

Soil Health and Utilizing Cover Crops In Semi-Arid Regions

NAICC

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THE SAMUEL ROBERTS

NOBLE

FOUNDATION

Noble Foundation



Lloyd Noble (1896 – 1950)

**Founded The Samuel
Roberts Noble
Foundation on
September 19th, 1945.**

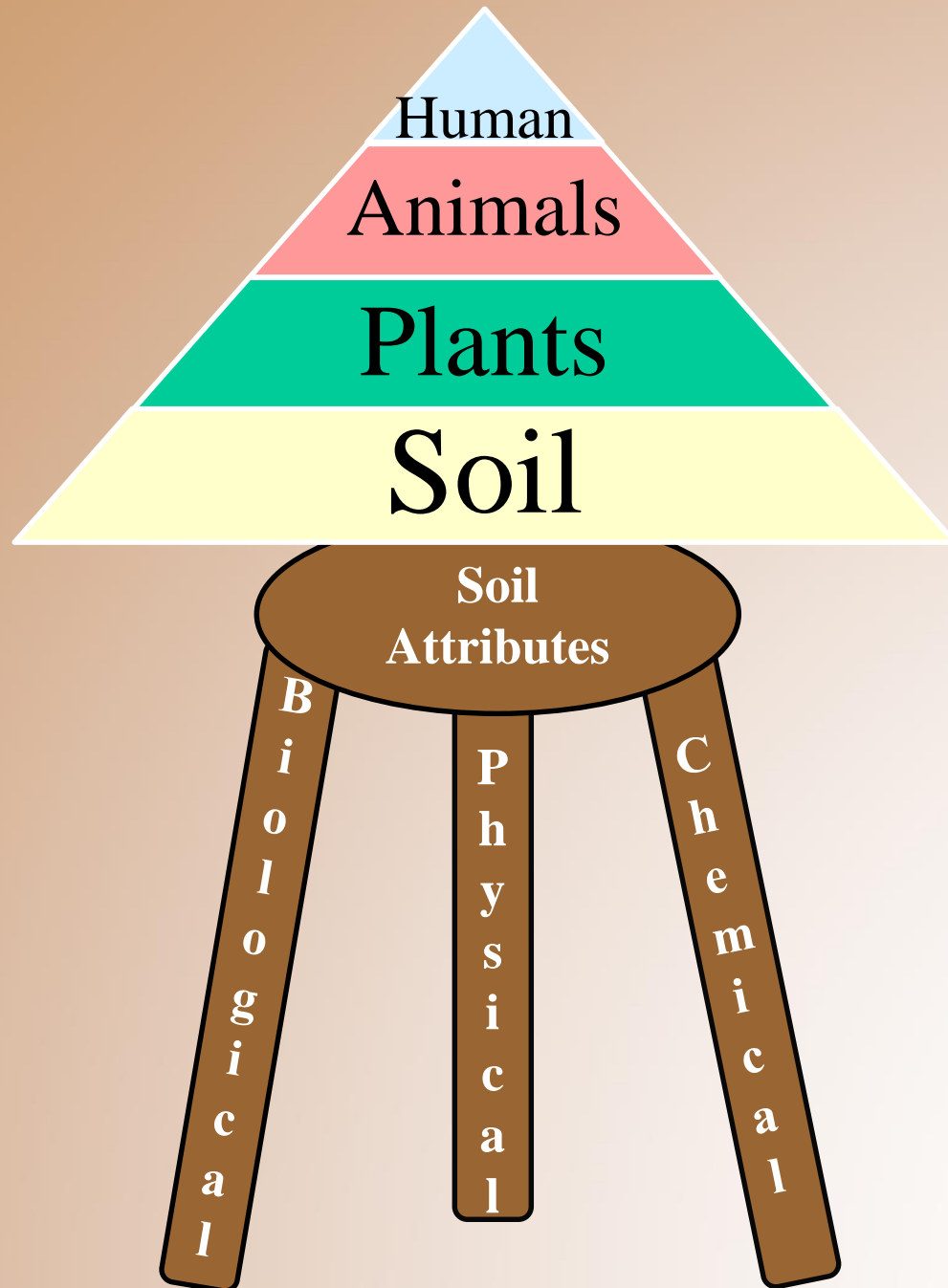
**His primary concern
was “the conservation
and improvement of soil
– our nation’s basic
resource”.**

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Soil Health

The continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.

USDA, NRCS



**“There can be no life without soil
and no soil without life;
they have evolved together.”**

Charles E. Kellogg

(1902-1980)

soil scientist



What is a Cover Crop

- A cover crop is a crop planted primarily **to manage soil fertility, soil quality, water, weeds, pests, diseases, biodiversity and wildlife** in an agroecosystem (Lu et al. 2000), an ecological system managed and largely shaped by humans across a range of intensities to produce food, feed, or fiber. Wikipedia http://en.wikipedia.org/wiki/Cover_crop
- A crop grown **for the protection and enrichment of the soil.**
http://www.oxforddictionaries.com/us/definition/american_english/cover-crop
- For insurance purposes, a cover crop is a crop generally recognized by agricultural experts as agronomically sound for the area **for erosion control or other purposes related to conservation or soil improvement.** USDA RMA
<http://www.rma.usda.gov/pubs/rme/covercrops.pdf>
- Cover crops are grasses, legumes, and other forbs that are planted for **erosion control, improving soil structure, moisture, and nutrient content, increasing beneficial soil biota, suppressing weeds, providing habitat for beneficial predatory insects, facilitating crop pollinators, providing wildlife habitat, and as forage for farm animals.** Furthermore, cover crops can provide energy savings both by **adding nitrogen to the soil and making more soil nutrients available**, thereby reducing the need to apply fertilizer. USDA NRCS
http://plants.usda.gov/about_cover_crops.html

Cover Crop

Something intentionally grown between crops for the benefit and improvement of the soil ecosystem and subsequent crops. A cover crop may or may not be multi-species and may or may not be grazed.

Jim Johnson

Ecosystem

An ecosystem includes all of the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere).

eschooltoday

Ecosystem

Wholes

Soil

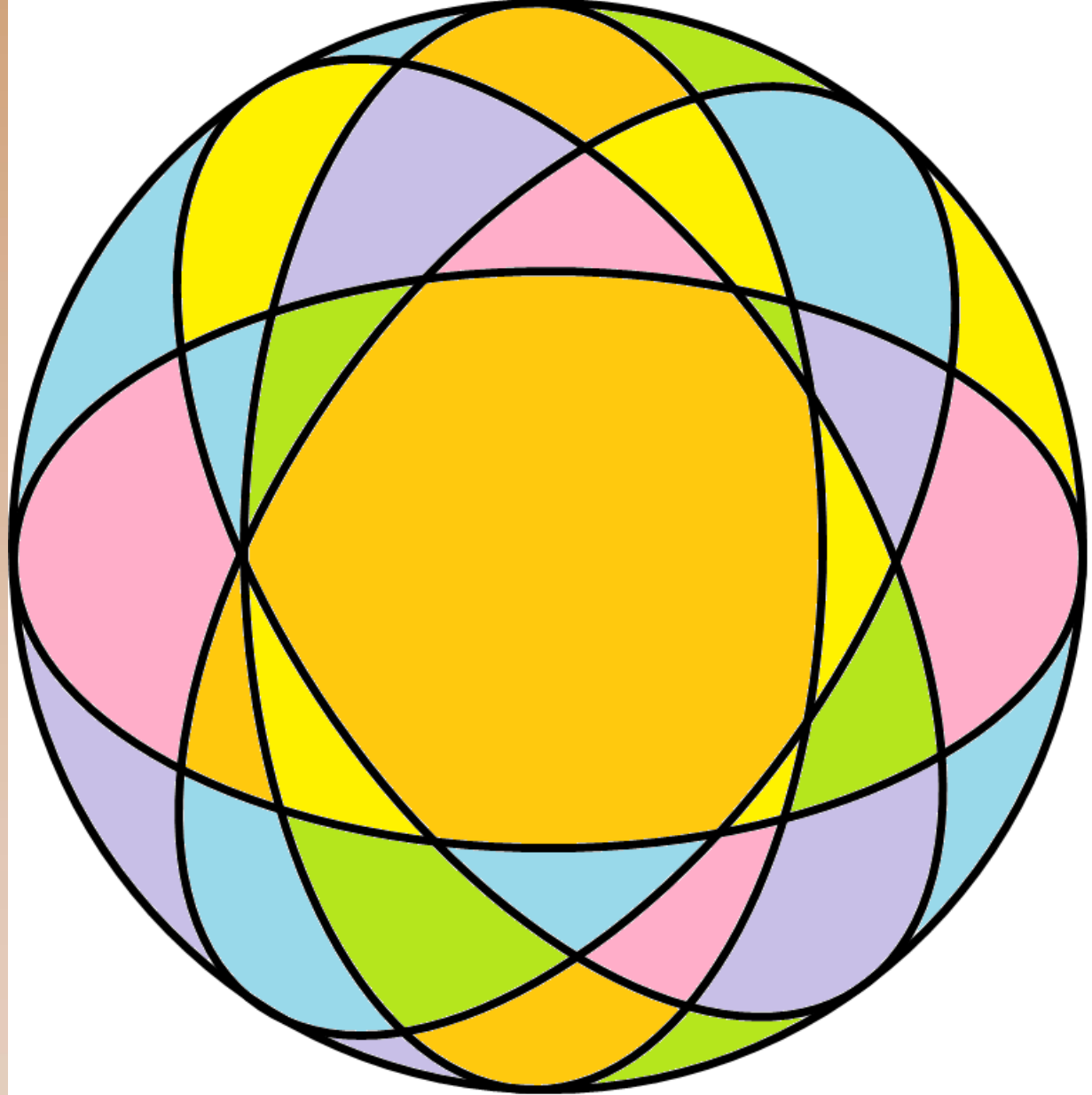
MOS

Plants

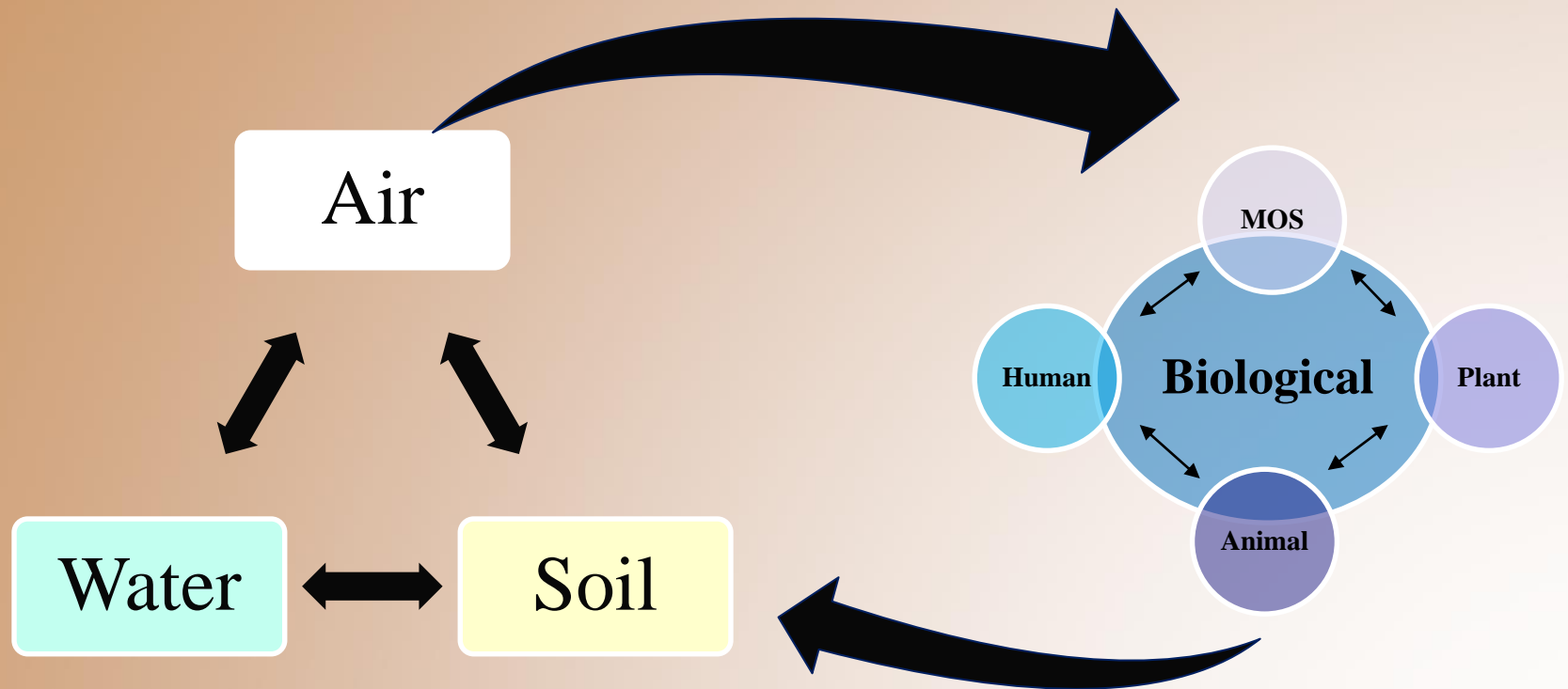
Animals

Air

Water



Soil Health = Ecosystem Health



Principles of Soil Health

Mimic Nature

- **Keep the soil surface covered**
- **Minimize soil disturbance**
- **Increase plant diversity**
- **Maximize days of root growth**
- **Increase livestock diversity**



Cover

- **Cover improves soil water relations**
 - prevents crust
 - holds moisture until it can soak in
 - reduces evaporation
- **Cover moderates soil temperature**
- **Cover suppresses weeds**
- **Cover provides food and shelter for MOS**

Minimize Soil Disturbance

- **Protects surface residue**
- **Protects MOS**
- **Preserves MOS food and habitat**
- **Conserves water**
- **Maintains or improves soil structure**
- **Reduces many weeds**

Increase Plant Diversity

- **Roots of different plants leak different substances**
- **Different plants provide habitat for beneficial micro and macro-organisms**
- **Some plants may be sinks for pests**
- **Different plants have different root structure**

Living Roots

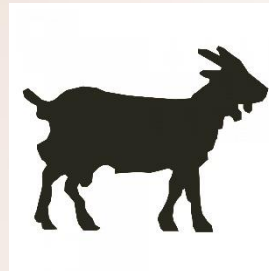
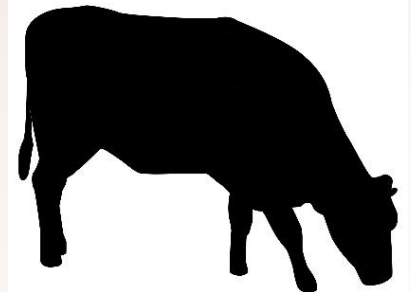
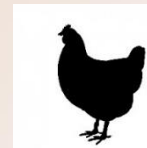
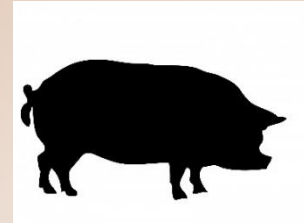
- **Roots leak sugars which build soil carbon and feed MOS**
- **Roots provide habitat for MOS**
- **Roots improve soil structure**
- **Roots aerate soil**
- **Roots grow plants**

Diverse Livestock

- **Takes advantage of “weeds”**
- **Helps control some pests**
- **Increases food for MOS**

Soil Health

- **Have proper soil fertility**
- **Don't till**
- **Manage traffic and surface disturbance**
- **Grow vigorous, well adapted plants**
- **Rotate crops**
- **Don't kill all the weeds**
- **Add diverse cover crops**



Why Cover Crops

Mimic Nature

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- **Maximize days of root growth**
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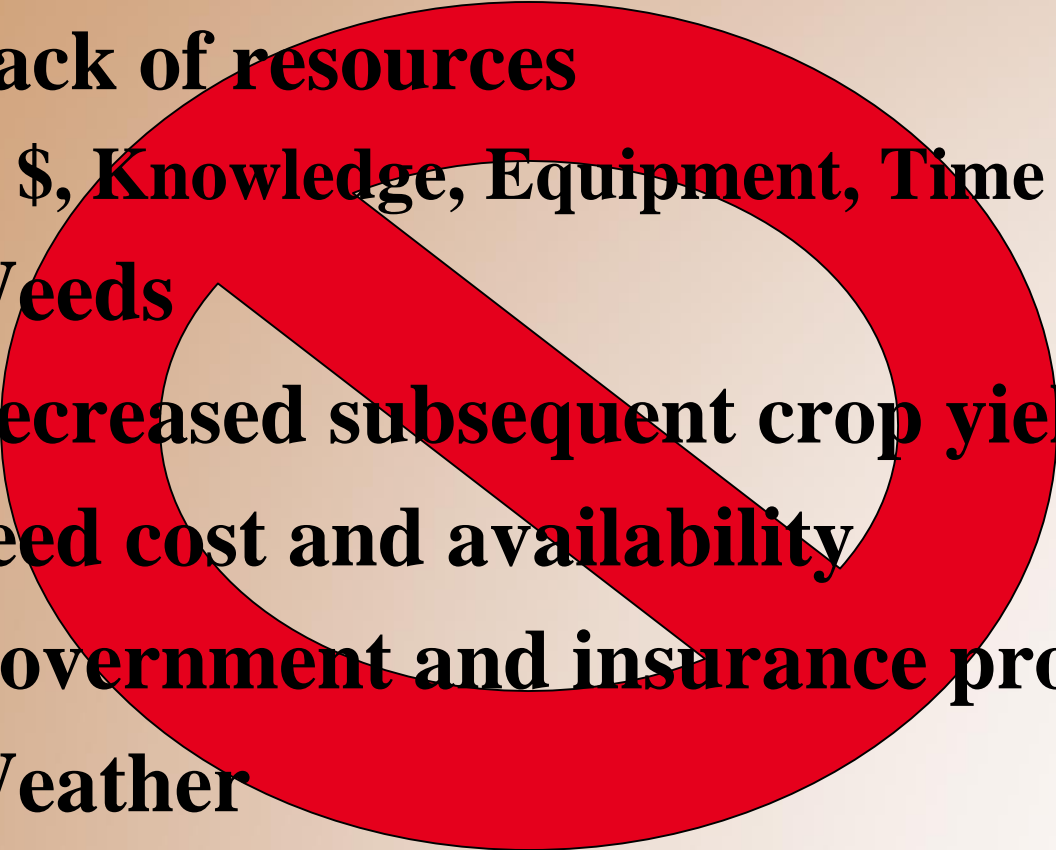
Mimic (Don't Fight) Nature

- **Think about your environment**
- **Covered soil surface**
 - plants and litter
- **Diverse plants**
 - cool and warm
 - grass and broadleaf
- **Diverse animals**
 - large and small
 - ruminant and non

Why Cover Crops

- **Smother or suppress weeds**
- **Erosion control**
- **Moderate soil temperature**
- **Break compaction**
- **Nutrient scavenging and recycling**
- **Food and shelter for beneficial organisms**
- **Improve water infiltration**

Why Not

- **Herbicide carryover**
 - **Lack of resources**
 - **\$, Knowledge, Equipment, Time**
 - **Weeds**
 - **Decreased subsequent crop yield**
 - **Seed cost and availability**
 - **Government and insurance programs**
 - **Weather**
 - **Teammates**
- 

Management Considerations

- **Goals**
- **Soils**
- **Existing vegetation and “seedbed” prep**
- **Planting equipment and calibration**
- **Pest control**
- **Planting date and seed rate**
- **Weather**
- **Seed availability and price**

Soil Considerations

- **Texture**
- **Depth**
- **Moisture**
- **Tillage**
- **Fertility**
 - N fixation, nutrient scavenging, P, K, pH
- **Problems**
 - salt, compaction



Cover Crop Fertilization

- **Depends on**
 - **soil test values**
 - **goal of the cover crop**
 - **previous crop and fertilizer applied**
 - **subsequent crop**
 - **species in the cover crop**

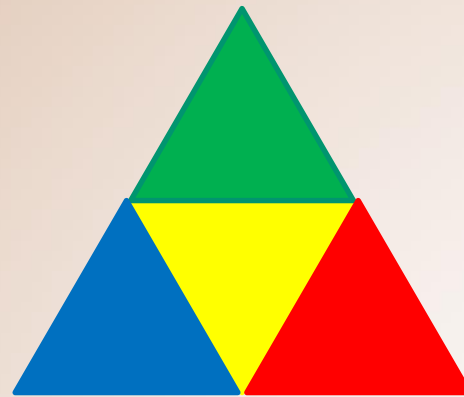
Seedbed Prep

- **In standing crop or stalks**
- **Baled or grazed residue**
- **Tilled, rolled or processed**
- **Herbicide, frost, senescence or fire**

Equipment

Planting single or multi-species cover crops

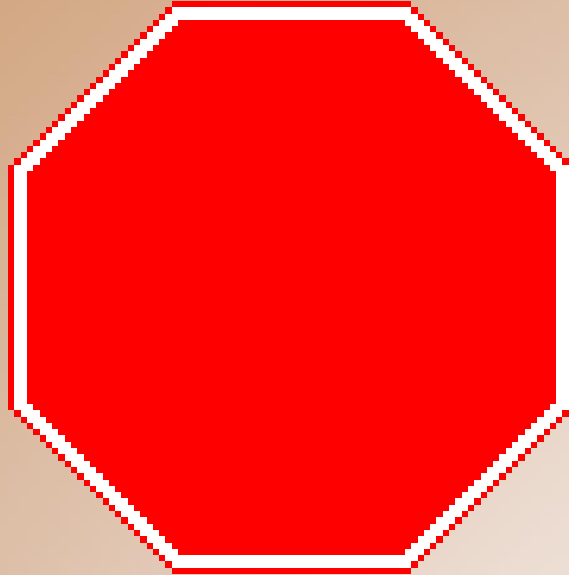
- **Box drill**
- **Air drill**
- **Planter**
- **Broadcast**



Planting next crop into cover crop

Pests

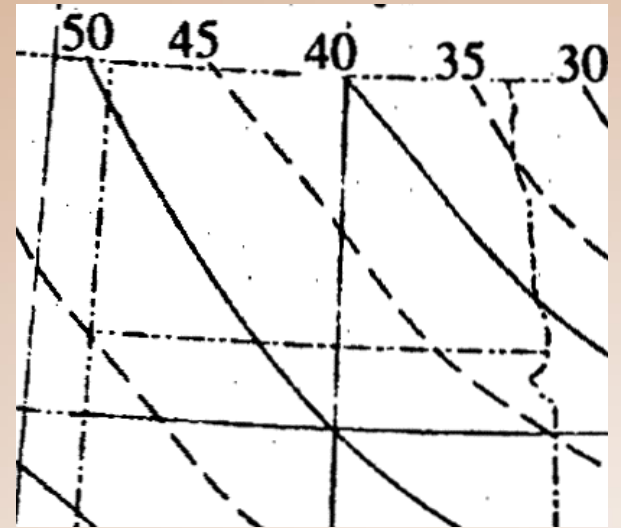
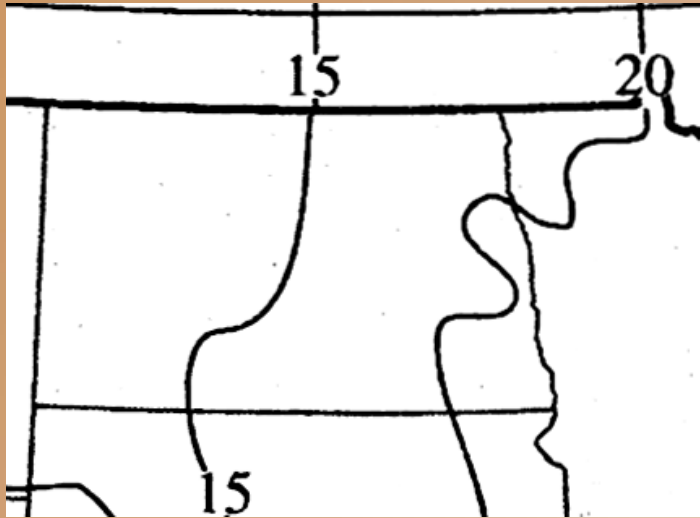
- **Pesticide**
- **Rotation**
- **Manage soil residue and disturbance**
- **Cover crop management**
 - **soil fertility**
 - **seed rate and date**
 - **species selection**
 - **germination date**



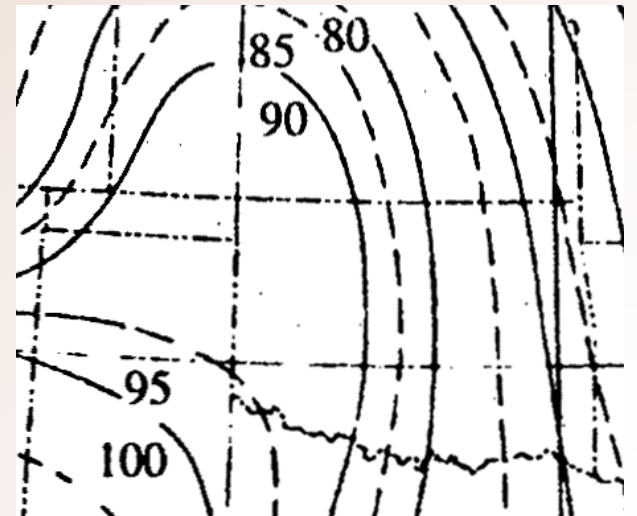
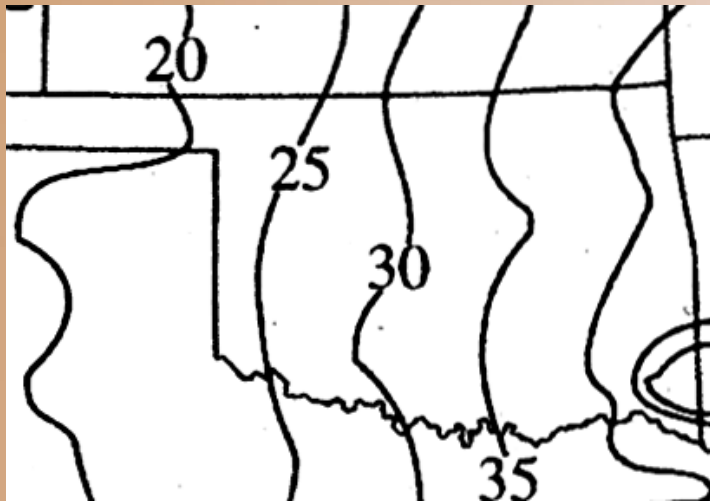
**ALWAYS READ AND
FOLLOW LABEL
DIRECTIONS**

Windows of Opportunity

- **Fall-spring between summer crops**
- **Summer between winter crops**
- **Transition from winter to summer crop or vice versa**
- **During rotation out of alfalfa**
- **As another crop in the rotation**



15, 33, 45, 81, 30, 48



What Plants to Use

- Warm season v Cool season
- Grass v Broadleaf
- Fibrous root v Tap root
- Tall v Short
- High C:N v Low C:N
- Legume v Broadleaf v Brassica
- Single species v Multi-species



NOT ONE SIZE FITS ALL!



Small Grains

- **Oats - heavy soil**
- **Triticale - “hybrid” vigor**
- **Rye - grows at lower temp, sandy soil, controls mareetail**
- **Wheat - many cultivars**
- **Barley - salty and high pH soil**

Grasses

- **Ryegrass - wet soil, low pH, ploidy**
- **Sorghums - PPS, various maturities and heights, nutrient scavenger**

Millets

- **Pearl - sandy soil**
- **Foxtail - responds to good environment**
- **Browntop - one of my favorites, seems broadly adapted, short season**
- **Proso - very short season**
- **Japanese - wet soil, barnyardgrass**

Legumes

- **Spring and Winter Peas - vigorous seedling growth**
- **Vetch - sandy soil, productive**
- **Cowpeas - heat and drought**
- **Mungbeans - short season, drought**
- **Guar - salt tolerant**
- **Sunnhemp - tough residue**

Clovers

**Crimson, Red, Sweet, Berseem, Persian,
Rose, Sub, Alsike, Arrowleaf, White,
Balansa**

Broadleaves

- **Buckwheat - short season**
- **Okra - loves heat, great roots**
- **Flax - mycorrhizal fungi**
- **Sunflower - fast growing**
- **Sugar beets - drought and heat once established**
- **Squash - drought tolerant**

Brassicas

- **Radish - nutrient scavenger**
- **Collards**
- **Turnips - cold tolerant**
- **Mustards - very short to very long season**

Easy to get too many brassicas





Add Legumes		Totals:		31%		8%		26%		\$ 6.10	
		Rates:	Full	Mix	Type	% Full Rate	% Wt	% Seeds	Seeds/lb	Cost/lb	Cost/Acre
✖	Yellow Clover: Yellow Swe ▾	i	10	3.13	CS-B	31%	8%	26%	174,200.00	\$ 1.95	\$ 6.10
Add Grasses		Totals:		31%		80%		33%		\$ 6.88	
		Rates:	Full	Mix	Type	% Full Rate	% Wt	% Seeds	Seeds/lb	Cost/lb	Cost/Acre
✖	Cereal Rye: Elbon 80.5 ▾	i	100	31.25	CS-G	31%	80%	33%	22,150.00	\$ 0.22	\$ 6.88
Add Brassicas		Totals:		31%		8%		27%		\$ 8.61	
		Rates:	Full	Mix	Type	% Full Rate	% Wt	% Seeds	Seeds/lb	Cost/lb	Cost/Acre
✖	African Cabbage: VNS 69 ▾	i	10	3.13	CS-B	31%	8%	27%	180,000.00	\$ 2.75	\$ 8.61
Add Broadleaves		Totals:		31%		4%		15%		\$ 7.02	
		Rates:	Full	Mix	Type	% Full Rate	% Wt	% Seeds	Seeds/lb	Cost/lb	Cost/Acre
✖	Plantain-"Boston" 65.5 ▾	i	5	1.56	CS-B	31%	4%	15%	200,000.00	\$ 4.50	\$ 7.02

Supplemental Grazing



Mycorrhizal Fungi Growth



Increase Soil Organic Matter



Summary

Pounds/Acre: 39.07
Seeds/Acre: 2,112,833.50
Species: 4.00
Total Pounds: 78,804.19



New!

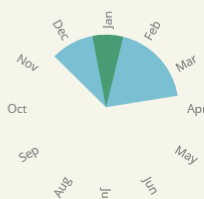
☒ Enable SmartMix Auto Adjust

2017 Acres

	Pound	Acre	Total
Seed Cost	\$ 0.73	\$ 28.61	\$ 57,698.30
Inoculant Cost	\$ 0.025	\$ 0.98	\$ 1,970.10
Mixing Cost	\$ 0.03	\$ 1.17	\$ 2,364.13
Bagging Cost	\$ 0.00	\$ 0.00	\$ 0.00
Total Cost	\$ 0.79	\$ 30.75	\$ 62,032.53

Growing Period

Start: 12/19/2016
End: 01/13/2017
Duration: 25 days
GDD: 33 GDD (base 50)
 147 GDD (base 40)



Region

Zip Code: 73401
 PHZ: 7b
 Frost Free: 03/22 - 11/14
 Projected Precip: 1.82"
 Avg. Annual Precip: 37.67"

Seed Cost

• Browntop Millet	16#	\$11.20
• Flax	32#	\$17.60
• Brown Mustard	8#	\$18.00
• Oat	75#	\$19.50
• Crimson Clover	16#	\$24.00
• Radish	9#	\$24.75
• Cowpea	54#	\$45.90
• Chicory	13#	\$58.50

How Do Cover Crops Make \$\$

- **Fertilizer savings**
- **Reduced pesticide in subsequent crop**
- **Yield bump in subsequent crop**
- **Saves topsoil from leaving**
- **Labor savings**
- **NRCS program payments**
- **Grazing**
- **Bees**



Questions



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"No civilization has outlived
the usefulness of its soils.
When the soil is destroyed,
the nation is gone."

Lloyd Noble
(1896-1950)
oilman, philanthropist



Healthier Soil

- **Improved water relations**
- **Temperature moderation**
- **↑ OM**
- **↑ Nutrient Cycling**
- **↓ Erosion**
- **↓ Compaction**



Cycles

