PNDSA ECONOMICS OF DIRECT SEEDING
A Simple Man’s Take On The Current Production Model

By Gabe Brown (A very, very simple man)
• What did this land look like prior to 1492?
DIVERSITY!
THIS DIVERSITY DROVE A HEALTHY ECOSYSTEM
MONOCULTURES
• These Practices Caused A Loss of Biodiversity
• This Lack Of Diversity Has Led To The Destruction Of....
Fungal hyphae binding soil particles together into aggregates. Arbuscular Mycorrhizal fungi produces Glomalin that glues soil particles together.
LOSS OF OUR SOIL RESOURCE
Eastern Colorado 1-12-14
• And If We Don’t Have Soil Aggregates We Cannot Infiltrate Water
5/22/15  3.5” IN 45 MINUTES
NO EROSION DUE TO ARMOR
• Too Many Producers Create Their Own Drought!
• We Must Be Able To Infiltrate
• And Then Store Every Raindrop!
• Lack Of Biodiversity Also Leads To Lower Nutrient Cycling
• Which Leads To...
INCREASED SYNTHETIC FERTILIZER USE
• This Increased Use Of Synthetic Fertilizer Spurs The Decline Of...
Fungal hyphae binding soil particles together into aggregates. Arbuscular Mycorrhizal fungi produces Glomalin that glues soil particles together.
High Synthetic Fertilizer Use Aids The Propagation Of.....
WEEDS: MOST WEEDS ARE HIGH N USERS
• Increased Weed Numbers Causes An Increase Use Of...
Many of these herbicides are chelates. Chelates bind metals.
• Metals Such As Zinc, Magnesium, Manganese, Iron and Copper Are Critical For The Plant To Ward Off Disease And Pests
• Because They Cannot Ward Off Disease, We.....
SPRAY FUNGICIDES
• Fungicides Are Detrimental To......
• Because Plants Are Not Healthy Enough To Ward Off Pests, We....
SPRAY PESTICIDES
• Because We Spray Pesticides, WE Have....
A DECLINE IN POLLINATORS
• These Pollinators Are Critical For Our Crop Production...DUH!!!
• These Pesticides Cause A Decline In The Predators Which Are Needed To Control The Very Pests We Are Spraying To Control!!
• The Current Production Model Is All About Killing…
• Kill Weeds, Pests, Fungus, Diversity…..Our Soil…..
• Our PROFIT!!!!
• US???
• The Nutrient Density of Food has Decreased Anywhere from 15% to 65% in the last 50 Years!

• Should Consumers be Satisfied With This?
MINERAL DEPLETION IN VEGETABLES 1940 - 1991

Average of 27 kinds of vegetables …

- Copper declined by 76%
- Calcium declined by 46%
- Iron declined by 27%
- Magnesium declined by 24%
- Potassium declined by 16%

Ref: David Thomas ‘A study on the mineral depletion of the foods available to us as a nation over the period 1940 to 1991’. Nutrition and Health 2003; 17: 85-115
MINERAL DEPLETION IN MEAT
1940 - 1991

Average of 10 kinds of meat …

- Copper **declined by** 24%
- Calcium **declined by** 41%
- Iron **declined by** 54%
- Magnesium **declined by** 10%
- Potassium **declined by** 16%

Ref: David Thomas ‘A study on the mineral depletion of the foods available to us as a nation over the period 1940 to 1991’. Nutrition and Health 2003; 17: 85-115
• I Used To Wake Up Every Morning Trying To Decide What I Would Kill That Day,
• Now I Wake Up Eager To Get More Life On My Ranch!
LET’S COMPARE SYSTEMS

• Four Producers
• Located In Close Proximity
• Same Soil Types
ORGANIC-HIGH DIVERSITY
NO-TILL LOW DIVERSITY
NO-TILL-MEDIUM DIVERSITY-HIGH SYN.
NT-HD-ZS-LVST, C
**MANAGEMENT COMPARISON**

- Management  
  | N | P | K | OC |
- Organic  
  | 2 | 156 | 95 | 233 |
- No-Till, Low Diversity  
  | 27 | 244 | 136 | 239 |
- No-Till, MD, High Syn.  
  | 37 | 217 | 199 | 262 |
- No-Till, HD, NS, Lvst, C  
  | 281 | 1006 | 1749 | 1095 |

- Tested by Dr. Rick Haney, ARS, Temple, TX
Nature’s Way:

- No mechanical disturbance
- Armor on the soil surface
- Cycles water
- Living plant-root networks
- Nutrient cycling via biology
- Thousands of years of R & D
Growing topsoil is a biological process.
85 - 90% of plant nutrient acquisition is microbially mediated
But who feeds the microbes - and with what?
Plants feed the microbes ... with liquid carbon
• This Is Why We Need Diverse Cover Crop Mixes!

• If We Grow Monoculture Covers We Are Not Feeding Biology A Diverse Diet!
PHOTOSYNTHESIS

- Plant Growth is about taking CO2 and H2O in the presence of a plant and sunlight and converting it to sugar.
- Sugar is then converted into everything we call a crop.
LIQUID CARBON PATHWAY

• Photosynthesis
• Translocation to roots
• Transfer to soil
• Consumed By Microbes
• Microbes Feed The Plants Via Their Life Cycle!
Of all the microbes important to humification (and hence N & P) mycorrhizal fungi are KING.
Mycorrhizal fungi are both the highway and the internet of the soil.
There would be sufficient length of mycorrhizal hyphae in the top 10cm of just four square metres of healthy grassland soil to stretch all the way around the equator (Leake et al, 2004)
Why have mycorrhizal fungi been overlooked in agriculture?
TILLAGE DESTROYS MYCO. FUNGI
• Thus Tillage Destroys A Large Part Of The Soils Ability To Transfer Nutrients!
THIS COSTS MONEY!!!

- $$$$$
THE ECONOMICS:

• IT’S NOT ABOUT YIELD,
• IT’S ABOUT PROFIT!
OATS INCOME

• Yield: 112
• Price/bu. $5.50
• Total Crop Income: $588.
• Grazing Income: $110.
• Total Income: $698.
OATS EXPENSES:

Land Cost: $50.
Seed: $16.
C/C Seed: 4.45
Seeding: 24.
Herbicide: 23.
Combining: 25.
Trucking: 22.40
Storage: 11.20
Cleaning:
Marketing Labor:
Total Expenses: $176.05
OATS TOTAL INCOME

• Total Income: $698.
• Total Expenses: 176.05
• Net Profit/Acre: $521.95
WINTER TRITICALE/ HAIRY VETCH INCOME

• Yield:  55 x $7.00     $385.00
• Yield  450# x $1.75    $787.50
• Price/bu.
• Total Crop Income:    $1,172.50
• Grazing Income:
• Total Income:         $1,172.50
WINTER TRIT./HAIRY VETCH EXPENSES:

- Land Cost: $50.00
- Seed: 40.
- C/C Seed:
- Seeding: 24.
- Combining: 35.
- Storage: 18.
- Marketing Labor: 32.50
- Total Expenses: $257.50
WINTER TRIT./HAIRY VETCH
TOTAL INCOME

• Total Income:        $1,172.50
• Total Expenses:         257.50
• Net Profit/Acre      $  915.00
HRSW INCOME

• Yield: 62
• Price/bu. $5.55
• Total Crop Income: $344.10
• Grazing Income: $ 90.00
• Total Income/Acre $434.10
## HRSW EXPENSES:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Cost</td>
<td>$50.</td>
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<tr>
<td>Seed</td>
<td>18.</td>
</tr>
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<tr>
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<tr>
<td>Herbicide</td>
<td></td>
</tr>
<tr>
<td>Combining</td>
<td>25.</td>
</tr>
<tr>
<td>Trucking</td>
<td>6.20</td>
</tr>
<tr>
<td>Storage</td>
<td>15.50</td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
</tr>
<tr>
<td>Marketing Labor</td>
<td></td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>$143.15</strong></td>
</tr>
</tbody>
</table>
HRSW TOTAL INCOME

• Total Income       $434.10
• Total Expenses    $143.15
• Net Profit/Acre    $290.95
• 368 head x $1.20/head/day = $441.60/acre gross

• - expenses:
  • seed, seeding, land cost, labor = $ 84.00
  • Net income per acre = $357.60

• Value of Recovery Time To Pastures???

• Value of Enhanced Soil Health???
GRASS FINISHING ON A WARM SEASON MIX
ECONOMICS

• 114 Grazing days / acre x $1.75 = $199.00

• Expenses:
  
  • Seed, seeding, land cost, labor = $ 79.00

• Net Income = $120.00

• TOTAL NET/ACRE = $477.60
Healthy Plants
Healthy Animals
Healthy People

Clean Water

Healthy Soil

Clean Air
HEALTHY FOOD FROM HEALTHY SOIL
Why Not Be Paid For Producing This Nutrition???
CURRENTLY

• 14% To The Farmer
• 86% To Processing and Marketing
• WHY?????
THE NEXT GENERATION
OUR CUSTOMER BASE
LOCAL FOOD COOP
WE MUST FOCUS ON OUR RESOURCES
TOTAL INCOME

• Total Income
• Total Expenses
• Net Profit/Acre
EXPENSES:

Land Cost:
Seed:
C/C Seed:
Seeding:
Herbicide:
Combining:
Trucking:
Storage:
Cleaning:
Marketing Labor:
Total Expenses:
• This Leads To Lower Nutrient Density In Our Food!
How much crop yield is attributable to fertilization?

- **Depends on many factors, e.g., crop, climate, soil, management, and others**
- **Some attempts have been made to estimate**
  - 33% of US grain production due to fertilizer (Council Ag. Sci. and Tech., 1974)
  - 55% of all US grain yield due to fertilizer from 1940-1955 (Christensen et al., 1964)
  - 31% of Midwest corn grain yield from 1939-1961 due to fertilizer (Auer and Heady)

Source: IPNI.net
INCOME

• Yield:
• Price/bu.
• Total Crop Income:
• Grazing Income:
• Total Income:
Crop yield attributable to fertilization...
other estimates

• **Magruder wheat plots (Oklahoma State U.)**
  - Established in 1892
  - Began using inorganic nutrients in 1930
  - Inorganic N rates ranged from 33-60 lb/A
  - Inorganic P$_2$O$_5$ rates 30 lb/A
  - Compare yields in control to yields from N+P treatments to determine yield due to fertilizer

Source: IPNI.net
Wheat yield attributable to fertilizer: 1930-2000
Magruder plots (OSU)

Average: 40%

Upward trend due to depletion of native N and P through crop removal.

Source: IPNI.net
Crop yield attributable to fertilization... other estimates

- **Morrow plots (U. of Illinois)**
  - Established in 1888
  - Have evaluated several crops, rotations, and fertility treatments
  - Began using inorganic nutrients in 1955
  - Compare yields in control to yields from N+P+K+lime treatments to determine yield due to fertilizer

Source: IPNI.net
Corn yield attributable to fertilizer and lime: 1955-2000
Morrow plots (U. of Illinois)

Outlier in 1956 reduced average for 1955-59.

Source: IPNI.net
40-year average percent change in irrigated corn yield due to N and P fertilization in W. KS

* Economic optimum rates are 160 lb N and 40 lb P₂O₅.

Source: IPNI.net
### Estimated impact of N fertilizer on yield of selected crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Baseline Yield</th>
<th>Yield without N</th>
<th>Reduction, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>122</td>
<td>72</td>
<td>41</td>
</tr>
<tr>
<td>Cotton</td>
<td>679</td>
<td>427</td>
<td>37</td>
</tr>
<tr>
<td>Rice</td>
<td>5500</td>
<td>4000</td>
<td>27</td>
</tr>
<tr>
<td>Barley</td>
<td>47</td>
<td>38</td>
<td>19</td>
</tr>
<tr>
<td>Sorghum</td>
<td>69</td>
<td>56</td>
<td>19</td>
</tr>
<tr>
<td>Wheat</td>
<td>32</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>Soybean</td>
<td>34</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>Peanut</td>
<td>2281</td>
<td>2281</td>
<td>0</td>
</tr>
</tbody>
</table>

1 crop yields are in bu/A for corn, barley, sorghum, wheat, and soybean; lb/A for cotton, rice, and peanut.

2 baseline yields taken from 1987 USDA/ERS report.

Taken from: Impacts of chemical use reduction on crop yields and costs. 1990. Smith et al., Texas A&M University

Source: IPNI.net
Conclusion

• Percent of yield attributable to fertilizer depends on many variables, but the generalization of 33 to 50% is probably sound

Source: IPNI.net
FARMING SUSTAINABLY

• 62 bu dryland spring wheat with no fertilizer?!? Possible?

• Background:
  • Burleigh county, ND
  • 16” rainfall zone
  • Average yield for region 35 bu (NASS 2010)