

Building Soil Biology with Rotations



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Soil Biology

- Abundance
 - How much and how active?
- Complexity
 - Nutrient cycling
 - Soil aggregate formation
 - Pest cycles
 - Decomposition rates

Complexity comes from FOOD SOURCE

Table 1. Carbon to nitrogen ratios of crop residues and other organic materials

Material	C:N Ratio
rye straw	82:1
wheat straw	80:1
oat straw	70:1
corn stover	57:1
rye cover crop (anthesis)	37:1
pea straw	29:1
rye cover crop (vegetative)	26:1
mature alfalfa hay	25:1
Ideal Microbial Diet	24:1
rotted barnyard manure	20:1
legume hay	17:1
beef manure	17:1
young alfalfa hay	13:1
hairy vetch cover crop	11:1
soil microbes (average)	8:1



↑
slower

Relative
Decomposition
Rate

↓
faster



(NRCS, 2011)



Cover Crop Chart

AREA
4
SCD

GROWTH CYCLE	
A	= Annual
B	= Biennial
P	= Perennial

RELATIVE WATER USE	
☾	= Low
💧	= Medium
💧💧	= High

PLANT ARCHITECTURE	
↯	= Upright
* *	= Upright-Spreading
~~~~	= Prostrate

-----Cool Season----- Warm Season-----

---Grass---								---Grass---									
A	<u>Barley</u>			-----Broadleaf-----						A	<u>Pearl millet</u>						
A	<u>Oat</u>	A	<u>Phacelia</u>					A	<u>Amaranth</u>	A	<u>Foxtail millet</u>						
A/P	<u>Ryegrass</u>	A	<u>Flax</u>	-----Legumes-----				A	<u>Buckwheat</u>	A	<u>Proso millet</u>						
A	<u>Wheat</u>	A	<u>Spinach</u>	B	<u>Turnip</u>	A	<u>Field pea</u>	A	<u>Berseem clover</u>	A/P	<u>Medic</u>	A	<u>Chickpea</u>	A	<u>Sunflower</u>	A	<u>Sudan grass</u>
A	<u>Cereal rye</u>	A	<u>Kale</u>	A	<u>Radish</u>	A	<u>Lentil</u>	B/P	<u>Red clover</u>	P	<u>Birdsfoot trefoil</u>	A	<u>Cowpea</u>	A	<u>Safflower</u>	A	<u>Teff</u>
A	<u>Triticale</u>	A/B	<u>Canola</u>	B	<u>Beet</u>	A	<u>Lupin</u>	P	<u>White clover</u>	P	<u>Sainfoin</u>	A	<u>Soybean</u>	A	<u>Squash</u>	A	<u>Grain sorghum</u>
A	<u>Annual fescue</u>	A/P	<u>Mustard</u>	A/B	<u>Carrot</u>	A/B	<u>Vetch</u>	A/B	<u>Sweetclover</u>	P	<u>Alfalfa</u>	A	<u>Mung bean</u>	P	<u>Chicory</u>	A	<u>Corn</u>

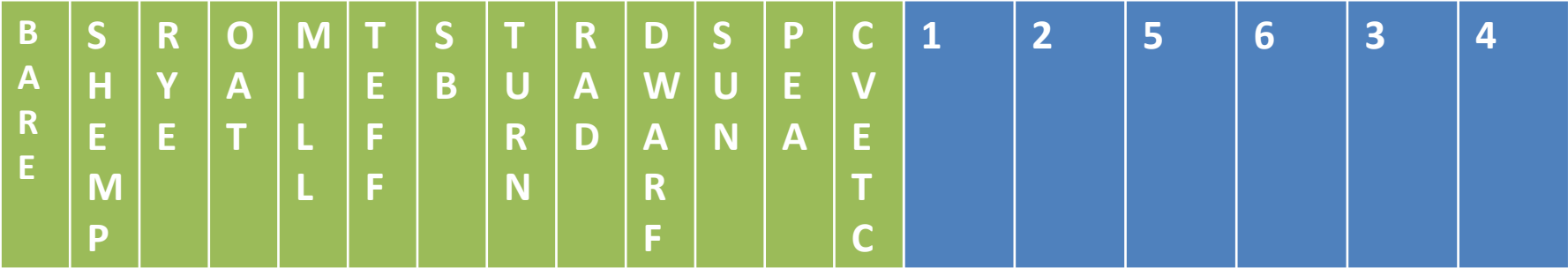
	<b>CORN</b>	<b>SOYBEAN</b>	<b>WHEAT</b>	<b>SUNFLOWER</b>
STALK/STEM	11-65	39	31-65	41-46
LEAF	13-20	14	15-29	11-14
ROOT	20-49	34	24-74	50-68
STRAW	57		80-95	14-19

	<b>C:N</b>
BEET	11-14
VETCH	10-19
FIELD PEA	13-27
RED CLOVER	15-23
RADISH	19-20
TURNIP	SIMILAR TO RADISH
ANNUAL RYE	14-40
CEREAL RYE	40-48
SUDAN GRASS	48-63

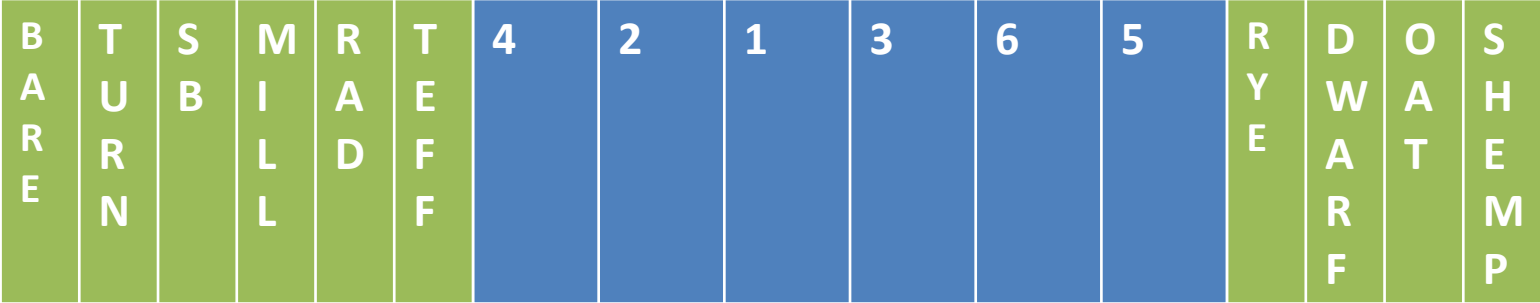
# Cover Crop Study (Dwight, ND)



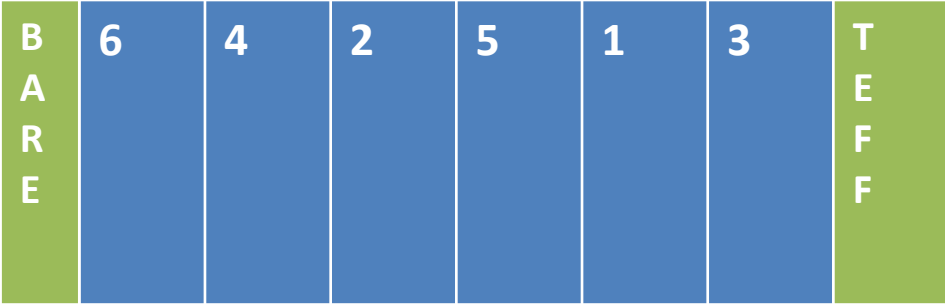
REP 1



REP 2



REP 3



BROADCAST: JULY 14  
4 WEEKS NO RAIN







## MIX 1

Cereal Rye (81%)  
Annual Rye (13%)  
Radish (4%)  
Turnip (2%)

\$28/acre



OCT. 7



NOV. 19

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OCT. 7



NOV. 19





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OCT. 7



NOV. 19









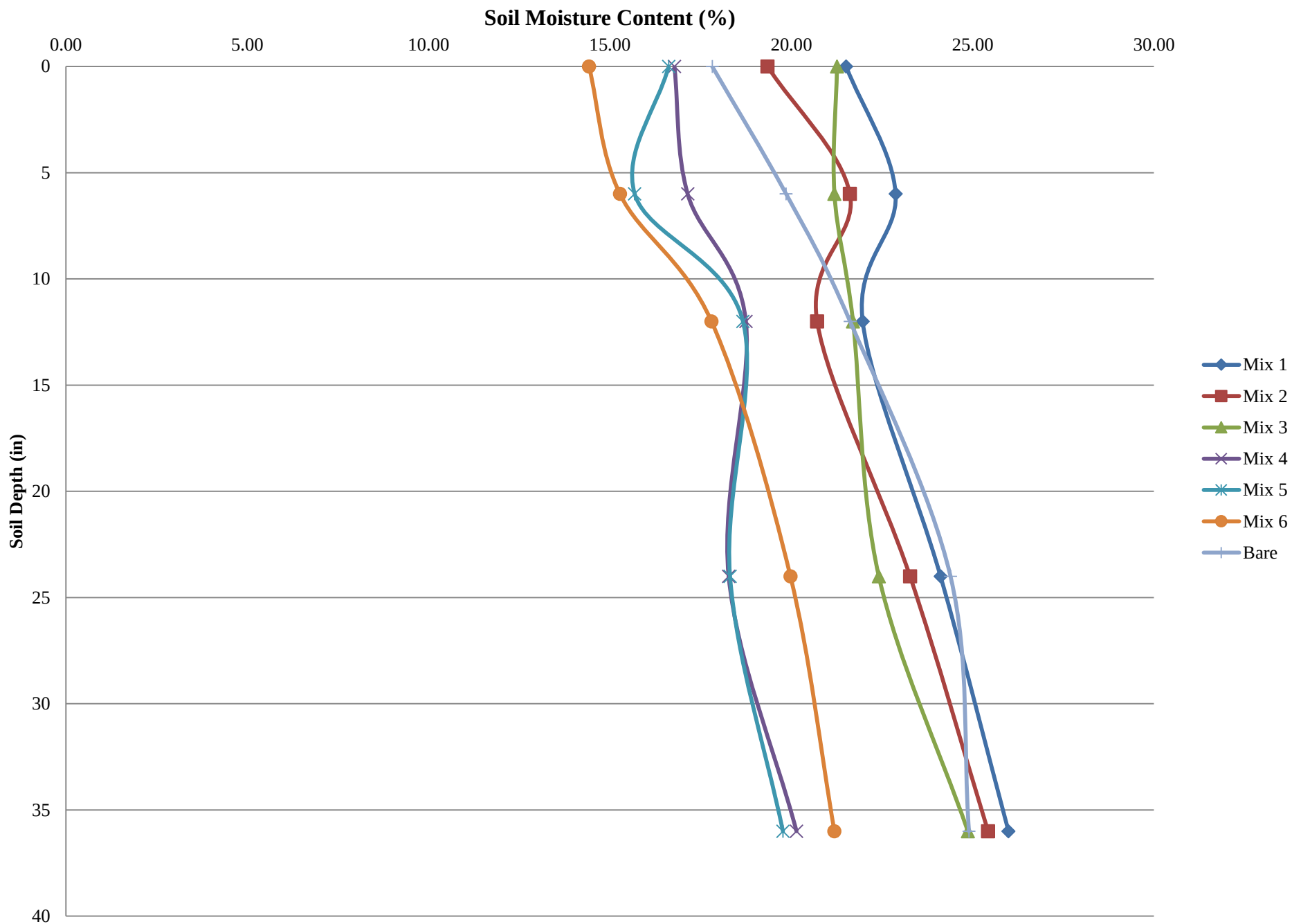


Aug. 14

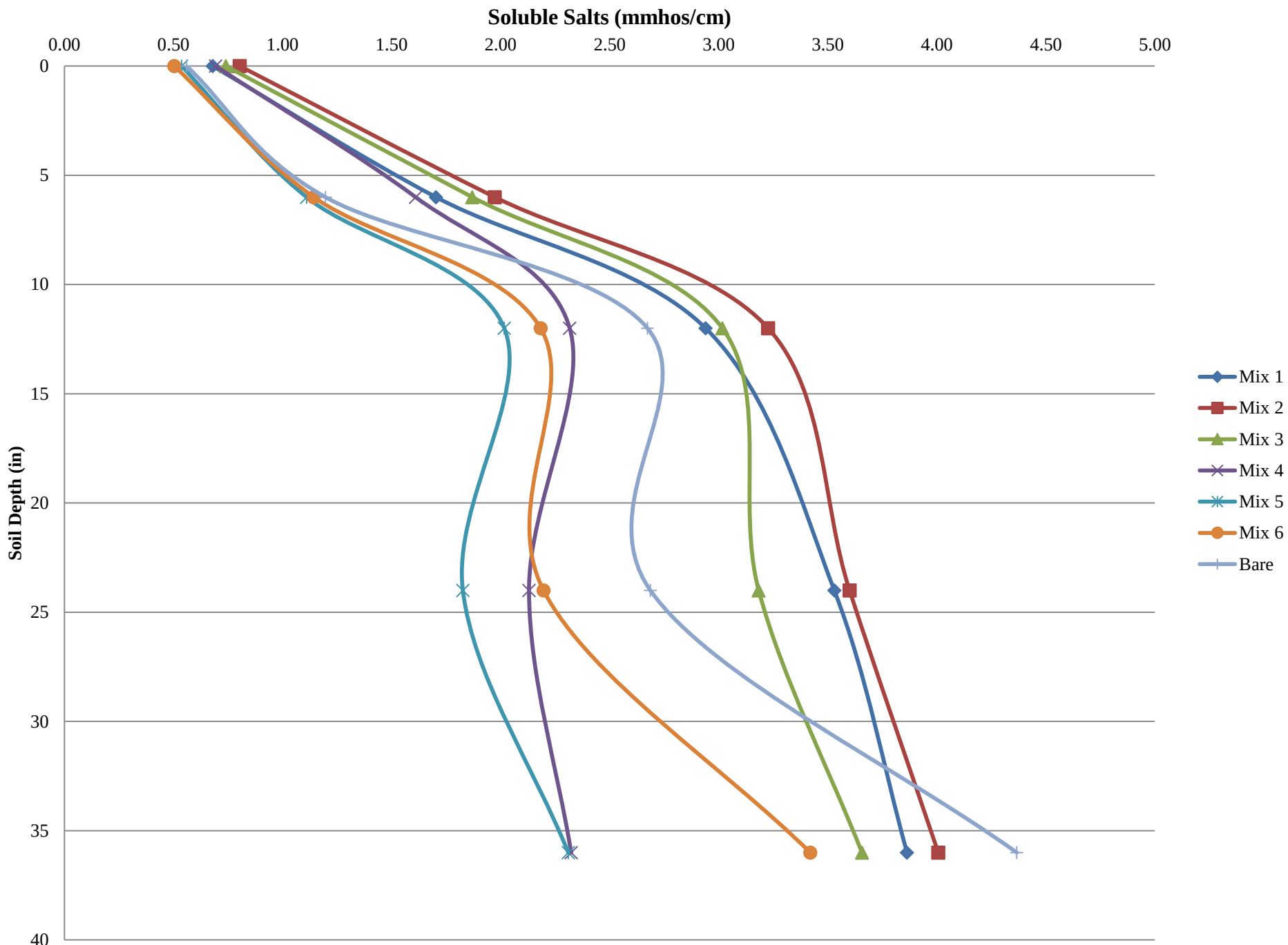


Oct. 21

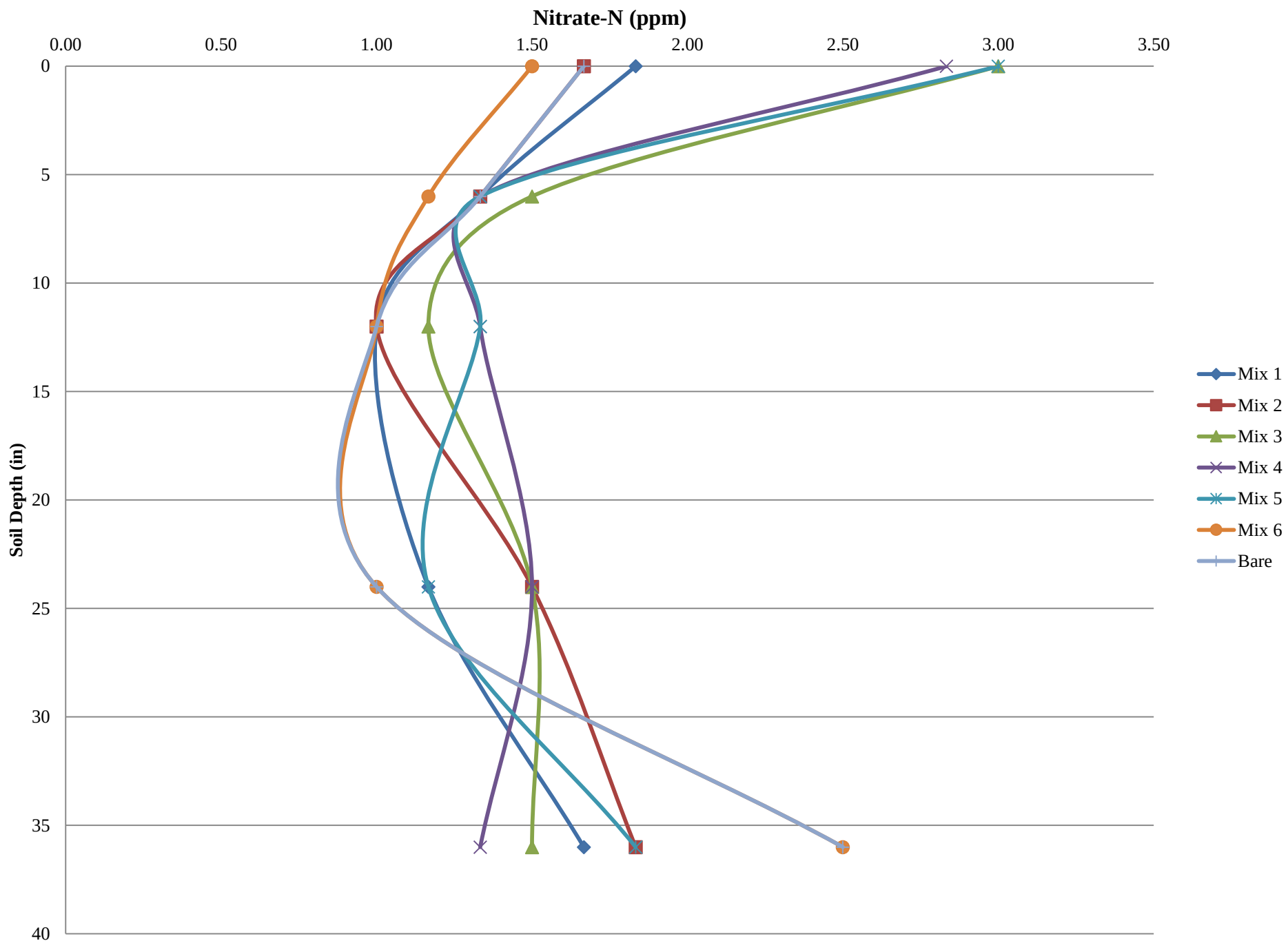














MIX	AVG OM%	AVG SOLVITA (microbial activity)
1	5.2	97.0
2	4.9	83.9
3	4.8	69.7
4	5.1	83.9
5	5.0	74.1
6	4.9	67.7

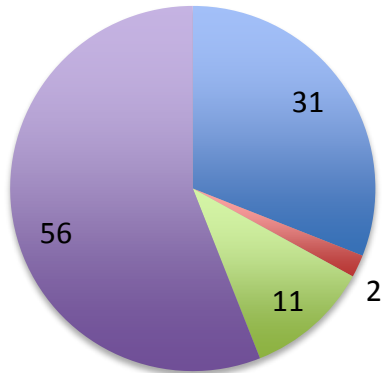
*0-6" depth



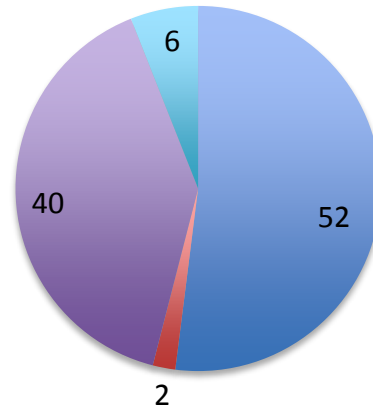


# Swap BRASSICAS: Radish/Turnip for Dwarf/Sugarbeet

**Mix 1 (% species)**

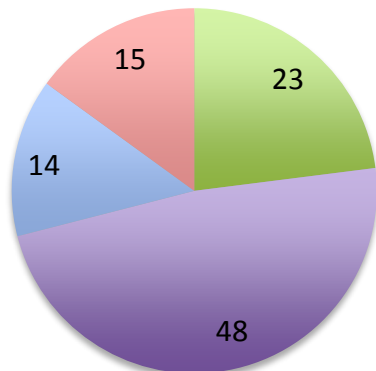


**Mix 2 (% species)**

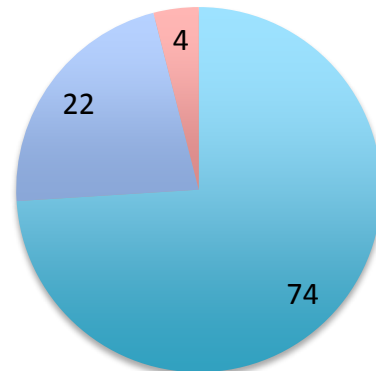


# Swap GRASSES: Annual/Cereal Rye for Oats/Triticale

**Mix 3 (% species)**



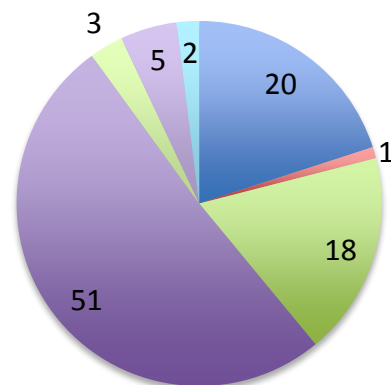
**Mix 4 (% species)**





# ADD DIVERSITY to BASE MIXES: Sunflower, Winter Pea, Flax

**Mix 5 (% species)**



Annual Rye

Cereal Rye

Radish

Turnip

Dwarf Essex

Sugarbeet

Oats

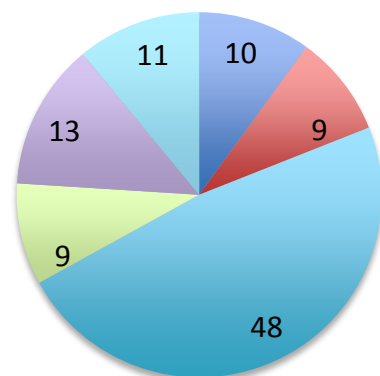
Triticale

Sunflower

Winter Pea

Flax

**Mix 6 (% species)**





LIVING ROOTS BUILD SOIL BIOLOGY!







KEEPING SOIL IN PLACE BUILDS SOIL BIOLOGY!



