



Fertility Issues With Wet Acres

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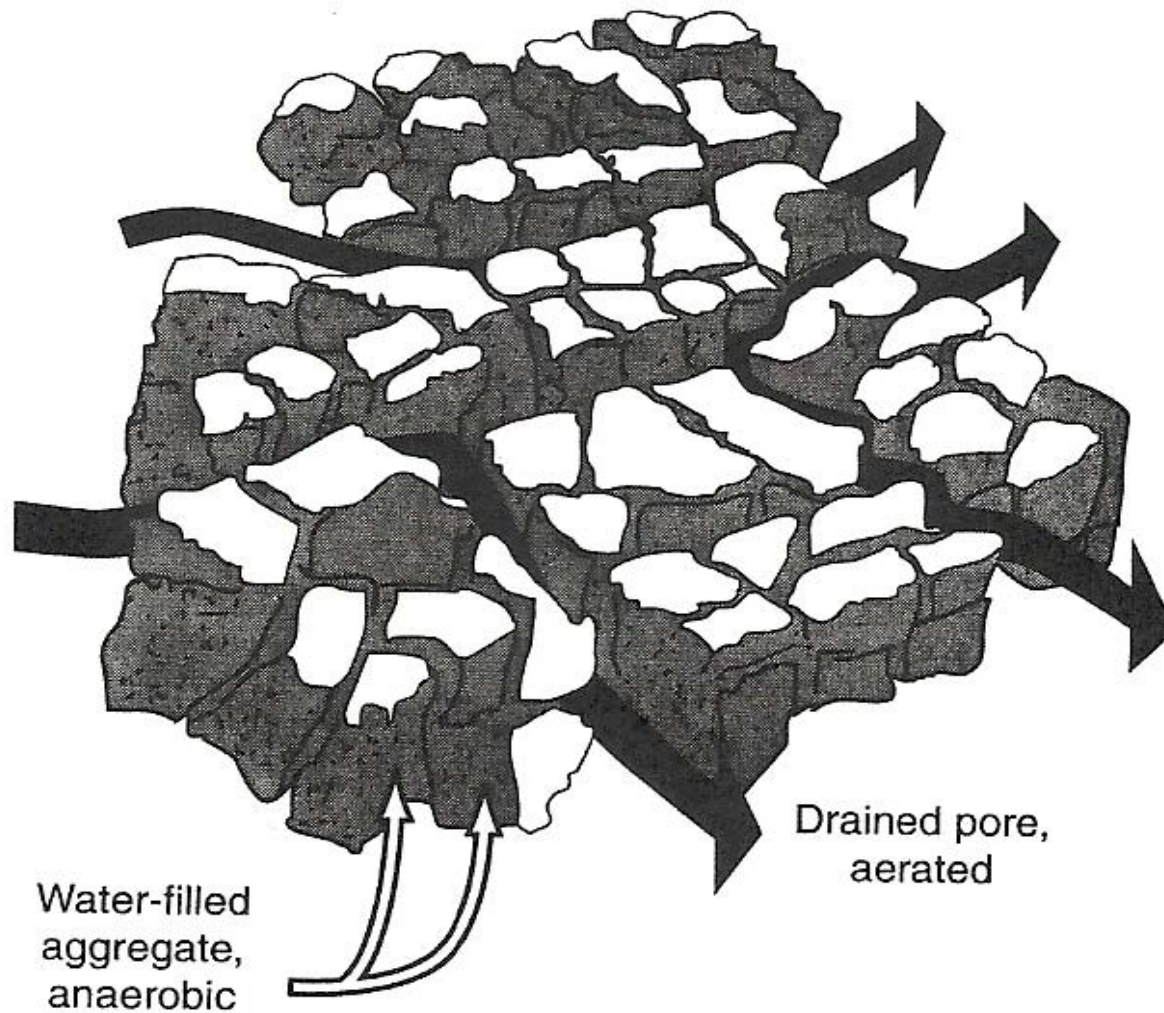


What happens when soils are flooded?

- **Air-filled pores become filled with water.**
- **Respiring microorganisms in the soil consume oxygen. O₂ content in soil drops!**
- **O₂ content drops, because diffusion of oxygen is much slower through water than air.**
- **Microbes start to use other sources as terminal electron acceptor in respiration:**
Use NO₃ (nitrate) first, then when nitrate is gone, they use SO₄ (sulfate)

Result

- Nitrate is converted to nitrous oxide (N_2O) and dinitrogen (N_2) gases (DENITRIFICATION)
- N_2 production tends to dominate over N_2O .
- Rapid and extensive N losses by denitrification with heavy rains, snowmelt that saturate the soil. Continuous small losses in anaerobic microsites.



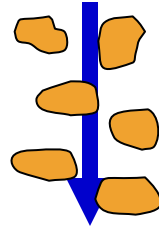
From Havlin et al. Soil Fertility and Fertilizers 2005

Result (continued)

- **Gaseous losses of S are small and insignificant.**
- **No gaseous losses of P and K.**
- **N losses through denitrification are variable, difficult to predict but losses up to 50% of applied fertilizer N have been reported in flooded soils.**

Result (continued)

- Gravity causes percolation of excess water downward through the soil pores and macro-channels when soil is above field capacity
(LEACHING)



- Water percolation greater in sandy soils.
- Water that percolates below the root zone carries the soluble nutrients (nitrate, sulfate) with it.

Result (continued)

- Nutrients that are not very soluble (P and K) not susceptible to leaching.
- Deep leaching not normally a large loss mechanism in our semi-arid environment.
- In humid environment with 700mm of annual precip, 25% to 50% of water observed to pass through soil profile to a depth of more than one meter (3 feet).

Several Possible Scenarios Out There In Context of Soil-Plant Nutrient Cycle

2011 Too Wet To Seed, Saturated For Duration of Season



2011 Too Wet To Seed, Saturated For Duration of Season

- Losses of any residual available N from previous season are likely to be substantial.
- Saturation through season means limited mineralization of organic N to plant available forms.
- Anticipate low available N (ammonium and nitrate) at start of 2012 season, but if dries out in 2012 could be significant contribution from mineralization over growing season.

2011 Too Wet To Seed, But Dried Out Later and Kept Weed Free



2011 Too Wet To Seed, But Dried Out Later and Kept Weed Free

- Losses of available N reduced compared to continuous saturation/flooding.
- Mineralization of organic N to plant available inorganic forms will take place once soil returns to field capacity. Warm (late summer, fall 2011), moist soil conditions (50-70% water filled pore space) favors mineralization.
- If weed growth is controlled early by herbicide or tillage, have a summerfallow situation where available N,S and P accumulate from mineralization.
- Anticipate higher available soil nutrient at start of 2012 season, unless flooded again!



Wheat stubble



**Unseeded
And Tilled**



Soil analysis from two adjacent areas in same field, sampled in October in Dk Brown soil zone in south-central Sask.

	pH	E.C.	NO ₃	P	K	SO ₄	Cu	Zn
	-----0-6" lb/ac-----							
Wheat Stubble	7.6	0.1	9	14	>600	10	0.8	1.2
Unseeded Tilled Weed free	6.6	0.1	22	31	>600	30	2.9	2.2

ALS Labs N recommendation:

Wheat Stubble for 30 bu/ac Canola: **75-85 lbs N/ac**
 Unseeded for 30 bu/ac Canola: **15-25 lbs N/ac**

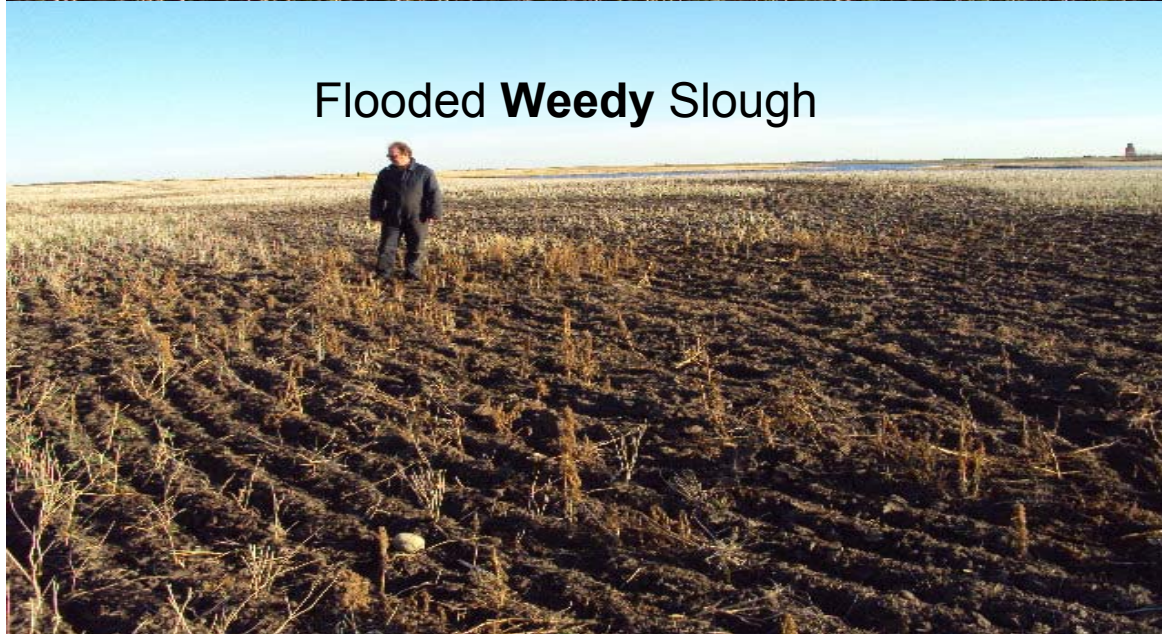
2011 Too Wet to Seed, Weed Invasion



Normal Canola Growth Area



Flooded **Weedy** Slough



Western Ag Labs PRS Soil Nutrient Supply Rates 0-6" and Forecasted Nutrient Requirement lb/ac for Flooded Weedy Slough versus Normal Canola Growth Area of Field in South-Central SK

Flooded Weedy Slough

	PRS Nutrient Supply	Nutrient for 35 bu/ac wheat
N	8	35
P ₂ O ₅	20	0
K ₂ O	84	0

Normal Canola Growth Area

N	9	32
P ₂ O ₅	4	10
K ₂ O	25	15

2011 Too Wet to Seed, Weed Invasion

- Weeds will assimilate soil nutrients during their growth.
Positive aspect: they will not be lost with water or gaseous escape.
- If weeds controlled when young (e.g. wild oats at 1-2 weeks growth), the nutrient contained in the weed biomass likely to be recycled by mineralization into plant available forms that will be available for 2012 crop.
- If weeds allowed to grow, reach maturity, the high C:N ratio, low soluble P content of the mature weeds likely means slow rate of release of nutrients from dead weed biomass in 2012.
- Anticipate lower available soil nutrient at start of 2012 season if weeds allowed to flourish.

2011 Seeded and Fertilized, Flooded Out Later



2011 Seeded and Fertilized, Flooded Out Later

➤ If fertilizer N was applied at time of seeding and flooding took place shortly afterwards, losses of N by leaching and denitrification may have been limited because the fertilizer N was in the ammonium form at the time of flooding.

-Unlike nitrate, ammonium does not readily leach nor is it denitrified.

-Flooding and lack of soil aeration will inhibit conversion of ammonium to nitrate.

➤ Losses of fertilizer P and K expected to be minimal. Some sulfate applied may have moved downward by leaching. If elemental S was applied, saturated conditions would limit oxidation to sulfate.

Speaking of Sulfur.....

- High water tables coupled with presence of sulfate salts in subsoil can result in significant migration of sulfate-rich water to the soil surface via evaporation and capillary rise.
- Result: sulfate salts accumulate at surface (SALINITY), resulting in high available sulfate in soil samples.

Field in south-central Sask that was fallowed in 2009, too wet to seed in 2010, showing surface sulfate salt accumulation in fall 2010.



Action To Be Taken

- ✓ **Soil Testing Will Be Very Important for 2012**
 - 2011 excess moisture affected fields and areas within fields are likely to have different soil nutrient availability, response to fertilizer than those that were seeded and grew normally. Sample separately.
 - Managing these moisture affected fields and areas separately with adjusted fertilizer rates can pay off with better fertilizer efficiency and improved return on dollars spent.



Options for “No Opener Contact” Fertilization

✓ **Granular fertilizers:**

- ✓ *Ammonium sulfate (21-0-0-24) and ammonium nitrate (34-0-0) less susceptible to NH_3 volatilization than urea (46-0-0).*
- ✓ Can treat urea with urease inhibitor: will halt hydrolysis and volatilization losses from surface applied urea for about 2 weeks.
- ✓ Polymer coated slow release urea (44-0-0) can reduce losses of N under wet growing season conditions.
- ✓ Broadcast P not as efficient as in-soil placement.

✓ **Liquid fertilizers:**

- ✓ Dribble banded liquids like urea ammonium nitrate (UAN) solution (28-0-0) can work well.

See Also

Canola Council-SaskCanola Canola Watch-Managing
Excessive Moisture

Questions and Discussion?

