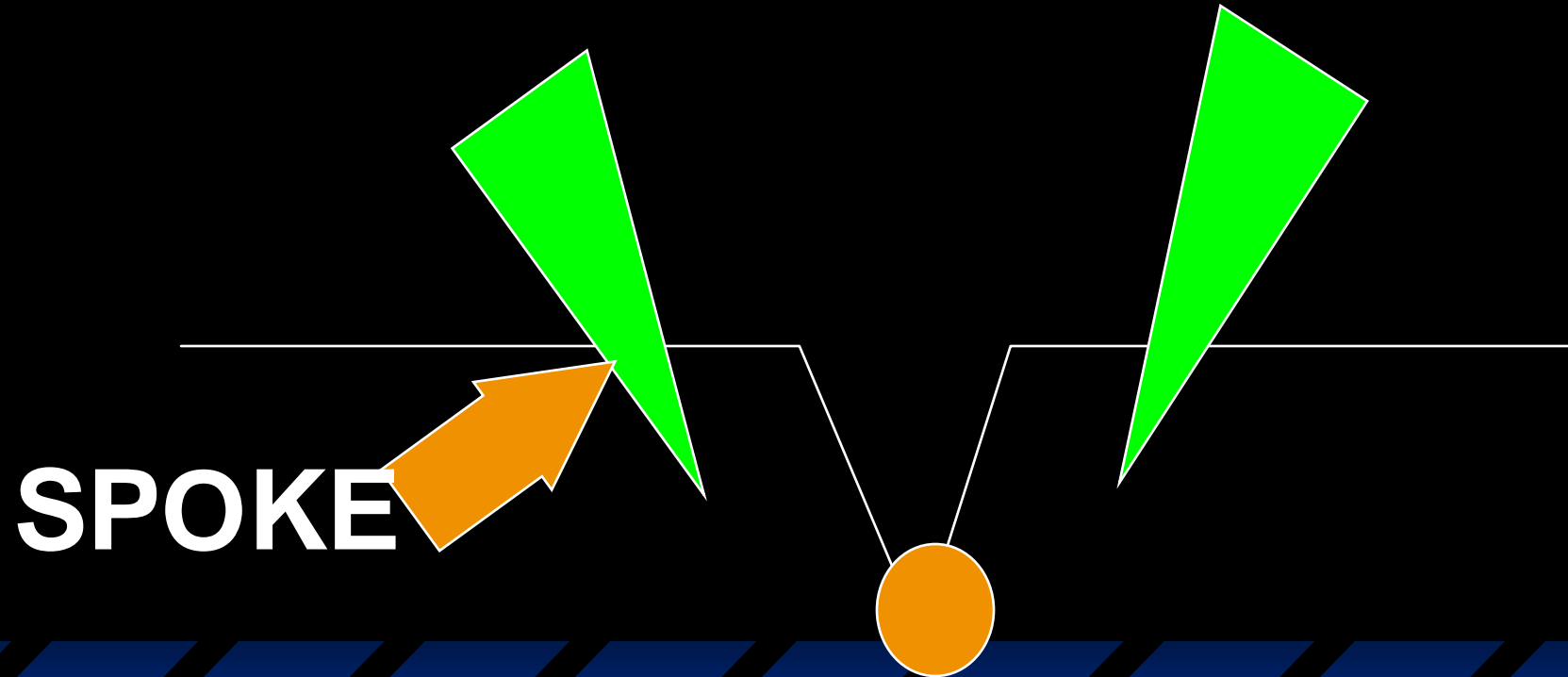


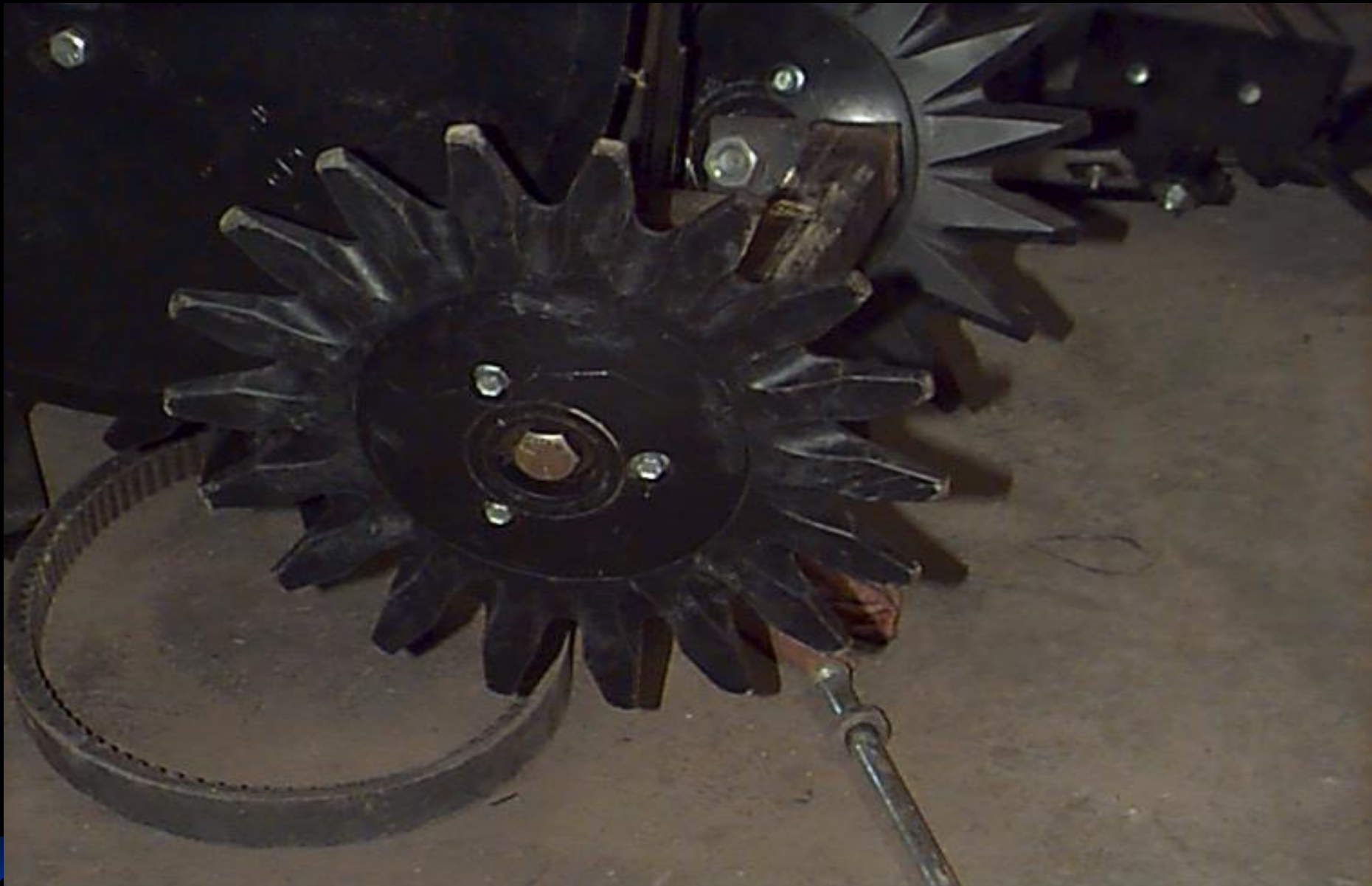
SEED LOCK MECHANISM



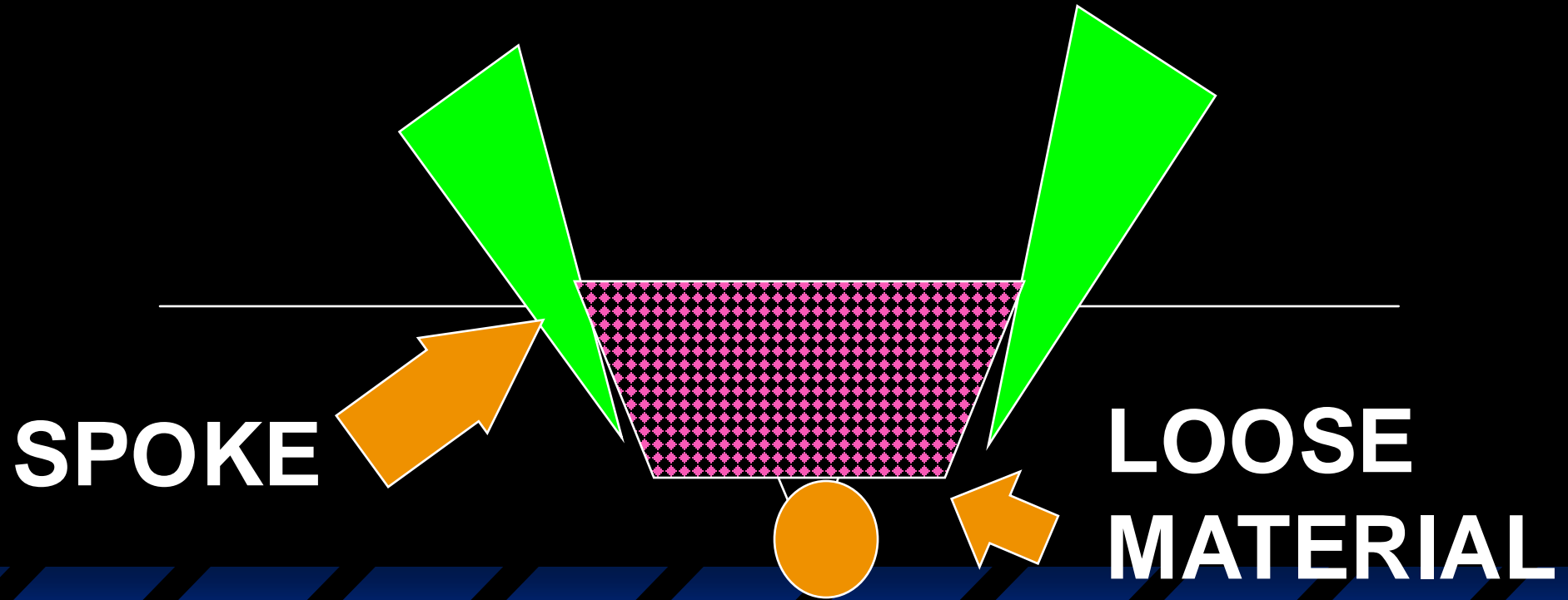
BUFFALO # 1

IMPROVED CLOSING SYSTEMS





IMPROVED SYSTEMS (BUFFALO # 2)





DO YOU C WHAT I C?

Dr. Dwayne Beck

Dakota Lakes Research Farm

South Dakota State University

Pierre South Dakota

2007



*15th Annual National No-Tillage Conference
January 10-13, 2007, Des Moines, Iowa*





WHAT IS YOUR PROBLEM?

Constraints to Adoption of No-till Systems

Dwayne Beck, PhD

Dakota Lakes Research Farm

Pierre, South Dakota

2010





Doing the Wrong Thing Better 2022

Dwayne Beck, PhD; Dakota Lakes Research Farm



**BUREAUCRACIES,
GOVERNMENTS, AND
CORPORATIONS ARE
OPERATED BY PEOPLE WITH
LIMITED TENURE (SHORT-
TERM GOALS)**



Dakota Lakes Research Farm

- OWNED BY FARMERS
- BOTH IRRIGATION AND DRYLAND
- 100% LOW-DISTURBANCE NO-TILL SINCE 1990
- PRODUCTION ENTERPRISE PROFITS SUPPORT RESEARCH



Eighty Percent of the total input costs in agriculture can be traced directly to fossil energy at the present time.



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150 years ago that was essentially zero

It will have to be zero again.

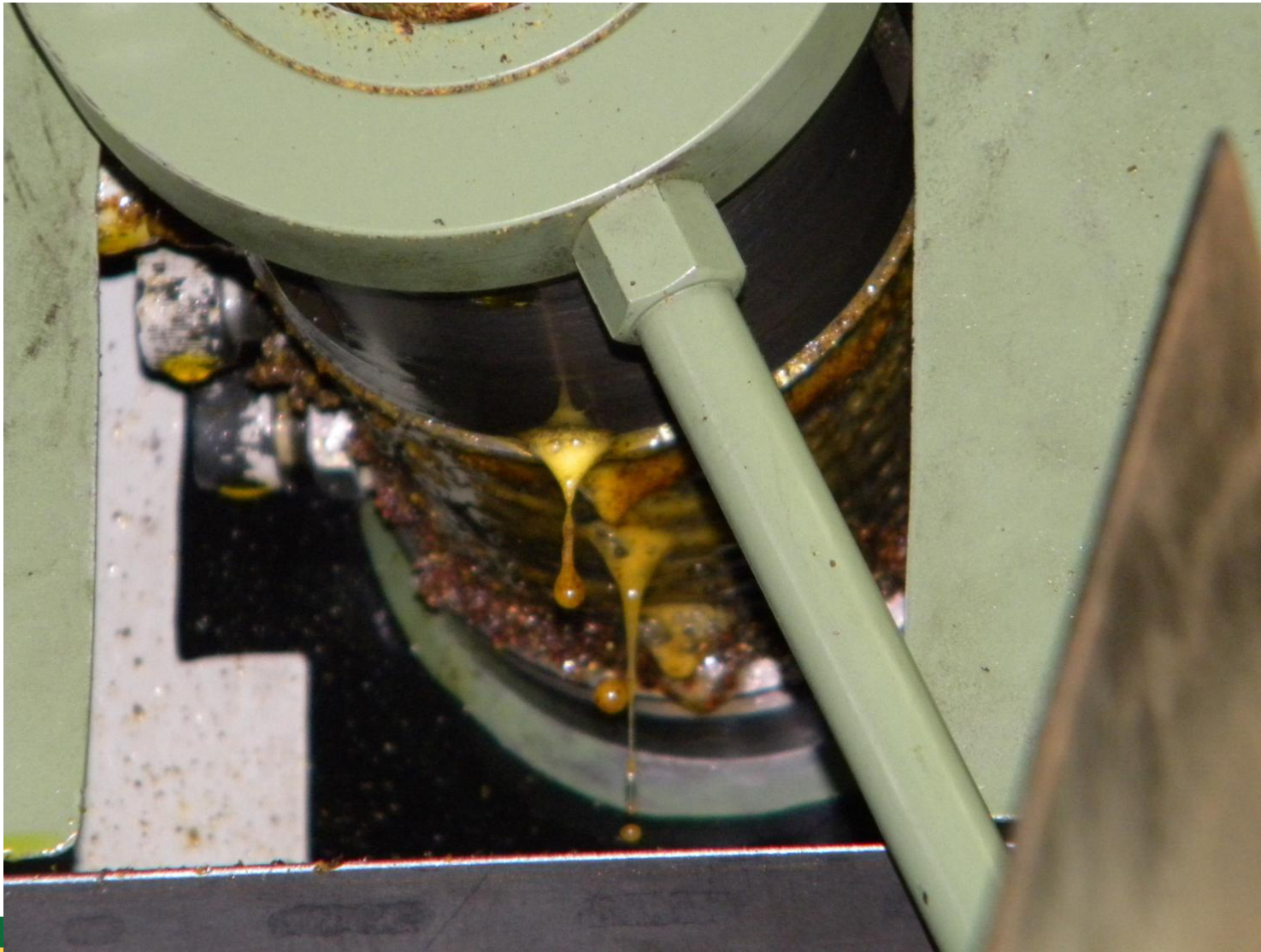


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Cold-Pressed Oil Results DLRF 2009 Crop

This is about 60 to 80 gal/acre

Species	Seed	Meal	Oil	Percent Oil
Canola (napus)	2390	1714	625	26%



Sustainable. No-till. Regenerative. Organic. Zero Till Direct Seed



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Whatever you call it, it must be based on science not tradition or feelings AND measured by **OUTPUTS** or **RESULTS** not on **INPUTS**.



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**DOING THE RIGHT THING
ENVIRONMENTALLY IS
ALMOST ALWAYS THE
CORRECT ECONOMIC
APPROACH IN THE LONG-
RUN.**



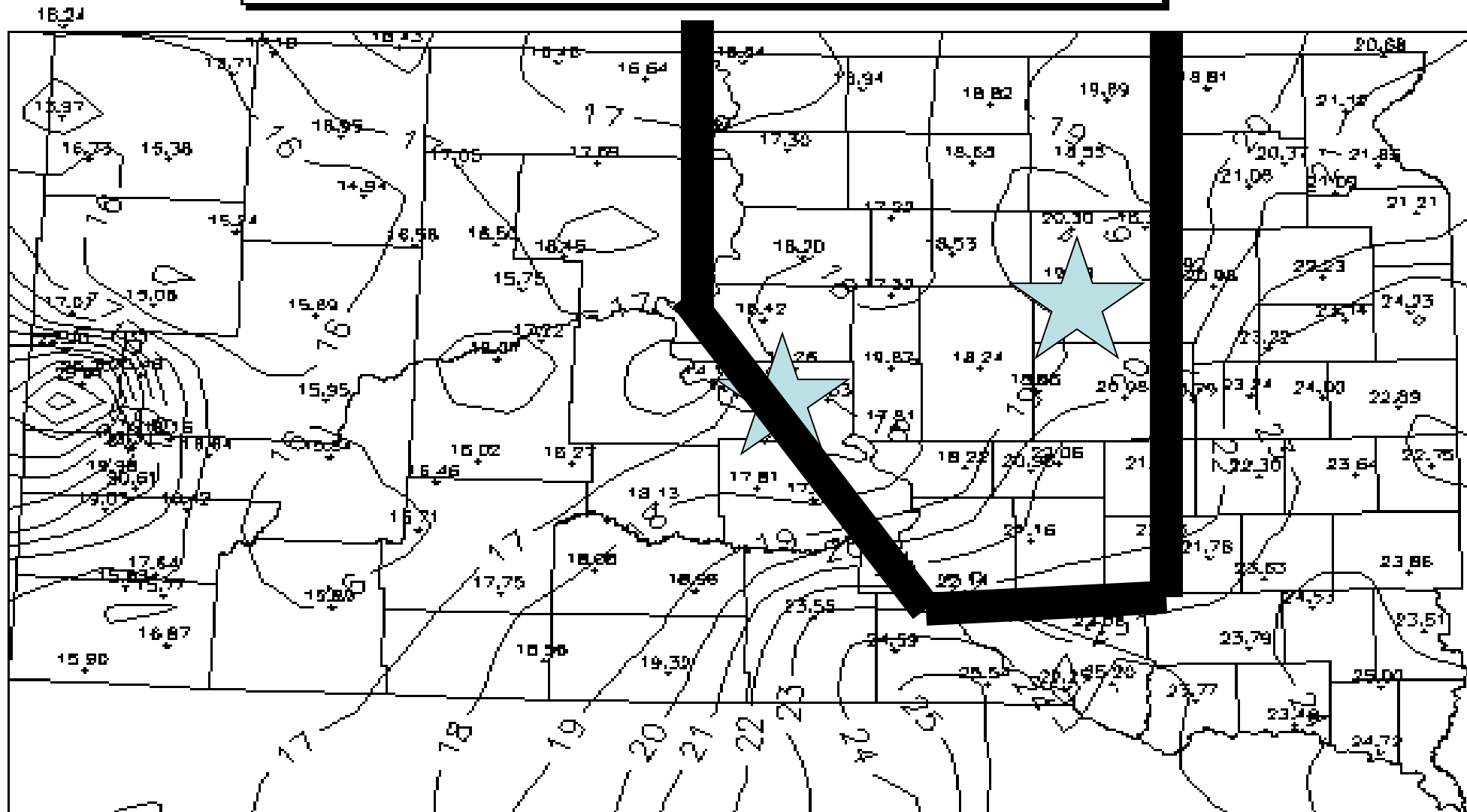
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Normal Precipitation (1961-90)



January 7-10,

CHANGE IN SD CROP PRODUCTION

Central and North Central Reporting Regions

	Change 1990-2009	Price 8/2010 Wolsey	Value 8/2010 Wolsey
S Wheat	6.2 m bu	\$6.01	\$37.3 mil
W Wheat	4.7 m bu	\$5.45	\$25.6 mil
Corn	168.1 m bu	\$3.53	\$593.4 mil
Soybean	48.1 m bu	\$9.71	\$467.1 mil
Sunflwr	249 m lbs	\$0.14	\$34.9 mil



**In August of 2010 that
calculated to increasing
income from the 5 major
crops by \$1.158 BILLION in
this area of South Dakota.**



**Farmers and Ranchers
harvest sunlight, carbon
dioxide, and water to produce
products we can sell.**



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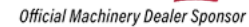


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Some of this is human food, we need to be aware of nutrition issues and off-site impacts.

If we want to eat beef, maybe we should concentrate on producing beef instead of corn or barley that feeds beef in feedlots.



**Weeds and diseases
are Mother Nature's
way of adding diversity
to a system that lacks
it.**



Over-reliance on herbicides leads to resistant weeds AND maybe disease problems.

Using surfactants too frequently may increase disease issues.



Fungicides and insecticides cause collateral damage. They are a disturbance to the ecosystem.

Use of fungicides and insecticides when they are not needed can increase insect and disease problems.



High disturbance techniques increase weed pressure and cause tillage erosion.



Rotation – Tillage Interaction

Weeds/Square Meter with no herbicide

	2 Crop Rotation	4 Crop Rotation	2 vs 4 Contrast
Tilled Site	225	44	1/5
No-Till Site	94	7	1/13



Tillage erosion needs to be stopped.

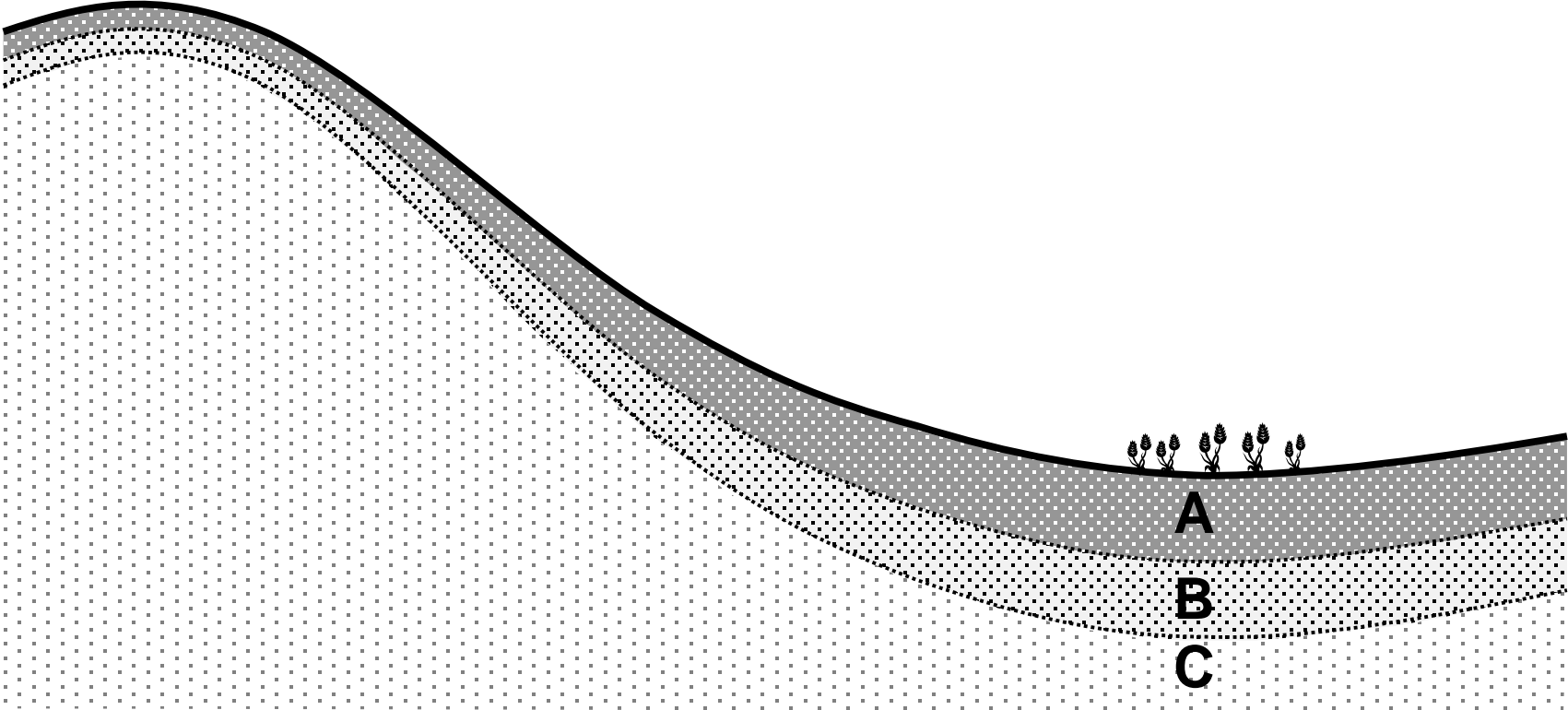
Past tillage erosion impacts need to be repaired.



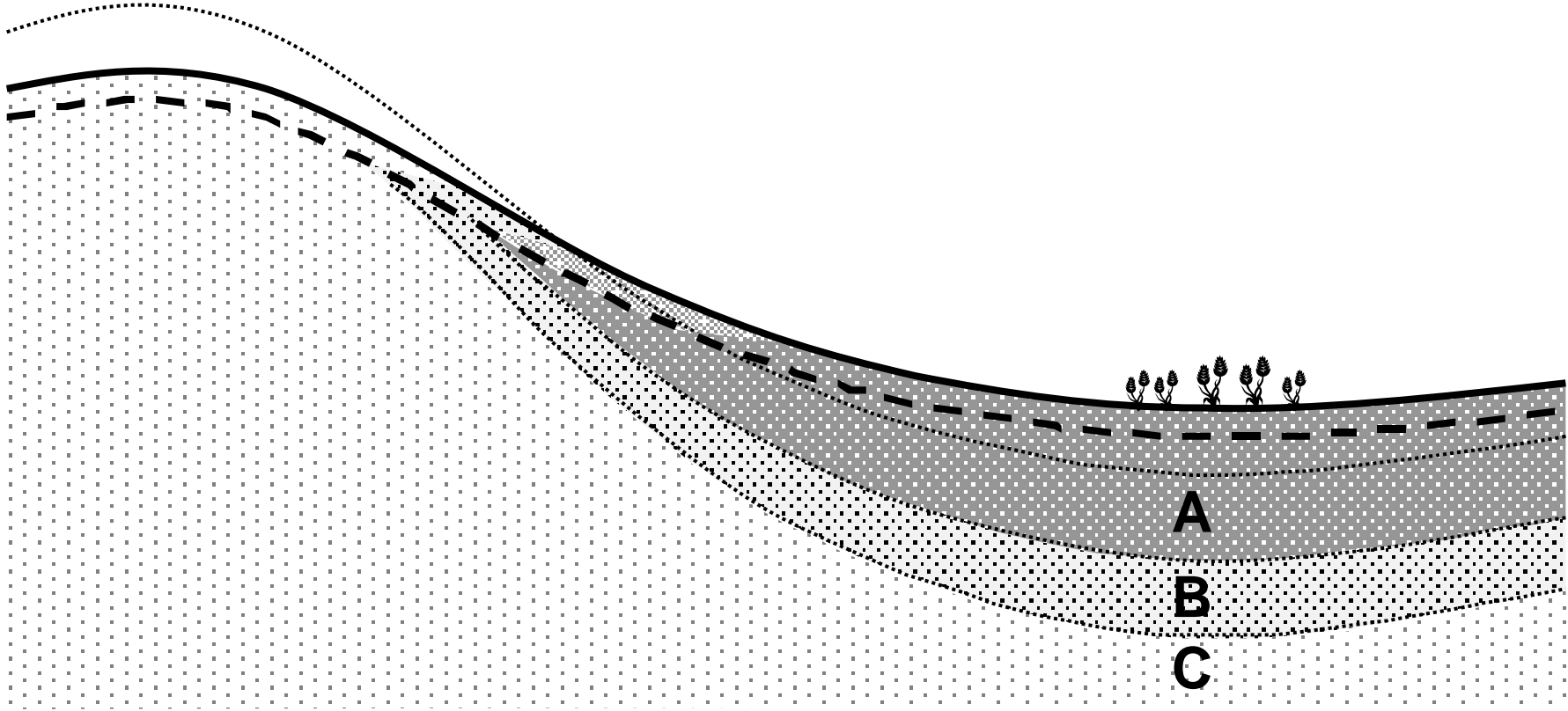
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a) Uncultivated



a) cultivated, medium-term





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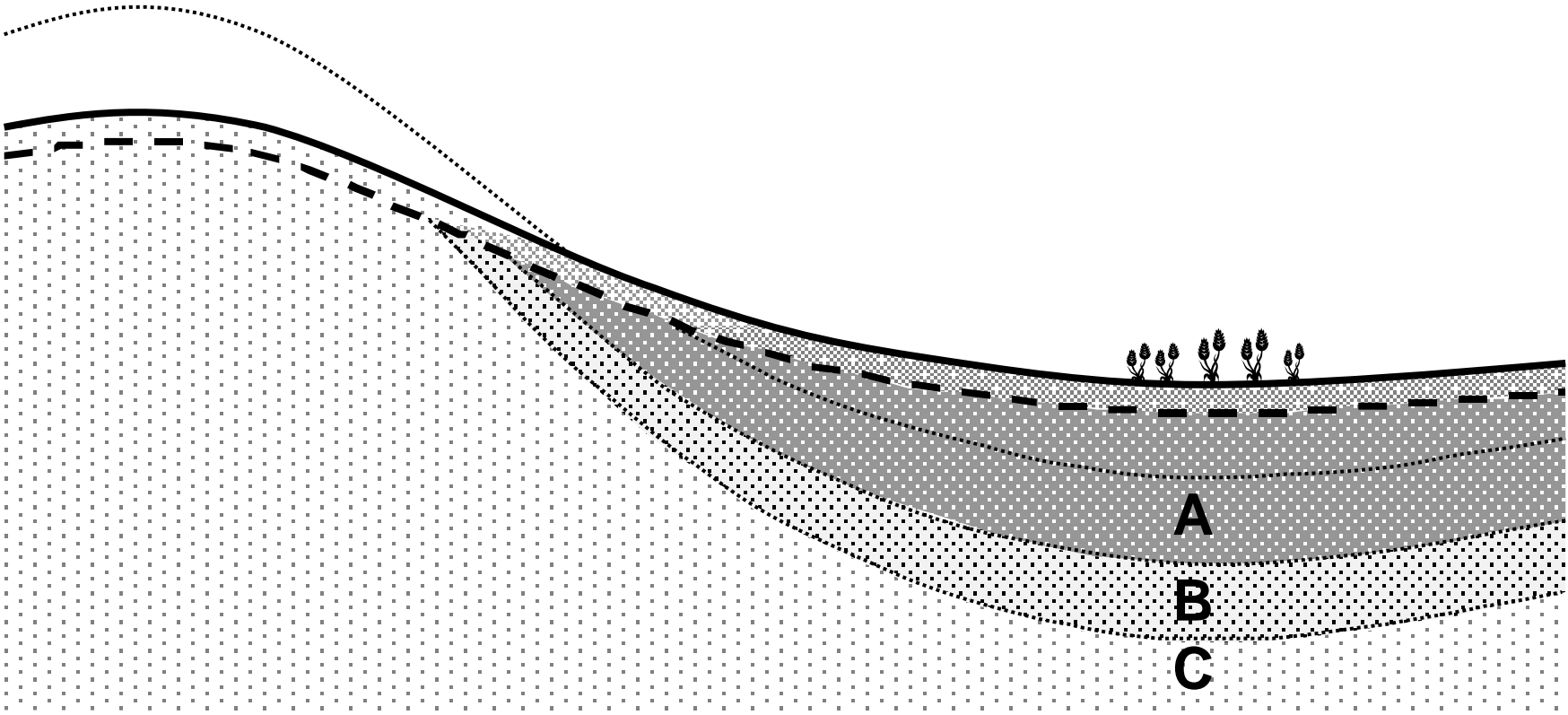
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b) cultivated, long-term





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Sanitation, Rotation, and Competition are the primary methods of pest control.



Pesticides are only part of sanitation, rotation, and competition.

Fertilizer placement and residue placement are part of competition.



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Seed is dominant P source through V1 V2 - Soil becomes dominant P source

No fertilizer nutrients needed but plant demand on the soil could hurt if N+K₂O too high for P approaches a maximum – roots

status at V3-V4 influences kernels initiated per ear need to be in starter band for max effectiveness





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Proper nutrient cycling is an extremely important factor.



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Ecosystems that leak nutrients for extended periods become deserts.

Saline seeps are symptom of improper nutrient and water cycling.

Nutrient placement is part of cycling



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CATCH AND RELEASE NUTRIENTS



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Fertility Management

- Available Nutrient
- Roots (VAM are roots)
- Water



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Developing proper water cycling information is important.



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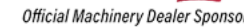
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Knowledge of the soil's water holding capacity characteristics is important.

Long-term rainfall data must be used.

Cover and forage crops are useful to help fine-tune the system.





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<http://websoilsurvey.nrcs.usda.gov/app/>

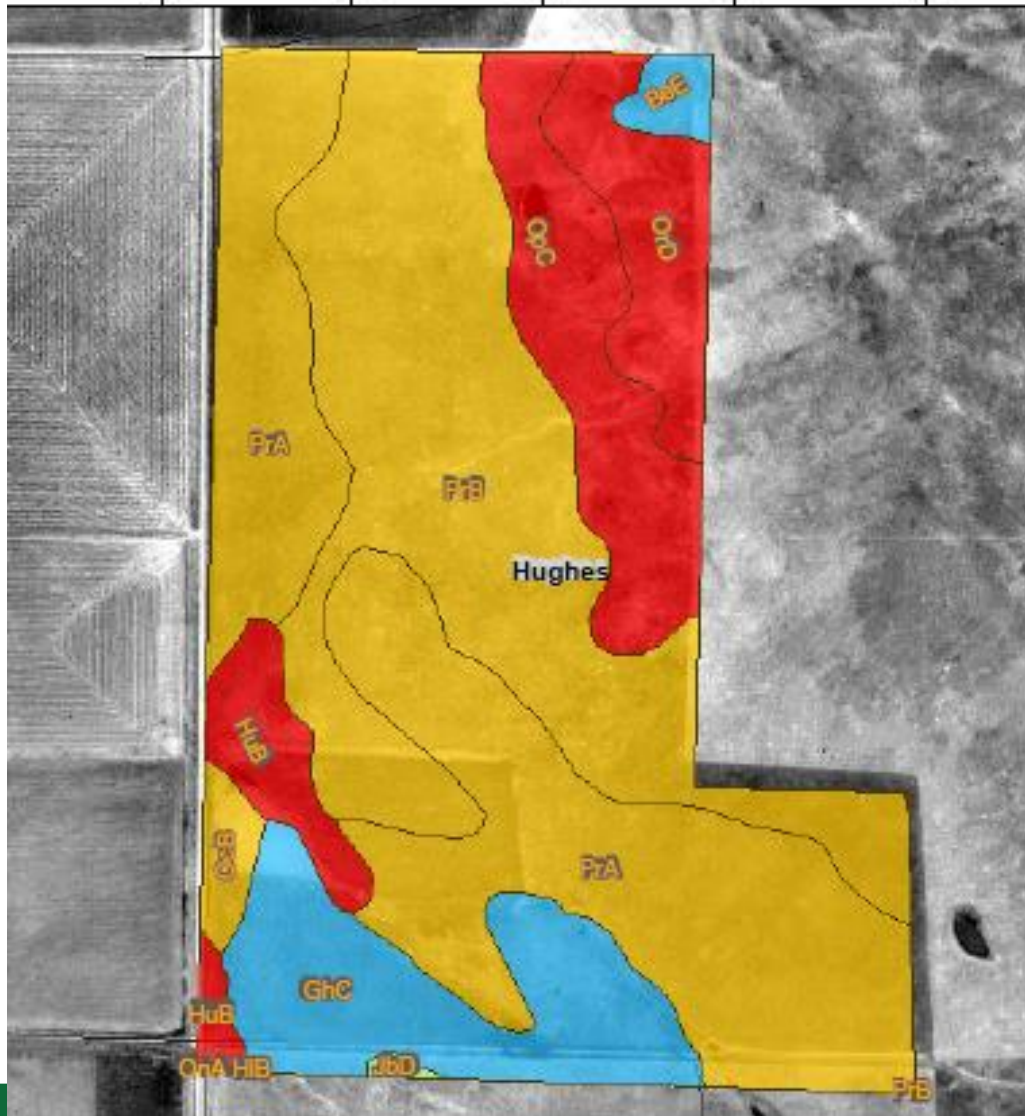


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Take the E out of ET



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COVER CROPS

In humid environments (tall-grass prairie or wetter) the goal should be to have something growing at all times. In areas with a limited growing season this will require the use of cover crops and/or forage double crops.



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COVER CROPS

If you get stranded in a rain on the back 40, do you drive home across the tilled field or the pasture?



PROPER INTENSITY

If at least some components of a rotation do not fail in excessively dry years, it is an indicator that there is not sufficient intensity. The rotation does not make full advantage of “normal” years and will fail badly in wet years.



PROPER INTENSITY

Crop insurance regulations impact the risk associated with differing rotational intensities.



There should be no need to use a ground engaging component of seed and fertilizer crops.



Clay seed balls.

“One Straw Revolution.”

Seed stakes, etc.



Livestock integration will be needed.



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Nutrient cycling.

Rotational flexibility.

It must be automated and multi-species.

Chance for young people to enter.





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Use of perennial sequences or perennial cover-crops will probably be necessary.



Nutrient cycling.

Rotational flexibility.

Building organic matter.



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Organic matter is the most important factor in determining the productivity of a soil.



“Within all textural groups, as organic matter increased from 1 to 3%, the available water capacity approximately doubled.

▪



When organic matter content increased to 4%, it then accounted for more than 60% of total AWC

▪



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Rotation Impact on W.Wheat Dakota Lakes Research Farm

Rotation	Yield	Precip*
Corn-Pea-WW 2006	60	7.9
SB-Corn-Pea-WW 2006	29	
Corn-Pea-WW 2005	92	23.7
Sb-Corn-Pea-WW 2005	57	
Corn-Pea-WW 2002	56	6.4
SB-Corn-Pea-WW 2002	28	





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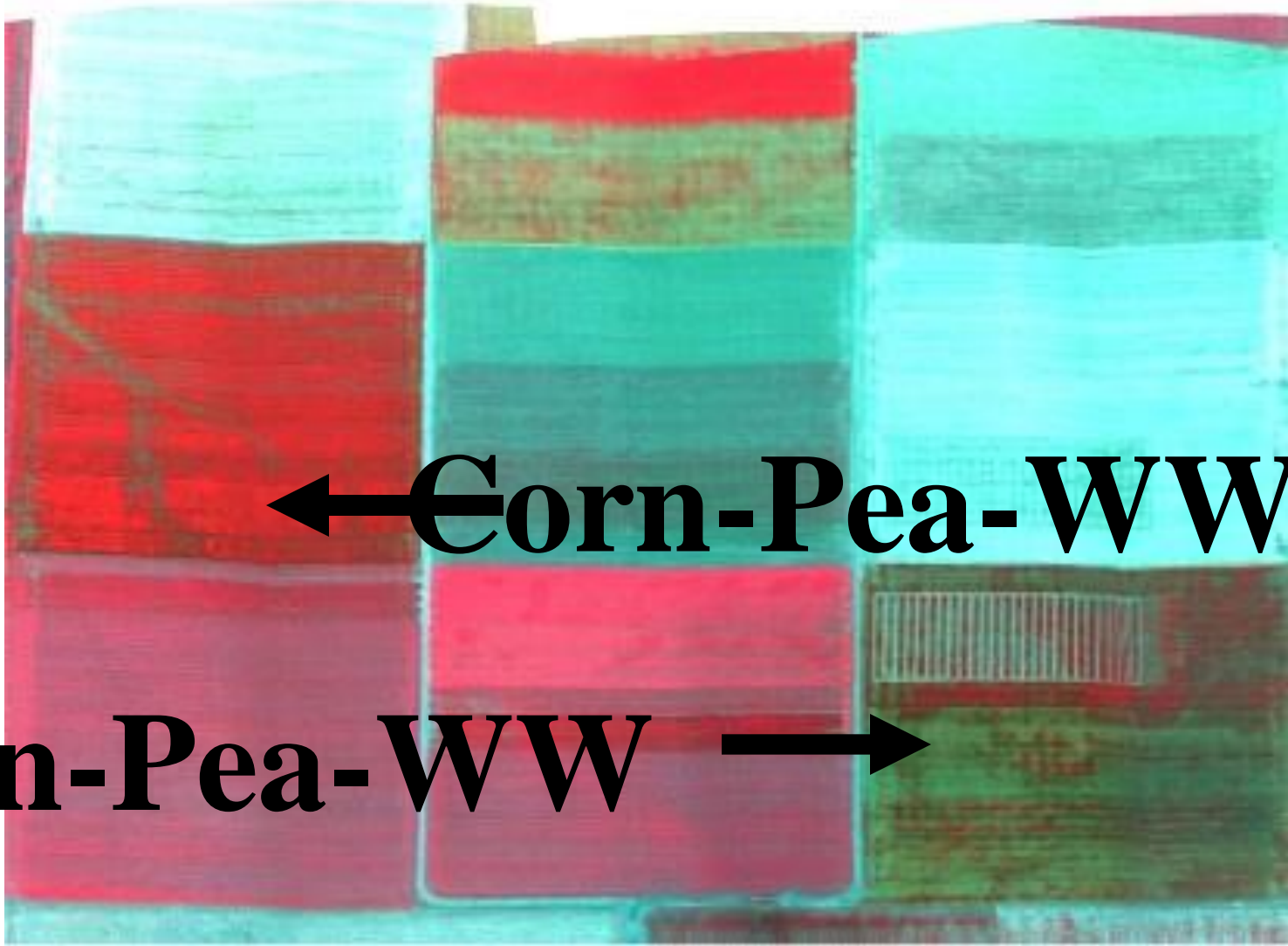
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← **Corn-Pea-WW**

Sb-Corn-Pea-WW →



Nutrients Lost by Removing Straw

75 bu/acre wheat or 1/2 of a 150 bu/acre corn crop

Nutrient	Content in Straw	Percent Lost
N	50 lbs/acre	100
P	5 lbs/acre	100
K	100 lbs/acre	100
CARBON	3000 lbs/a	100



ORGANIC MATTER MAKES A DIFFERENCE.



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Multiple tillage passes can compact the soil and result in the formation of a “plow pan” and platy structure. The amount and size of pores will decrease in this zone with concomitant air and water movement reductions. With decreased rates of infiltration, surface runoff and soil erosion become issues. Plant roots have greater difficulty penetrating the platy structure and compacted soil, and limited rooting depth can affect plant performance.





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DIVERSITY IMPACT ON IRRIGATED CORN YIELD

- CONTINUOUS CORN 203 Bu
- CORN-SOYBEAN 217 Bu
- C-C-SB-W-SB (corn 1) 256 Bu
- C-C-SB-W-SB (corn 2) 213 Bu



DIVERSITY IMPACT IF 5,000 ACRES

- **CONTINUOUS CORN**
 - 1,015,000 Corn, 0 Soybeans, 0 Wheat
- **CORN-SOYBEAN**
 - 542,500 Corn, 103,000 Soybeans, 0 Wheat
- **C-C-SB-W-SB**
 - 469,000 Corn, 112,300 Soybeans, 120,000 Wheat
- **CORN-SOYBEAN with CC**
 - 542,000 Corn, 121,250 Soybeans, 0 Wheat



WHY DIVERSITY

- 9,300 bushels more soybeans on less acres
- 73,500 bushels less corn on less acres
- 120,000 bushels of wheat
- I am willing to trade 73,500 bushels of corn for 120,000 bushels of wheat
- Less herbicide fungicide and insecticide



DIVERSITY IMPACT WITH SAME MACHINERY AND LABOR

- **CONTINUOUS CORN** **2,000 acres**
 - =406,000 bu of corn
- **CORN-SOYBEAN** **4,000 acres**
 - =434,000 corn + 82,400
- **C-C-SB-W-SB** **5,000 acres**
 - = 469,000 Corn + 112,300 Soybeans + 120,000 Wheat



WHY DIVERSITY

- BETTER WILDLIFE HABITAT.
- PROVIDES OPPORTUNITY FOR USING COVER AND FORAGE CROPS.
- BETTER WORKLOAD SPREADING
- IMPROVED SOIL STRUCTURE






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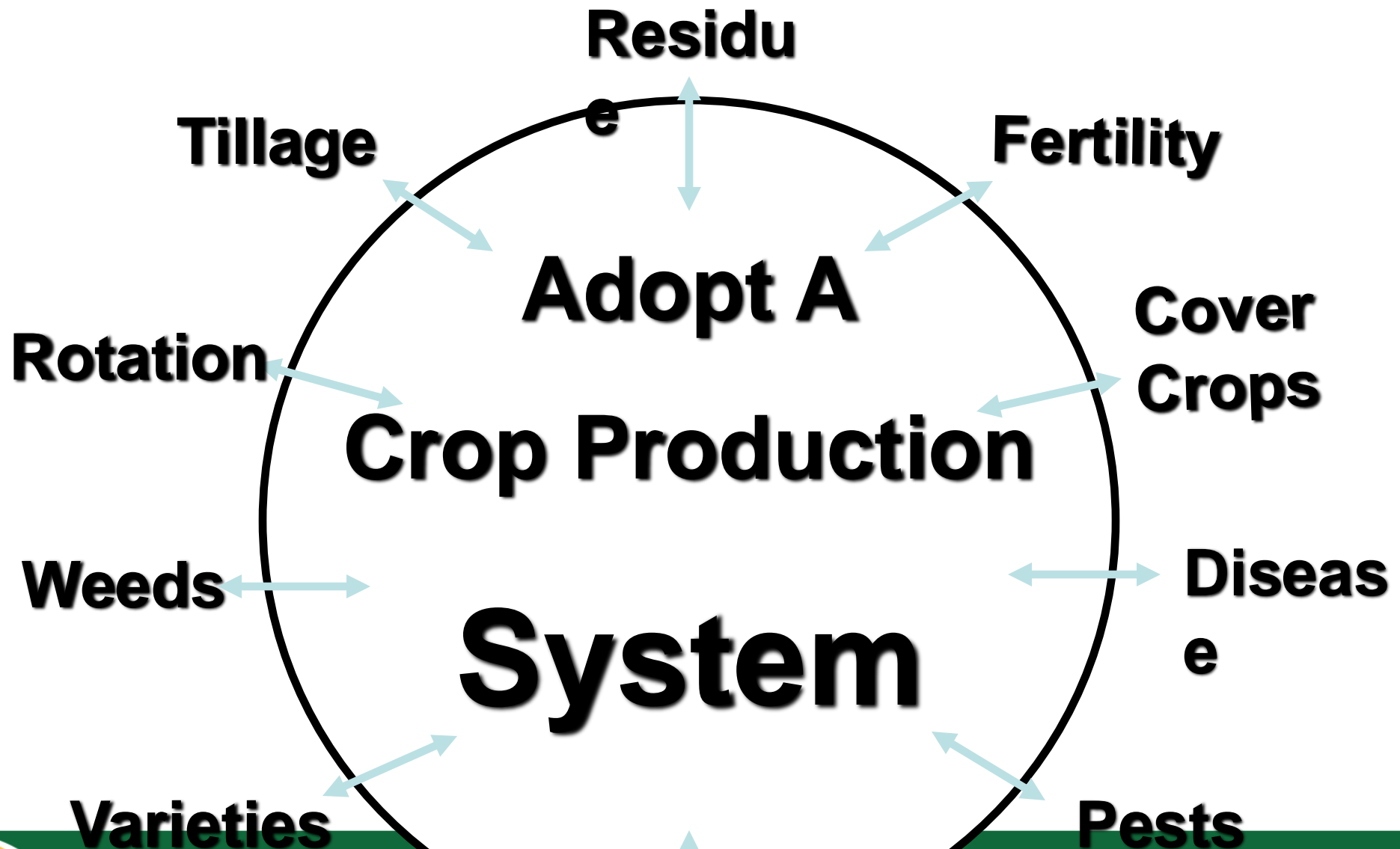
Martin Till

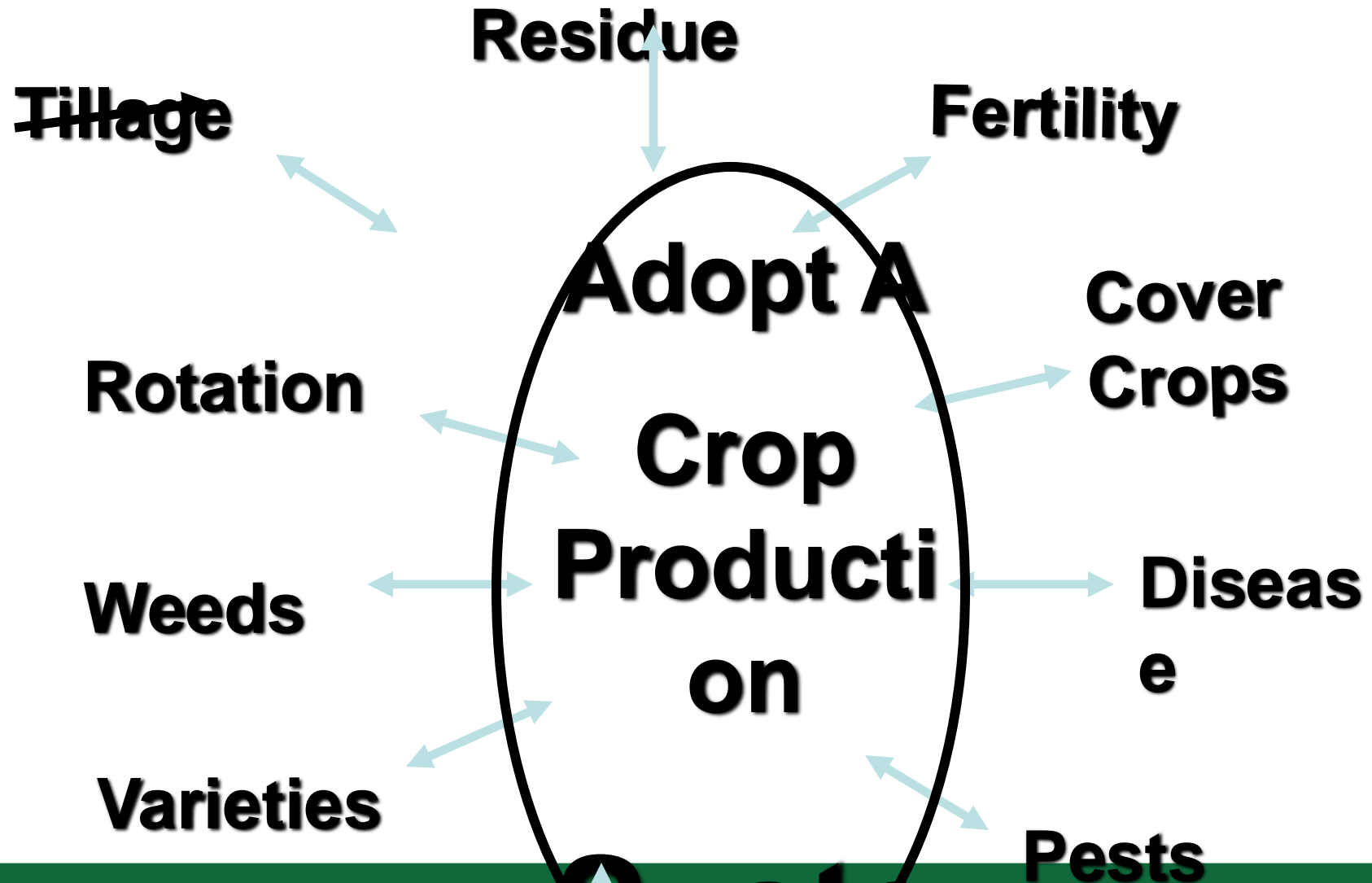


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