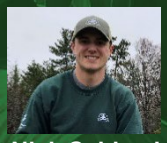
Agronomy **Weekly Update**

October 25th, 2021



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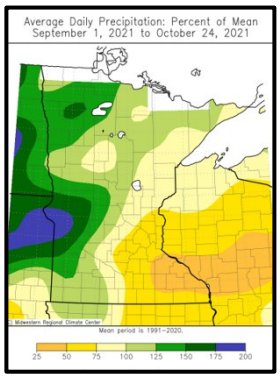
Field Update- Fall Volunteers and Moisture Tracking

Tremendous harvest progress has been made over the last month throughout the region! Currently, Minnesota is under 5% remaining soybean acres to be harvested and <30% of corn acres. The continued mild conditions along with sporadic rainfall has resulted in volunteer corn and soybean to start growing already in early harvested fields or fields with hail/wind damage. The volunteers may be unsightly this fall, but will terminate during the winter which will leave less volunteers to control next season.

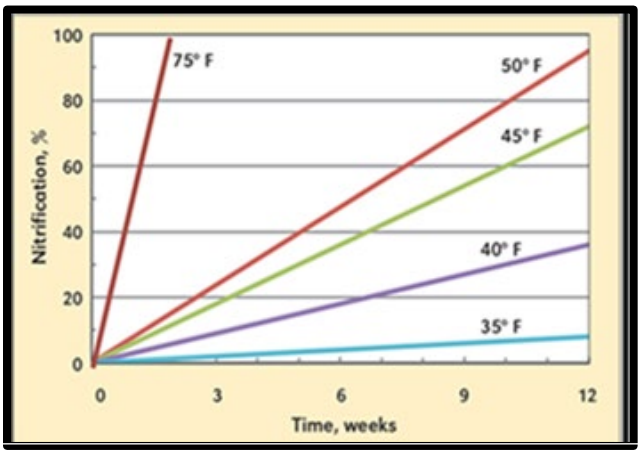


The first 28°F frost occurred last week for most of central MN and marks the end of the growing season. The extended above average temperatures this fall allowed for one of the longest growing seasons to date. In terms of GDUs, the region accumulated nearly 3000 GDUs since April 26th until the first killing frost. The focus now turns to precipitation replenishing the soil profile before soils freeze. The moisture trend has tracked similar to the 20-year average since September 1st (75-100% of normal – left image). A common question has been how the continued warm/wet trend this fall will make an impact going into next year after a dry growing season. The topics below include more details on nitrogen management this fall, as well as how the dry conditions can impact herbicide carryover looking into next year.

Nitrogen Behavior in Fall Applications

The conditions have been favorable for a majority of the harvest season to date, which has allowed for a great opportunity for fall manure applications. Fall applications not only help supply nutrients for the following crop under proper management, but allow for an opportunity to empty lagoons so there is enough storage through the winter. However, care needs to be taken to minimize risks associated with fall manure applications. One of the main concerns is protecting nitrogen to prevent loss. Early fall manure applications under warm soil temps can result in rapid conversion of ammonium ($NH4^+$) to nitrate ($NO3^-$), which is susceptible to leaching. **How does this occur?**

- Manure primarily contains nitrogen in 2 forms: organic N and inorganic-$NH4^+$. Organic N is slowly available, while $NH4^+$ is readily available.
- The positive charge of $NH4^+$ is attracted to the negative charge of the soil and will not leach. Ammonium is converted to $NO3^-$ through nitrification by soil bacteria. Nitrates are not held to the soil due to its negative charge and is therefore susceptible to leaching.
- Nitrification is accelerated under warm soil temperatures and slowed once temps drop below 50°F. Greater than 75% of ammonium is converted in only 3-4 weeks at temps greater than 50°F.



Rate of nitrification at various soil temperatures. (Western Fertilizer Handbook, 2012).

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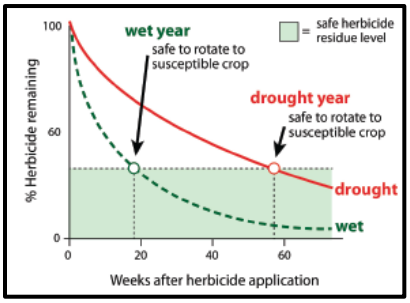
What can be done to help manage the risk of loss? First and foremost, manure and soil testing should be done to determine nutrient concentrations and avoid over or under applications. Nitrogen stabilizers can also be used to reduce nitrogen losses. Certain stabilizers, such as Instinct, contain Nitrapyrin and prevent the action of nitrosomonas bacteria which convert ammonium into nitrate. Therefore, the use of a stabilizer can allow more nitrogen to stay in the stable ammonium form until soils get cold enough to prevent further breakdown. In warm soils, nitrapyrin can remain active for 30-40 days, while in cool soils (late-fall/winter) activity can continue for 30+ weeks.

Carryover Concern? Considerations for 2022

I know many are still trying to put the finishing touches on the 2021 growing season with harvest still charging on throughout much of the region. However, several questions have come up over the last 2-3 weeks regarding the potential for herbicide carryover following the drought conditions this year. Below are several scenarios regarding the impact a drought can have on herbicide carryover.

How does herbicide carryover occur?

- Herbicides primarily break down through microbial activity, but chemical processes such as hydrolysis or photodecomposition can also break down the herbicide molecules.
- Microbial breakdown is driven by time, temperature, and moisture. Dry conditions result in less microbial survival → less herbicide breakdown → more herbicide remaining in the soil.



Soil moisture effect on herbicide persistence. Colquhoun, 2006.

Four Primary Factors Affecting Carryover:

1) Herbicide characteristics, i.e. chemical structure.
2) Soil characteristics- High clay content and high %OM soils tend to bind more herbicide molecules. Also, soil pH above or below neutral (6.5-7.0) can affect chemical degradation.
3) Weather- Primarily temperature and rainfall. Warm/moist conditions favor degradation, while dry/cool decreases rate of degradation.
4) Susceptibility of rotational crop.

Management – Reducing Risk:

- First, review previous spray records. When/where/what rate was the herbicide applied and what was the half-life (rotational cropping restrictions)?
- Change planned crop in fields of concern.
- Delay planting or minimize seedling stress as much as possible.
- Will tillage help? Potentially, but there are mixed results on whether this truly will have an impact.

MOA/ Family	Active Ingredient	Primary Dissipation Mode	Risk for Carryover Injury the Year After Application to[1]:			
			Corn	Soybean	Cotton	Sugarbeets
EPSPS	glyphosate	adsorption, microbial	very low	very low	very low	very low
GS	glufosinate	microbial	very low	very low	very low	very low
ALS/ IMI	imazaquin	microbial	high[2,3]	very low	high[4]	high[4]
ALS/ IMI	imazethapyr	microbial	moderate	very low	high[4]	high[4]
ALS/SU	chlorimuron	chemical, microbial	low to moderate[5]	very low	low	high[4]
PSII	atrazine	microbial	very low	high[6]	low	high[4]
PSII	metribuzin	microbial	low	low	high[4]	high[4]
PPO	fomesafen	microbial	moderate	very low	very low	high[4]
PPO	flumioxazin	microbial	low	very low	low	moderate[7]
PPO	saflufenacil	microbial	very low	low	low	low
PPO	sulfentrazone	microbial	low	very low	moderate[8]	high[4]
HPPD	mesotrione	microbial	very low	moderate[9]	low	high[4]
HPPD	topramezone	microbial	very low	low	low	high[4]
HPPD	tembotrione	microbial	very low	low	low	high[2]
HPPD	isoxaflutole	microbial	very low	low	high[4]	high[2,3]
Auxin	2,4-D	microbial	very low	very low	very low	very low
Auxin	dicamba	microbial	very low	very low	very low	very low
Auxin	clopyralid	microbial	very low	moderate[2]	high[4]	very low

Carryover risk to several commodities for commonly used herbicides. Risk may be higher in drought conditions.

Carryover into the 2022 season is not guaranteed and may not even need to be a concern for most. Ultimately, it will depend on the type of chemical used, herbicide application timing, specific weather conditions, and soil type. However, this may be an important topic to consider in vulnerable fields as you begin to review your cropping plan for next season.

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