Wisconsin
Department of Natural Resources

Tillage, Cropping and Manure Hot Topics

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Tillage by Definition

- Snap Plus has settings for many of the most common tillage types
- Definitions include number of passes, equipment considerations and timing
- If you do not fit in one of these published criteria, email support@snapplus.wisc.edu and one can be found with closest stir value equivalent

Tillage Considerations:

Tillage information 8

Tillages should be entered by **cropping year,** not calendar year. See the Let's talk cropping years section on page 6 for an explanation & examples.

SnapPlus tillage codes and explanations

SnapPlus uses the most soil-disturbing tillage option selected in the RUSLE2 database for each primary tillage category. If you meet "T" with SnapPlus, then you are protecting the field from excess soil erosion. Fall and spring chisel and moldboard options listed include multiple tillage passes.

increasing soil disturbance value

Code	Tillage	RUSLE2 operations (assumptions for soil loss calculations)
NTg	No-till green	No soil disturbance except for planter using a double-disk opener and fluted coulter. Spray operation kills previous cover crop the day before planting.
NT	No-till	No soil disturbance except for planter using a double-disk opener and fluted coulter.
ST	Strip-till	No soil disturbance except for 30% of the surface at planting with a strip-till planter.
SVT 1-pass	Spring vertical tillage	Spring pass using a seedbed conditioner with a double gang coulter caddy, rotary harrow, and rolling basket incorporator.
FFC 1-pass	Fall cultivation	One field cultivation in the fall with no spring tillage. Use for fall one-pass systems.
SFC 1-pass	Spring cultivation	One field cultivation before planting, use for most 1-pass systems.
FVT 2-pass	Fall vertical tillage	Fall pass plus a spring pass with same seedbed conditioner: double gang coulter caddy, rotary harrow, and rolling basket incorporator.
FCND 2-pass	Fall chisel, no disk	Fall chisel plowing (twisted shovel) and field cultivation before planting.
SCND 2-pass	Spring chisel, no disk	Spring chisel plowing (twisted shovel) and field cultivation before planting.
FCD 3-pass	Fall chisel, disked	Fall chisel plowing (twisted shovel) with spring disking (tandem) and field cultivation before planting.
SCD 3-pass	Spring chisel, disked	Spring chisel plowing (twisted shovel) followed by disking (tandem) and field cultivation before planting.
FP 3-pass	Fall moldboard plow	Fall moldboard plowing with spring disking (tandem) and field cultivation before planting.
SP 3-pass	Spring moldboard plow	Spring moldboard plowing followed by disking (tandem) and field cultivation before planting.

Note: Not all tillage options are used for all crops in SnapPlus because some crops are not typically grown with the full range of tillage systems.

Cropping Considerations

- What year is the crop to be classified in Snap Plus?
  - The year the crop is to be harvested in would be the correct year to be entered into snap plus!

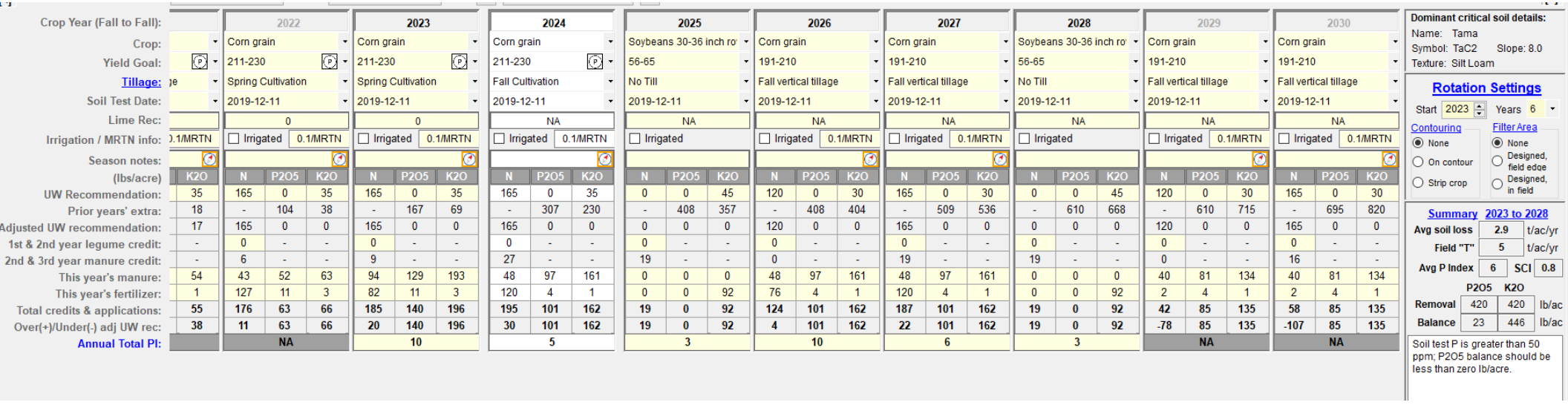
  Ex: Winter Wheat harvested in 2024 is considered a 2024 crop in Snap Plus, Fall Seeding after wheat with nothing harvested until 2025 would be a Fall Seeding under 2025 crop year

- Manure & Fertilizer goes on the crop year for the yield it is fertilizing

  Ex: Fall planted Alfalfa in 2023, manured prior to planting. First crop to be taken off in 2024. Manure would be considered "Fall" applied for 2024 crop year, and Alfalfa would be considered a Fall Seeding for the 2024 crop year in Snap Plus.

Cropping Considerations

- Importance of complete rotation for the following to run accurately: Soil Loss (T), Phosphorus (PI or Soil Test P), Nutrient Budgets
  - *P/K Based on cumulative amount needed in the rotation



Crop Year (Fall to Fall):		2022			2023			2024			2025			2026			2027			2028			2029			2030		
Crop:		Corn grain			Corn grain			Corn grain			Soybeans 30-36 inch ro			Corn grain			Corn grain			Soybeans 30-36 inch ro			Corn grain			Corn grain		
Yield Goal:		211-230			211-230			211-230			56-65			191-210			191-210			56-65			191-210			191-210		
Tillage:		Spring Cultivation			Spring Cultivation			Fall Cultivation			No Till			Fall vertical tillage			Fall vertical tillage			No Till			Fall vertical tillage			Fall vertical tillage		
Soil Test Date:		2019-12-11			2019-12-11			2019-12-11			2019-12-11			2019-12-11			2019-12-11			2019-12-11			2019-12-11			2019-12-11		
Lime Rec:		0			0			NA			NA			NA			NA			NA			NA			NA		
Irrigation / MRTN info:		Irrigated 0.1/MRTN			Irrigated 0.1/MRTN			Irrigated 0.1/MRTN			Irrigated			Irrigated 0.1/MRTN			Irrigated 0.1/MRTN			Irrigated			Irrigated 0.1/MRTN			Irrigated 0.1/MRTN		
Season notes:																												
(lbs/acre)	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
UW Recommendation:	35	165	0	35	165	0	35	165	0	35	0	0	45	120	0	30	165	0	30	0	0	45	120	0	30	165	0	30
Prior years' extra:	18	-	104	38	-	167	69	-	307	230	-	408	357	-	408	404	-	509	536	-	610	668	-	610	715	-	695	820
Adjusted UW recommendation:	17	165	0	0	165	0	0	165	0	0	0	0	0	120	0	0	165	0	0	0	0	0	120	0	0	165	0	0
1st & 2nd year legume credit:	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
2nd & 3rd year manure credit:	-	6	-	-	9	-	-	27	-	-	19	-	-	0	-	-	19	-	-	19	-	-	0	-	-	16	-	-
This year's manure:	54	43	52	63	94	129	193	48	97	161	0	0	0	48	97	161	48	97	161	0	0	0	40	81	134	40	81	134
This year's fertilizer:	1	127	11	3	82	11	3	120	4	1	0	0	92	76	4	1	120	4	1	0	0	92	2	4	1	2	4	1
Total credits & applications:	55	176	63	66	185	140	196	195	101	162	19	0	92	124	101	162	187	101	162	19	0	92	42	85	135	58	85	135
Over(+)/Under(-) adj UW rec:	38	11	63	66	20	140	196	30	101	162	19	0	92	4	101	162	22	101	162	19	0	92	-78	85	135	-107	85	135
Annual Total PI:		NA			10			5			3			10			6			3			NA			NA		

Dominant critical soil details:
Name: Tama
Symbol: TaC2 Slope: 8.0
Texture: Silt Loam

Rotation Settings
Start 2023 Years 6

Contouring: None / On contour / Strip crop
Filter Area: None / Designed, field edge / Designed, in field

Summary 2023 to 2028

Avg soil loss	2.9	t/ac/yr
Field "T"	5	t/ac/yr
Avg P Index	6	SCI 0.8

	P2O5	K2O	
Removal	420	420	lb/ac
Balance	23	446	lb/ac

Soil test P is greater than 50 ppm; P2O5 balance should be less than zero lb/acre.

Manure Application Trends

- 360 Rain: Delivering bands of water or manure directly to base of plant through Y drop style hoses

https://youtu.be/11TbY4lpX1E

Manure Application Trends

- LDMI-Low Disturbance Manure Injection
  - *Applies the manure below the surface of the soil and minimizes the soil surface area disturbed. This method also minimizes the depth and degree of soil disturbance and fracturing below the surface.*

More on LDMI Specifications can be found here (WI 590 Guidance Document):

https://efotg.sc.egov.usda.gov/api/CPSFile/43027/590_WI_GD_Nutrient_Management_Low-Disturbance-Manure-Injection_2023

LDMI: WI NMP 590 Guidance Document

Low Disturbance Manure Injection

Wisconsin Nutrient Management (590) Guidance Document

Introduction and Background

In the development of a conservation plan and a nutrient management plan for a farming operation that applies manure we need to account the impact of the manure application on the resource concerns.

- **Surface application** of manure minimizes the tillage, reducing the erosion potential and the breakdown of soil organic matter. However, it increases the risk of ammonia volatilization and of odor release. In a heavy rainstorm causing significant runoff, surface application creates a high risk of manure runoff which can contaminate surface water.
- **Incorporation** of surface applied manure using tillage reduces ammonia volatilization and odor release. The risk of runoff is reduced and the soil contact will immobilize phosphorus in most soils. However, the increased tillage can increase the erosion delivering more total P to surface water.
- **Injection** of liquid manure products reduces ammonia volatilization and odor release even more than most incorporation systems. The amount of soil disturbance varies greatly depending on the aggressiveness of the implement, the depth, the soil conditions, and the speed. However, injection can be designed to minimize soil disturbance and the subsequent increased risk of soil erosion and organic matter breakdown.

Low Disturbance Manure Injection (LDMI) equipment – alternatively called Low Disturbance Manure Application (LDMA) equipment – are manure injection implements developed by industry to:

- apply the liquid manure below the surface of the soil while
- minimizing the soil surface area disturbed and
- minimizing the depth and degree of soil disturbance and fracturing below the surface.

How effective they are at doing this depends on the design, the adjustments made to the implement, the speed of application, and the soil conditions.

It is important to note that even a well designed injection implement can cause extensive soil disturbance depending on how it is used. In the end *"low disturbance" is the result in the field. It is not the implement itself.*

Criteria for Low Disturbance Manure Injection (LDMI)[i]

To meet the definition of LDMI meet all five of the following criteria.

☐ **No more than 30% of the soil surface is disturbed across the operational width of the equipment.**
- This includes soil removed from the tilled zone and "splashed" onto the untilled zone.

☐ **Inject to a subsurface depth of approximately 4" and no more than 6".**
- This avoids placing manure too deep – beyond the optimal crop rooting depth – and minimizes the amount of soil disturbed.

☐ **Minimal manure is present or visible on the soil surface after the pass is complete.**
- Adjust manure injection rates so that the manure is placed below the soil surface.

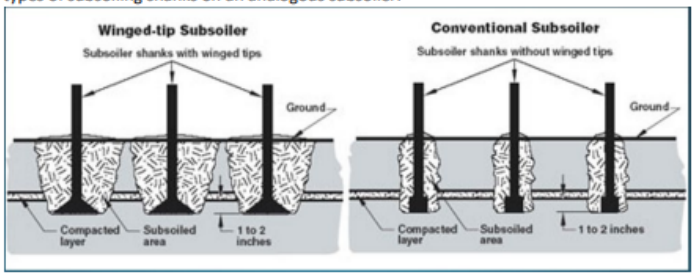
☐ **After application, no additional tillage passes are needed to level a field prior to planting the next crop including a cover crop.**

☐ **Implement a Nutrient Management (590) plan. Design the manure application source, rate, placement, and timing to meet 590 criteria.**

LDMI Operational and Equipment Configuration Factors

Below are some LDMI implement design and setup considerations to manage the amount of disturbance during injection.

- Injection tips, chisel points, sweeps or rolling points may contribute to more soil lifting and fracturing. Don't use injectors with subsoiling shanks. The deep knife and blade/tip depths lift and fracture large volumes of soil. The figure below demonstrates the soil disturbing impact of two types of subsoiling shanks on an analogous subsoiler.



- Single disk blades that create an offset slice tend to disturb less soil.
- Closing blades ideally just skim the soil surface to re-direct loose soil clods back over the disturbed injection slot and minimize the soil splash. They minimally disturb the soil.
- Wide row, 30" on center, units tend to disturb the lowest percent of the operational width of the equipment. Narrow row, 9" to 15", results in a higher percentage of soil disturbance.
- Some LDMI implements use flat disc blades that run straight. These are often used in sod or similar fields and often result in very low disturbance.
- Heavy construction-style disk units often use concave, scalloped disc blades and are designed for full-width disturbance and manure incorporation. These cause high disturbance.
- The slower you go and the less deep the injection knife the less the disturbance.

"Certifying" Low Disturbance Manure Injection (LDMI) Equipment

NRCS does not "certify" any specific LDMI implement. We did this in the past, but field observations demonstrated that "low disturbance" depended not just on well-designed implements, but also the angle the closing blades were set, the depth of soil disturbance and injection, the speed of application, soil texture, soil moisture, and gallons injected. These application variables make certification of an implement impossible.

[i] This LDMI criteria is designed to estimate a Soil Tillage Intensity Rating (STIR) of ≤15. Over the next years we will test this estimate. Separately, watch for guidance on how to assess the STIR.

More about LDMI:

- Criteria for LDMI:
  - ❑ No more than 30% of the soil surface is disturbed across the operational width of the equipment
  - ❑ Inject to a subsurface depth of approximately 4” and not more than 6”
  - ❑ Minimal manure is present on the soil surface after pass is complete
  - ❑ After application, no additional tillage passes are needed to level field prior to planting the next crop/cover crop.

Manure rate and classification:

- Make sure manure rate and application method line up

  Ex-injection rates

- Update Snap Plus as new things come up or lead to changes in planned applications

  Ex- Turned over established cover crop in fall, should potentially be removed from snap plus then

Contact Information

- CAFO NMP Questions
  - Aaron O'Rourke- CAFO Nutrient Management Coordinator (Aaron.Orourke@Wisconsin.gov)
    - 715-214-5503
  - Ashley Scheel- CAFO Nutrient Management Plan Reviewer (Ashley.Scheel@Wisconsin.gov)
    - 608-212-8460
- CAFO Permit Intake/Substantial Revision/ePermitting questions
  - Falon French- CAFO Intake Specialist
    - (Falon.French@Wisconsin.gov)
    - 608-228-5265

Questions??