Dakota Lakes Research Farm

- OWNED BY FARMERS
- BOTH IRRIGATION AND DRYLAND
- 100% LOW-DISTURBANCE NO-TILL
- PRODUCTION ENTERPRISE PROFITS HELP SUPPORT RESEARCH
Sustainable.
No-till.
Regenerative.
Organic.
Zero Till
Direct Seed
The Key To Success

Diversified Rotations

No till

Cover Crops

Soil Health
Define Beautiful Woman
or
Handsome Man
As a society, we need to decide and what we want the US and agriculture to look like in 100 or 200 years.
Only then can we start doing the things needed to reach those goals.
Average Wheat Price in 1970 was $1.37/bu. The Average price of a barrel of oil was $3.39
In Minnesota where tillage is king, it takes slightly under 10 gallons of diesel/acre for tillage, seeding, and harvest.
It takes the energy of 1 gallon of diesel fuel to manufacture, transport and apply 5 lbs of N.
Eighty Percent of the total input costs in agriculture can be traced directly to energy at the present time.
One hundred and twenty years ago this was essentially ZERO.
If ALL of the biological oils and fats produced in the US were made into B100, it would equal about 20% of road diesel and home heating needs.
NO RUNOFF WITH IRRIGATORS APPLYING 2 INCHES OF WATER IN 9 MINUTES
NO-TILL IS NOT ABOUT LACK OF TILLAGE BUT ABOUT MANAGING SOIL WATER, SOIL STRUCTURE, SOIL BIOLOGY, AND CARBON COMPOUNDS IN THE SOIL.
TILLAGE SYSTEMS ARE NOT ACCEPTABLE.
TAKE THE E OUT OF ET
(MAXIMIZE WUE IN LATE SUMMER)

MAKE WATER ENTER THE SOIL

MAXIMIZE THE WATER HOLDING CAPACITY OF THE SOIL
CONCENTRATE ON HAVING THE SOIL MOIST DURING THE DRY PART OF THE YEAR
INSTEAD OF JUST FOCUSING ON HAVING IT DRY DURING THE WET PART OF THE YEAR
FOCUS ON HAVING THE SOIL COOL DURING THE HOT PART OF THE YEAR!
INSTEAD OF JUST FOCUSING ON HAVING IT WARM DURING THE COOL PART OF THE YEAR!
These concepts are important under irrigation, they are imperative for rainfed farming.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

• Decide what you want to do before trying to choose a cover crop, forage crop, or cover crop mixture.
• Think of the cover crop as another component in a rotation.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

• Using a mixture of cover-crops allows meeting several goals simultaneously. Mixtures add more diversity, grow at different times, better compete with weeds, optimize nutrient cycling, etc.
• Creating conditions beneficial to the next crop is usually one of the primary goals of a cover-crop.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

- Water and nutrient management is often another primary goal. Water used by a cover-crop during the non-crop period can often be regained during the growing season because of better infiltration, reduced runoff, and improved water relations.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

• Understanding rainfall patterns in your area and the water holding characteristics of your soils is mandatory to fully benefit from cover and forage crop programs.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

• Cover crop seed must be CHEAP in terms of cost/acre. Small seeds mean less volume/acre thus requiring less tank fills.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

- Small seeds grow better on the surface than large seeds while large seeds usually emerge better through a mat of residue. In mixtures the large seeds help the small ones emerge.
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

• One important goal is to use the cover crop to balance the diet of soil organisms. High carbon residue (low protein) requires low carbon (high protein) cover crops to balance the diet. Low residue crops (low C) require high residue crops (high C).
TOP 10 THINGS TO KNOW ABOUT COVER CROPS

• Proper planting date and achievement of uniform stands is paramount to success.
**Corn Yields**

<table>
<thead>
<tr>
<th>Cover Crop</th>
<th>Grain Yield, bu/ac</th>
<th>Nitrogen</th>
<th>No Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Cover Crop</td>
<td>220</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Lentil</td>
<td>230</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>Canola</td>
<td>240</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>Cowpea</td>
<td>230</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>Canola/Lentil</td>
<td>250</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Canola/Cowpea</td>
<td>260</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Canola/Cowpea/Lentil</td>
<td>270</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Radish/Cowpea/Lentil</td>
<td>280</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>Turnip/Cowpea/Lentil</td>
<td>290</td>
<td>240</td>
<td></td>
</tr>
</tbody>
</table>
Irrigated Corn By Previous Crop
Wheat-Wheat-C-C-SB-SB rotation
2009 Dakota Lakes Res. Farm

Nitrogen rate impact on yields
STN = 108 lbs/ac  Yield goal = 220 bu/ac

<table>
<thead>
<tr>
<th>Rotation</th>
<th>N rate 0 lb Yield Bu/ac</th>
<th>N rate 36 Yield Bu/ac</th>
<th>N rate 108 Yield Bu/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC – lentil, CVetch, turnip</td>
<td>176.0</td>
<td>236.1</td>
<td>233.9</td>
</tr>
</tbody>
</table>
2010/2011 Results WW/CC Corn
DLRF Dryland Field 5-1 Mixtures
Includes value of forage and cost of inputs (40% use)

<table>
<thead>
<tr>
<th>Combination</th>
<th>0 N</th>
<th>75 lb N/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>CV-Cowpea-Lentil-Flax</td>
<td>$72.78</td>
<td>$93.26</td>
</tr>
<tr>
<td>CV-Cowpea-Lentil-Flax +Rape</td>
<td>$34.88</td>
<td>$64.96</td>
</tr>
<tr>
<td>CV-Pea-Lentil-Flax</td>
<td>$171.19</td>
<td>$63.03</td>
</tr>
<tr>
<td>CV-Pea-Lentil-Flax + Rape</td>
<td>$168.70</td>
<td>$129.02</td>
</tr>
<tr>
<td>Pea-Flax-Sb-</td>
<td>$101.65</td>
<td>$92.05</td>
</tr>
<tr>
<td>Pea-Flax-Sb-+ Rape</td>
<td>$99.70</td>
<td>$96.50</td>
</tr>
</tbody>
</table>
2010/2011 Results WW/CC Corn Profit/Loss
DLRF Dryland Field 5-1 Single Crop
Includes value of forage and cost of inputs (40% use)

<table>
<thead>
<tr>
<th>Crop</th>
<th>0 N</th>
<th>75 lb N/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Oats</td>
<td>(18.6)</td>
<td>(13.1)</td>
</tr>
<tr>
<td>Millet</td>
<td>(18.3)</td>
<td>(15.5)</td>
</tr>
<tr>
<td>Lentil</td>
<td>(14.1)</td>
<td>(15.4)</td>
</tr>
<tr>
<td>Cowpea</td>
<td>(16.1)</td>
<td>(9.5)</td>
</tr>
<tr>
<td>Radish</td>
<td>(12.7)</td>
<td>(12.6)</td>
</tr>
<tr>
<td>Mix of Above</td>
<td>1.3</td>
<td>(9.4)</td>
</tr>
</tbody>
</table>
COVER CROPS

• BUT THE COVER NEEDS TO BE MAINTAINED.
COVER CROPS

If you get stranded in a rain on the back 40, do you drive home across the tilled field or the pasture?
MANAGING COVER CROPS IS MORE ART THAN SCIENCE AT THIS POINT

A small amount of organic matter by weight has a big impact on pore space because it only weighs 1/5 as much for the same volume.
“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.
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.
NO-TILL IS NOT ABOUT LACK OF TILLAGE BUT ABOUT MANAGING SOIL STRUCTURE, SOIL BIOLOGY, AND CARBON COMPOUNDS IN THE SOIL.
Focus on results not on inputs.

What will Michigan look like 600 years from now.