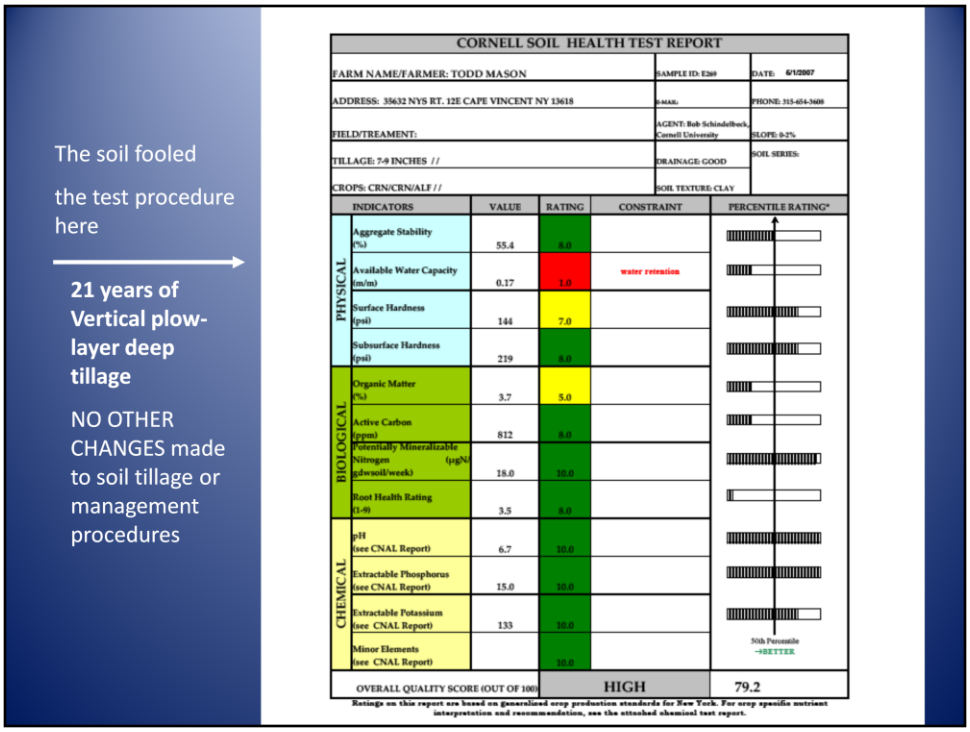
Welcome to everyone who joined us for the field demonstration to day here in Norborne, MO. We want to take an in-depth look at what happens to soils under long term, consistent management using Curse Buster Tillage technology.



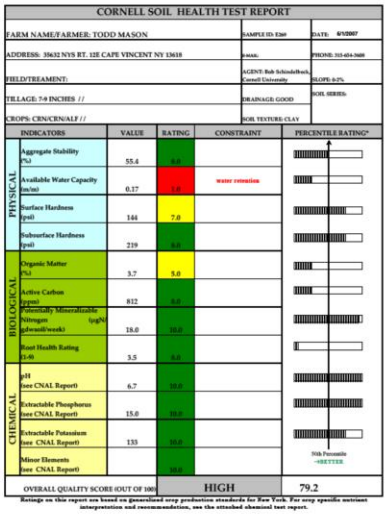
We are very fortunate to have the Mason Family in northern NY State who have persisted and persevered for almost 30 years now with a machine that was built in 1983 to conform to the designs of the Ground-Hog pasture aerator which originated in New Zealand in the 1970's.

The soil report you are looking at is for a field that had never seen a disk, or field cultivator or rotary harrow since 1985. The colors used in the report are selected by the computer based on the readings given it from a series of test procedures which are designed to portray soil health.

This includes levels of carbon that are used by the rhizosphere to support growth and reproduction of soil microbial populations. It portrays the ability of the soil to resist compacting forces. I portrays the ability of the soil to transport water and even the ability of the soil to produce nitrogen resources for crop production. Lastly it even reports indirectly on the disease pathogens and natural controls present by growing a very sensitive crop in the soil sample.

Other readings are given for bulk density using penetrometer readings and of course typical mineral test results are reported.

Cornell Soil Health Test - 07



CORNELL SOIL HEALTH TEST REPORT

FARM NAME/FARMER: TODD MASON | SAMPLE ID: E360 | DATE: 6/1/2007

ADDRESS: 35632 NYS RT. 12E CAPE VINCENT NY 13618 | e-MAIL: | PHONE: 315-654-3600

FIELD/TREAMENT: | AGENT: Bob Schindelbeck, Cornell University | SLOPE: 0-2%

TILLAGE: 7-9 INCHES // | DRAINAGE: GOOD | SOIL SERIES:

CROPS: CRN/CRN/ALF // | SOIL TEXTURE: CLAY

	INDICATORS	VALUE	RATING	CONSTRAINT	PERCENTILE RATING*
PHYSICAL	Aggregate Stability (%)	55.4	8.0		
	Available Water Capacity (in/in)	0.17	3.0	water retention	
	Surface Hardness (psi)	144	7.0		
	Subsurface Hardness (psi)	239	8.0		
BIOLOGICAL	Organic Matter (%)	3.7	5.0		
	Active Carbon (ppm)	812	8.0		
	Potentially Mineralizable Nitrogen (ug/N/g dry soil/week)	18.0	10.0		
	Root Health Rating (1-10)	3.5	8.0		
CHEMICAL	pH (see CNAL Report)	6.7	10.0		
	Extractable Phosphorus (see CNAL Report)	15.0	10.0		
	Extractable Potassium (see CNAL Report)	133	10.0		
	Minor Elements (see CNAL Report)		10.0		

50th Percentile →BETTER

OVERALL QUALITY SCORE (OUT OF 100): HIGH 79.2

Ratings on this report are based on generalized crop production standards for New York. For crop specific nutrient interpretation and recommendation, see the attached chemical test report.

21 years of Plow-Layer Deep Vertical Tillage

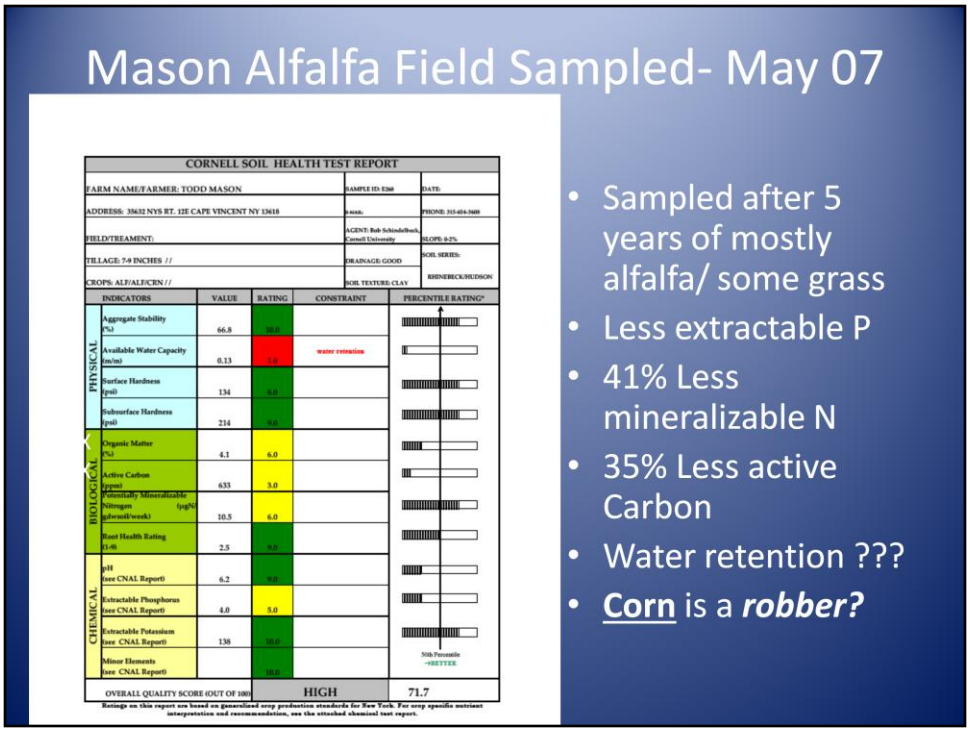
- Aeration tillage "only" since 1985
- No inversion/mixing
- Alfalfa/Corn rotation
- 5 yrs. Alfalfa/
- 2 yrs. Corn- tested
- Sampled May -1st wk.
- Manure surface applied

This particular field test result portrays what is happening after growing two consecutive years of Corn for Silage. The field had 10K gallons of liquid dairy waste surface applied following a single pass of the vertical tillage machine they have had since 1984.

Pay particular attention to the ACTIVE CARBON and POTENTIALLY MINERALIZABLE NITROGEN readings for this field.

Also we need to mention that cover-crops following corn silage harvest have never been planted in the history of the farm.

Now let's look at the same soil under the same long-term management following a continuous five years in alfalfa production.



Alfalfa is a nitrogen fixer right? The potential of the soil to supply nitrogen to the corn crop that is to be planted here is less by 41% than it was following two consecutive years of corn silage production.

Active carbon is normally destroyed thru tillage and corn production. Looke here! Active carbon is 35% lower at the conclusion of 5 years in alfalfa. So far I fail to see where corn silage production has done anything to harm this soil.

You are probably wondering about the red reading, Available Water Capacity. I wish I understood better how this test connects with a soils ability to supply water to a growing crop. To degress slightly, each soil is placed in a database based on the percentages of sand, silt and clay in the soil. When a test procedure produces a resulting reading each characteristic for that soil gets a rating.

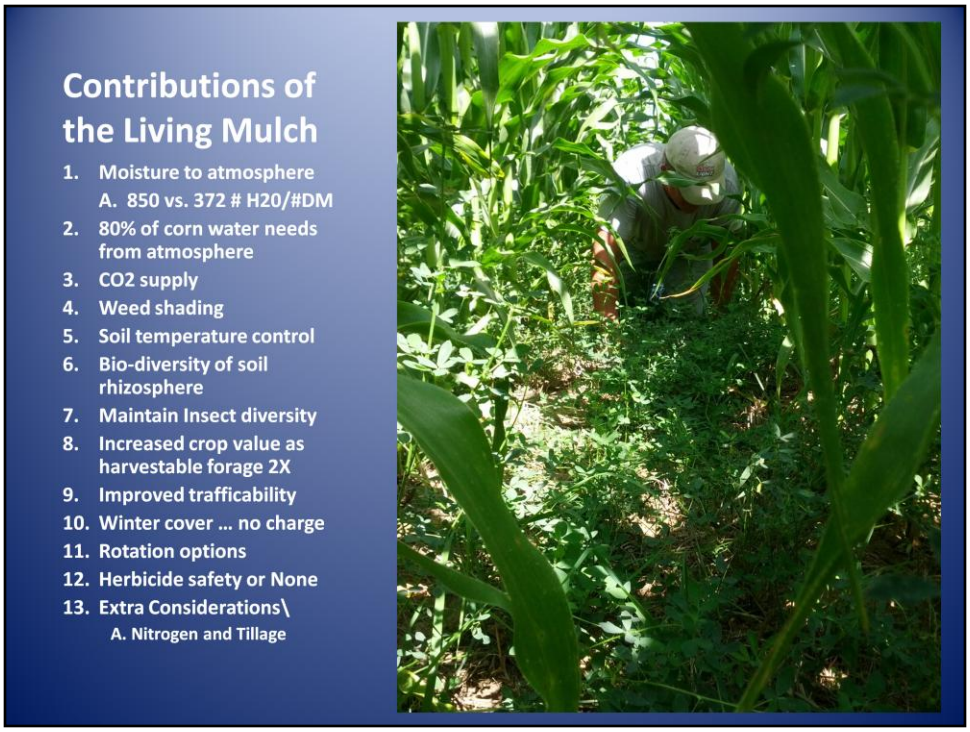
Something does not connect with this soils make up and performance regarding water. The soil is a clay loam composed of 45% Clay, 45% Silt and <5% Sand. This much clay does not have a problem of storing water. It proves it 1999 when the crops received no rainfall after June 10th. The corn silage dipped from 24 tons average to 19.5 tons. Alfalfa yielded right on the farm average. Soil in the area produced less than half the normal corn silage tonnage.

So although this set of testing procedures is a great step forward in helping us understand how various crop production practices can influence soil health advancement, the procedures are not fool-proof or infallible.

Developing root systems under crops and then decomposing them properly with lots of efficient water and air exchange will always succeed in producing healthier soils with greater productive potential.

These roots contain no LIGNIN so they decompose very quickly and contribute to the carbon food sources for microbes better than any above ground plant parts.

The secret the Masons have exposed is the power of soil breathing and leaving root systems in the soil to decompose where they grew.



Taking this to the next level, I want to introduce you to the concept of the what I call the Legume Living Mulch. You can read the list on the slide of the advantages this system offers.

The thing which I need to discuss is item #13. It is a aspect of crop production everyone has heard of and probably has experienced. With the advent of chemical weed control most crop producers don't see this as often but still it is working in the bag of tricks that make for a harvestable crop. I'm referring to organic matter oxidation or mineralization of nitrogen. Here's how it works.

When oxygen enters the soil, the nitrifying bacteria convert amine forms of nitrogen to nitrate nitrogen. You've seen it when the nitrogen gets left off on the side-dress rig or when you rarely use a row crop cultivator. Generally, it is held that a cultivator pass is good for an additional 20#N/acre.

In the living mulch we have a legume, say alfalfa, that prefers amine nitrogen forms. It is already established and not readily willing to give any N to the growing corn crop which "prefers" Nitrate N in its early plant development. The nitrate N makes corn get mass so that it can extract more energy from sunlight through the chlorophyll in its large leaves. A blindfolded operator pass with the Curse Buster through the corn at V-3 addresses the challenge for light from the alfalfa. A good hot sunny after noon is all one needs.

One of the exciting things about the legume living mulch is the diversification in insects that visit the corn/alfalfa field. Interestingly, the honeybees did not show up for the alfalfa flowers. They stopped by when the corn began to pollinate.

Then they went after the flowers and the nectar.

Maybe that should send a message to us about the nature of the pollen these bees are taking back to the hive to feed the developing brood. You've heard of Sudden Colony Collapse?

The entire eco-system is a balancing act between organisms which are reproducing and those which are decomposing. When the eco-system is in agreement such as one finds with corn producing seed and alfalfa producing seed wonderful things happen.

I think there are implications here for cover-crop strategies. We may find that there is more to establishing a crop in the midst of a dying and decomposing crop than we currently understand. For the present I support the use of a cover-crop which dies over winter and at once begins decomposing in the springtime.

Here is the result of the living mulch practice in 2012, the Year of the Drought. The silage went over 11 ton/acre and the first cutting of dry hay equivalent was close to 1.5 tons/acre. The alfalfa went off with the corn silage harvest and the orchard grass remained to provide ground cover for the winter. This grower elected to plant corn a second year but he could have overseeded more forage grass seed if that was more advantageous.

Here was an example of how NOT to do a legume living mulch. Got the right tool for making a seedbed while not disturbing the mulch root system. Problem was it was three weeks after the 2.5 tons of clover was removed before the corn was planted.

Secondly, the Curse Buster should have been directly cross-wise the field. The wheel tracks from planting, topdressing and harvesting the wheat which preceded the clover were not fully addressed by “kiddering” the field. Of course in 2012 it forgot how to rain so that the moisture the clover took in regrowing was GONE!!!

Not much to look at for 4 weeks in the ground

Miraculously, the crop did actually emerge from a depth of 2-2.5 inches. It would be several more weeks before moisture would visit this field. The only thing that saved this corn crop was the fact that nothing else would germinate even of it was replanted to something else.

No rain and Clover Competition 2012- 9 weeks

By the time this pic was snapped, the clover had been sprayed with Clarity herbicide. The first little break in heat and precip had just taken place at 9 weeks from planting.

In about 20 days, this was the crop. Close to 50% of the plants had had no leaf area showing when relief finally came. The plants that actually died were the ones who couldn't establish a root depth beyond 3 to 4 inches. That was the situation in undisturbed wheel track areas. Final stand varied widely from 100% or 34K down to places where the stand was half.

Were the population was normal the yield monitor in the combine was running 160-170 ba. The field averaged 100ba. When the net profit for the field was figured for all crops harvested and all inputs and expenses, the net profit was slightly under $1200/ac. In 2013 the 100 acre field averaged over 220 ba. and received a total of 160#N/ac.

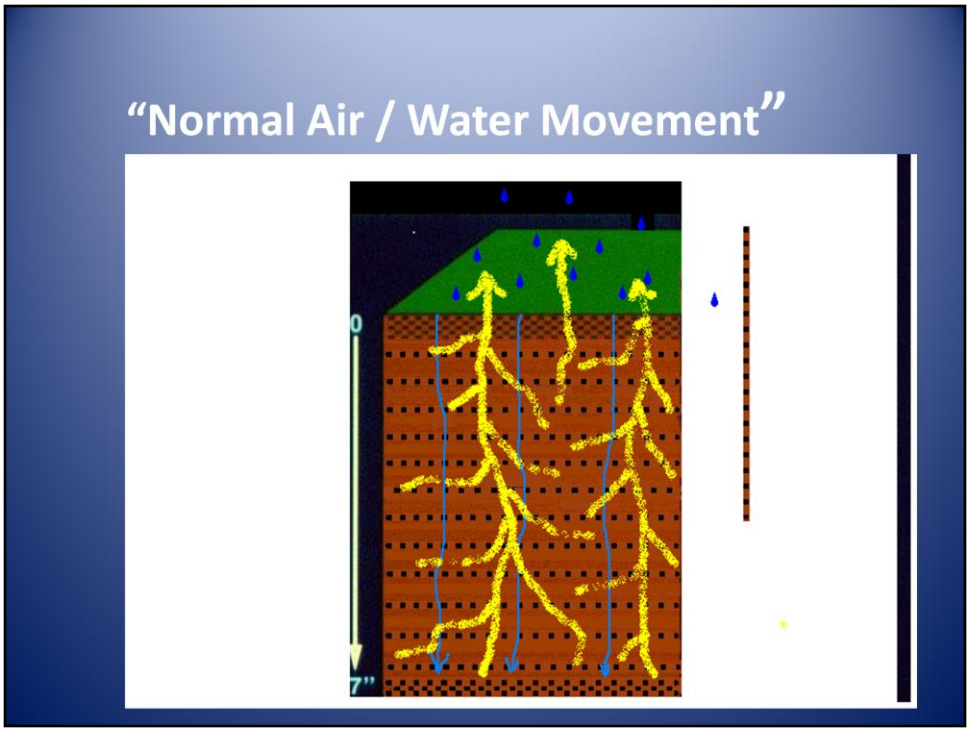
This field of clover was aerated using a single pass of a single rank aerator prior to planting. It was never harvested for corn because the cows broke through the fence and took care of all the harvesting.

You can see the corn is sure struggling.

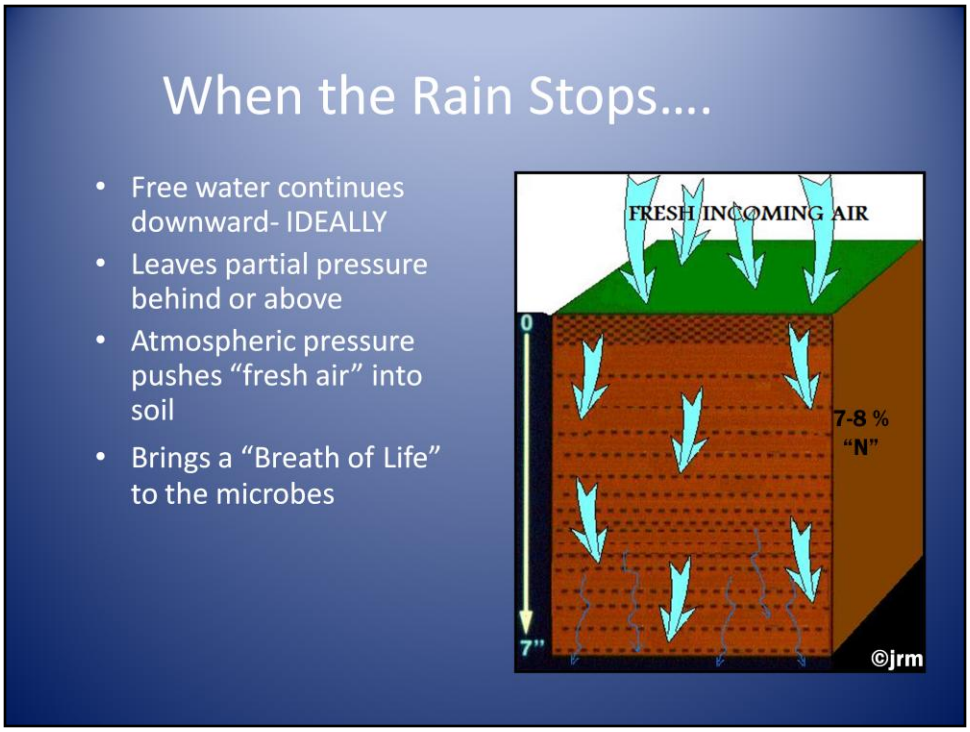
This is Ruby Red popcorn and Alfalfa Living Mulch grown in Berne, IN. This field received 60#N as sidedress. It was the highest yielding Ruby Red field of 12 fields total.

Of course the alfalfa sod is an asset to any corn crop. The point is why not leave it in Alfalfa so the effect of the legume sod is good for two years instead of one. How about skipping a year of corn to let the alfalfa recover from the intense shading from the corn crop. Then do it again!!!!

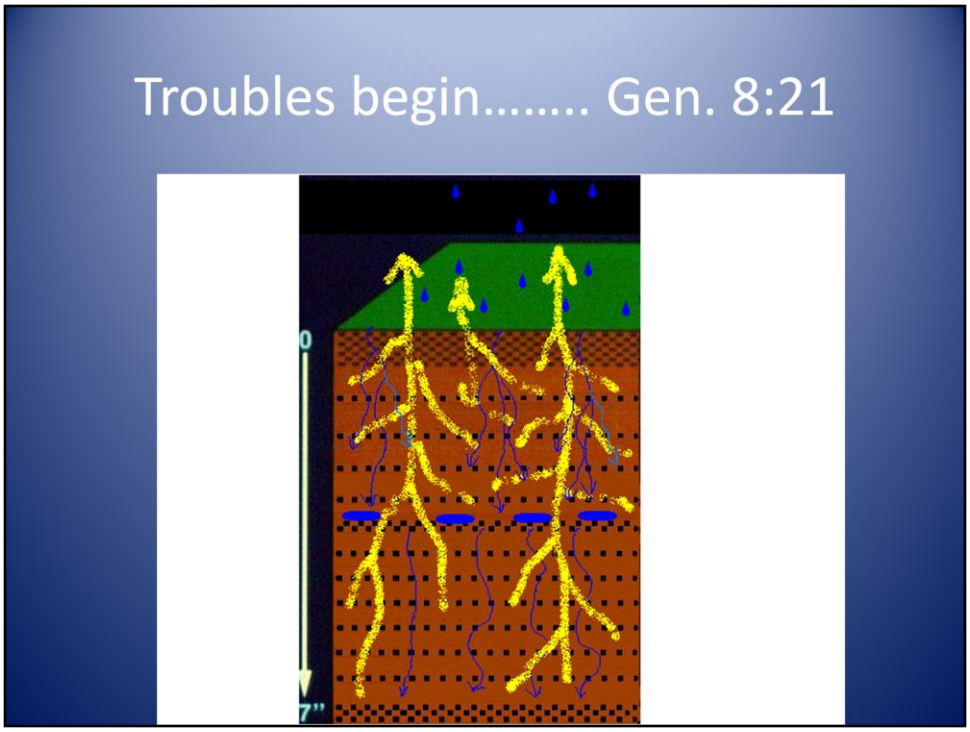
The numbers speak for themselves.



I am hoping that the key role of tillage that doesn't destroy the soil eco-system and permits rotation to corn is possible, even practical. The secret is promoting thorough air and water exchange throughout the life of the legume and the rotational crop.

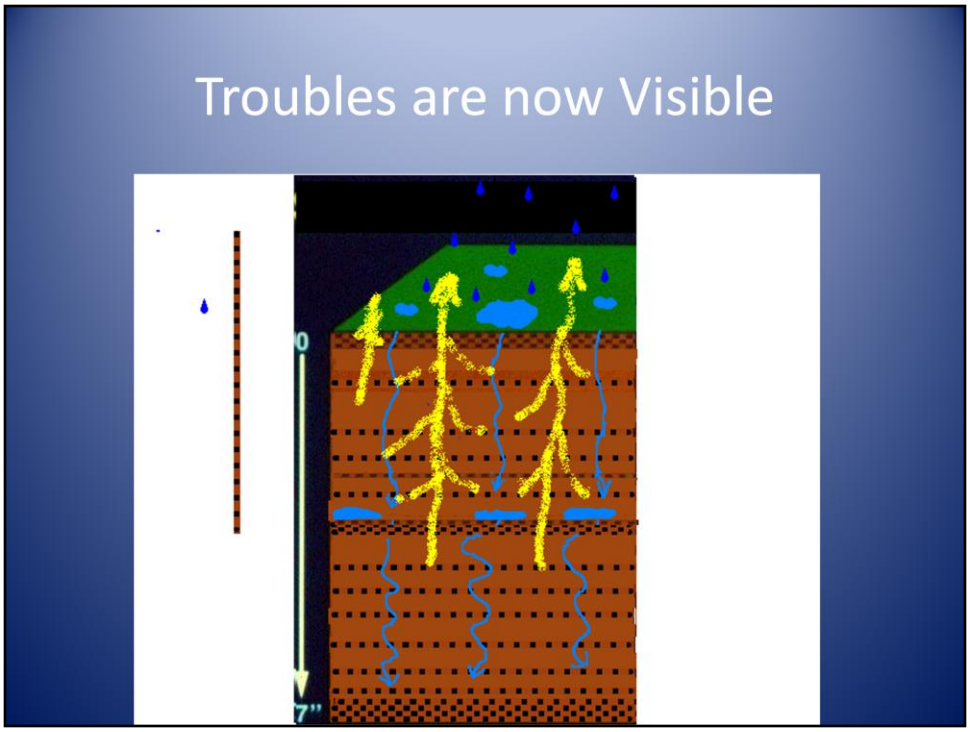


Air is the life of the soil rhizosphere. A soil which is no longer percolating water efficiently is not breathing efficiently either. If it is not breathing it doesn’t have access to the tremendous amount of resources that are in the atmosphere above the soil., such as nitrogen. The atmosphere contains the equivalent of almost 36 tons of Nitrogen gas above each acre of land area. Sounds like that ought to be enough to grow things.

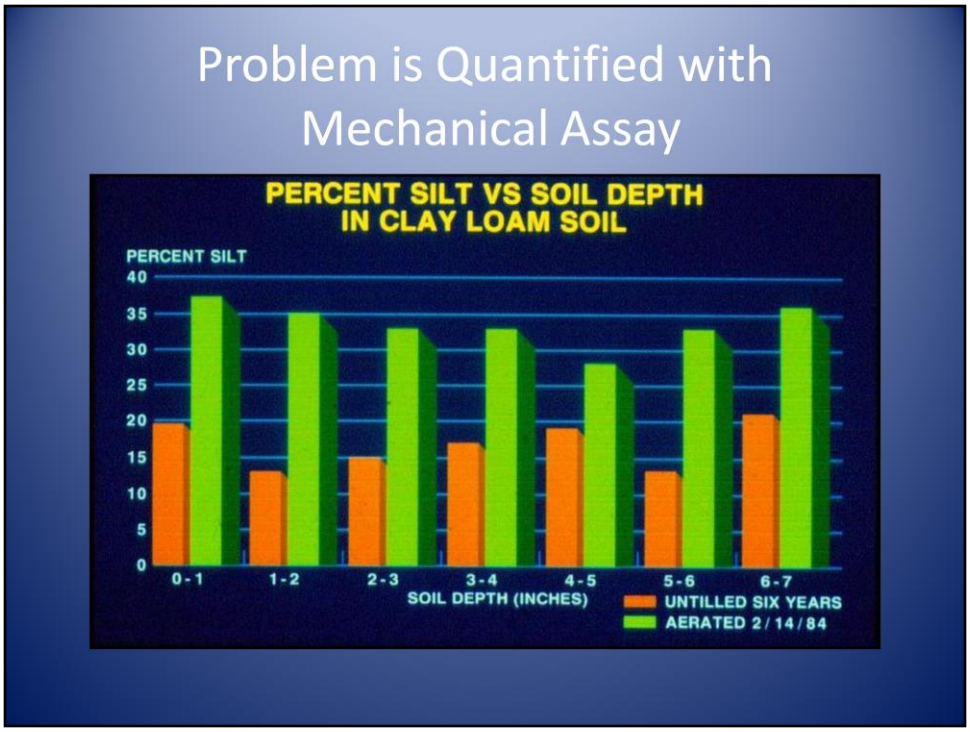


To be sure we get exposed to the real message of the Scriptures in Genesis where the cataclysmic events of Noah's Flood are better understood, we need to look at what happens when water flows downward through soil. A careful reading of the creation and Flood record will help us to understand that the eco-system was not designed to run top down when it comes to water and air infusion into soil.

Now when water percolates it carries silt-sized soil particles downward with it. These silt particles begin to clog the macropores where the air and water are able to pass each other.



The more it rains the more clogging takes place. We are unaware of the problem until it gets bad enough that we begin to see water sitting in low areas in our fields and collecting at roadside ditches in a effort to get off of the field. This silt is normally accumulating at depths of from 3 to 6 inches.



This was chart which was created by measuring the silt, sand and clay in each inch of soil down to 7 inches, shows the amount of silt found in each inch for soil that was disturbed and soil left undisturbed at 22 months after being left at rest.

The slide is wrong… it should say left untilled for 22 months not six years.

The decision to be made is how to address this problem. We would like to address it without destroying the soil eco-system and crop. If we plow, chisel or deep disc we can redistribute the silt and the problem is solved for getting water to percolate. The soil eco-system advancement is arrested too.

THE REALITY IS THAT FRACTURING AND BREAKING THROUGH THE ZONE OF SILT ACCUMULATION SOLVES THE WATER/AIR EXCHANGE PROBLEM AND RESTORES THE ENTIRE ECO-SYTEM TO NORMAL OR BETTER THAN NORMAL FUNCTION.

The soil penetrometer can be a very useful tool in diagnosing the silt density layer location. Obviously when puncturing the density layer it is imperative that the tillage tines be long enough to do the job.

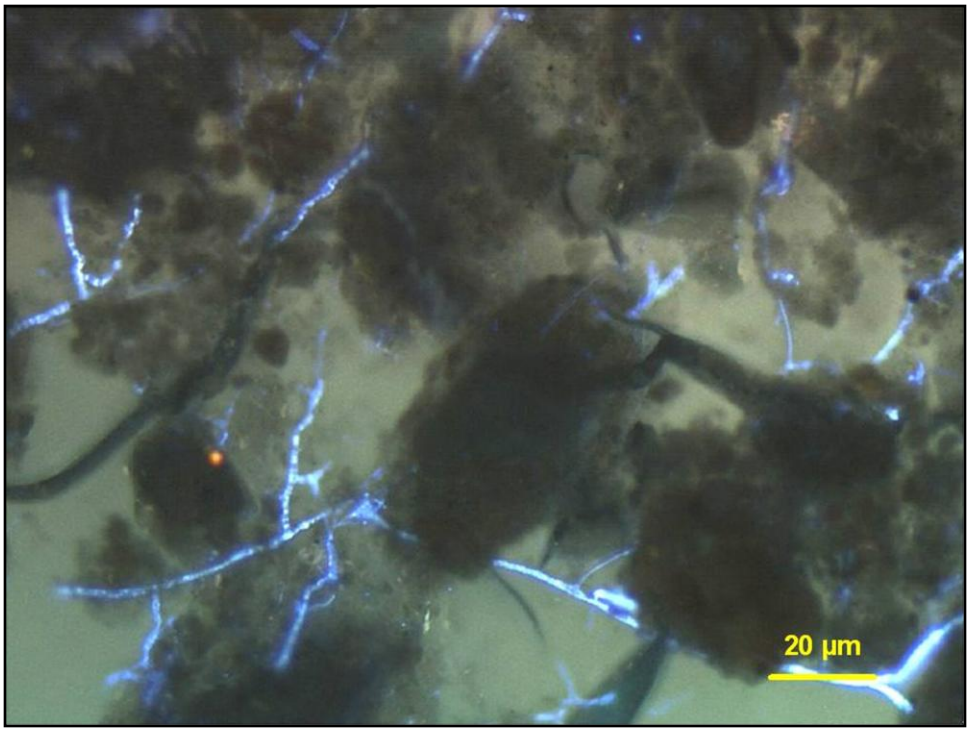
This is also why we strongly suggest performing vertical tillage with Curse Buster opposite the direction of normal field traffic. If we bridge depressions in the field the tine doesn't get the penetration that may be needed to address structural issues such as the density layer of silt.

Most of the time we don't fully grasp the importance of the shallow compaction or other weathering influences like the silt layer. If we considered the roots journey as a three day once in a lifetime event it might us. Remember the last time you had just enough time to get to a destination when you left home? Then you found a bridge was out or a train was coming at a crossing o your route of travel.

How far down roots get in their three day journey is very largely dependent on how the early part of the trip goes for them. The breadth and depth at 40 days set the row count. The new growth of roots ceases at pollination.

So we need to make every provision possible for a good start and rapid progress early in the life of a root system.

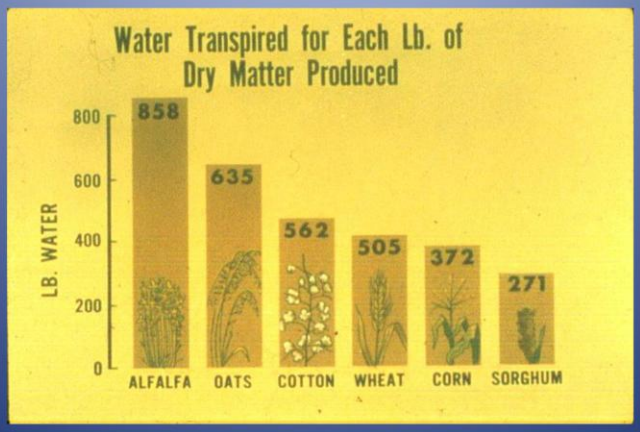
When this process of vertical tillage is faithfully performed, even peformed to what some might consider to be excessive, the soil will develop a progressively deeper aerobic zone. This is the zone of mycorrhizael fungal root colonization which leads to a very profitable soil. One that creates plant nutrition out of soil air and finds mineral resources for improved health, disease prevention and bumper economic yields.



This is a microscopic image of the fungal hyphae that I am talking about. Can you imagine a soil that can produce 20 ba dry corn with 120 pounds of applied N from dairy manure and the plants aren't fired at all when moisture is ready for the combine? This is what has developed on the Mason Farm in Northern NY State in the last 20 years.

Please pick up a DVD or write for one using the contact button on the home page of the website for the story.

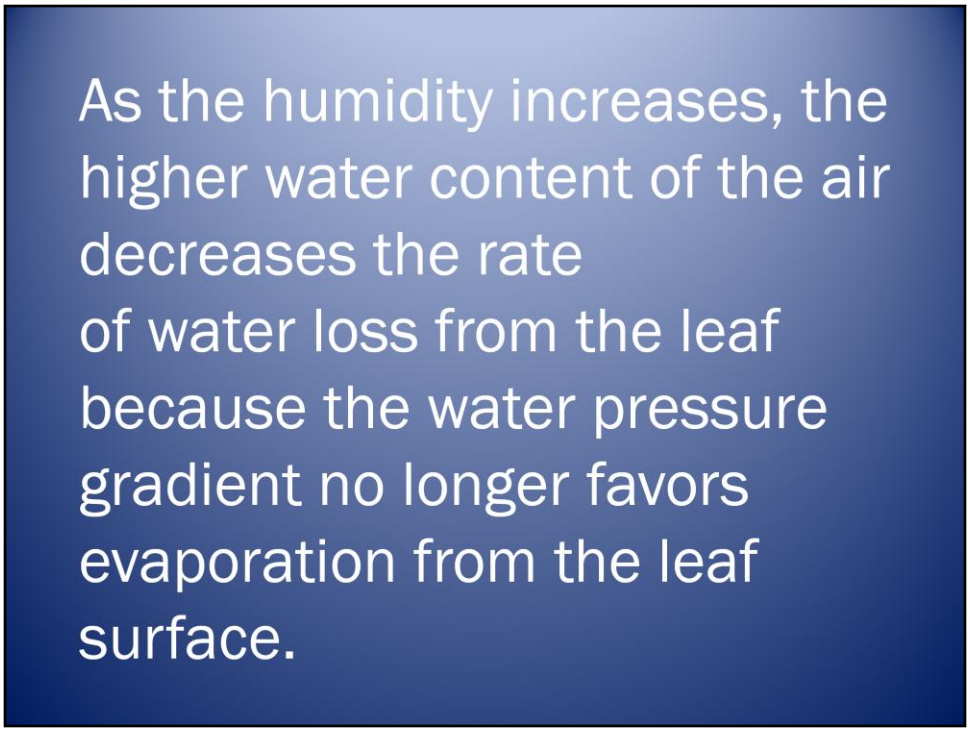
Water Usage Rates



We normally think of water as being one of our first yield limiting resources. Obviously these plants all take a lot of water. The water supply should not the first limiter.

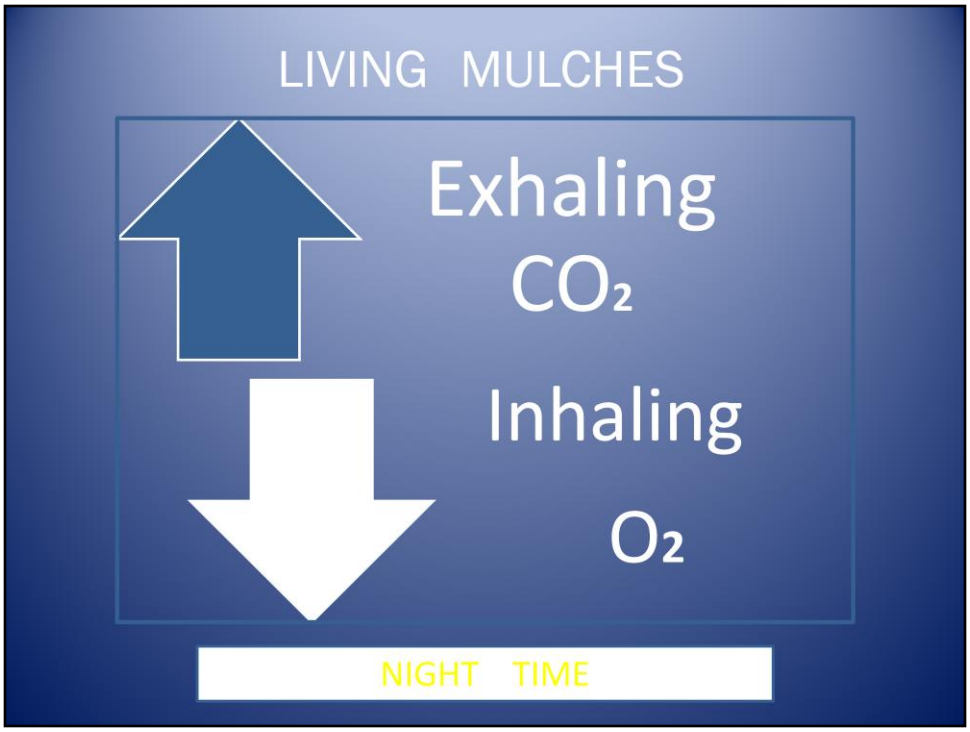
A soil that is properly fractured in the fall following harvest will much more efficiently restore or recharge the water table for the next cropping season.

Leaving the root systems intact to decompose where they grew will hold soil movement in check too.

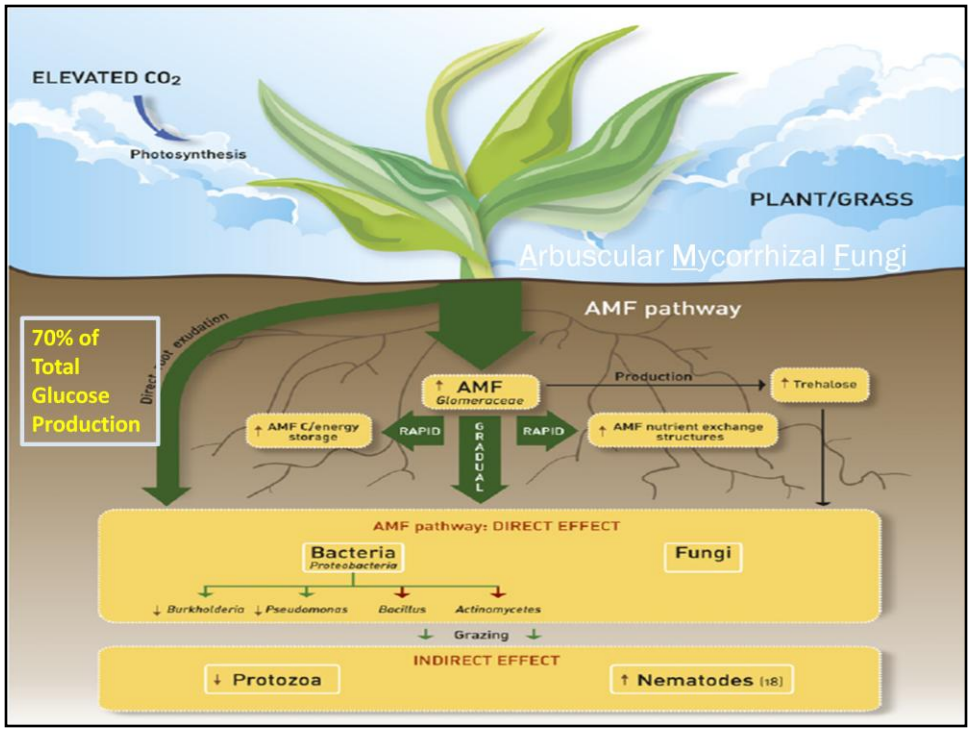


Read this slide a couple of times. It is one of the reasons why the legume living mulch concept works in very dry conditions.

Couple with this the fact that corn can remove up to 80% of its total water requirements from the air. The alfalfa mulch is supplying plenty of moisture to the air inside the corn crop.



By the same token, the legume mulch as long as it is alive is actively changing the air quality inside the corn crop. The living mulch is literally increasing the levels of CO2 and O2 for the corn crop on a daily basis.



The soil food web is incredibly complex as borne out by this greatly simplified conceptual diagram of it. To the extent to which it can remain functioning intact and even continue to build upon itself we will develop a drought resistant soil, plants that don't suffer from disease and fungal attacks and superior nutritional content in the grains and forages that we produce in our soils.

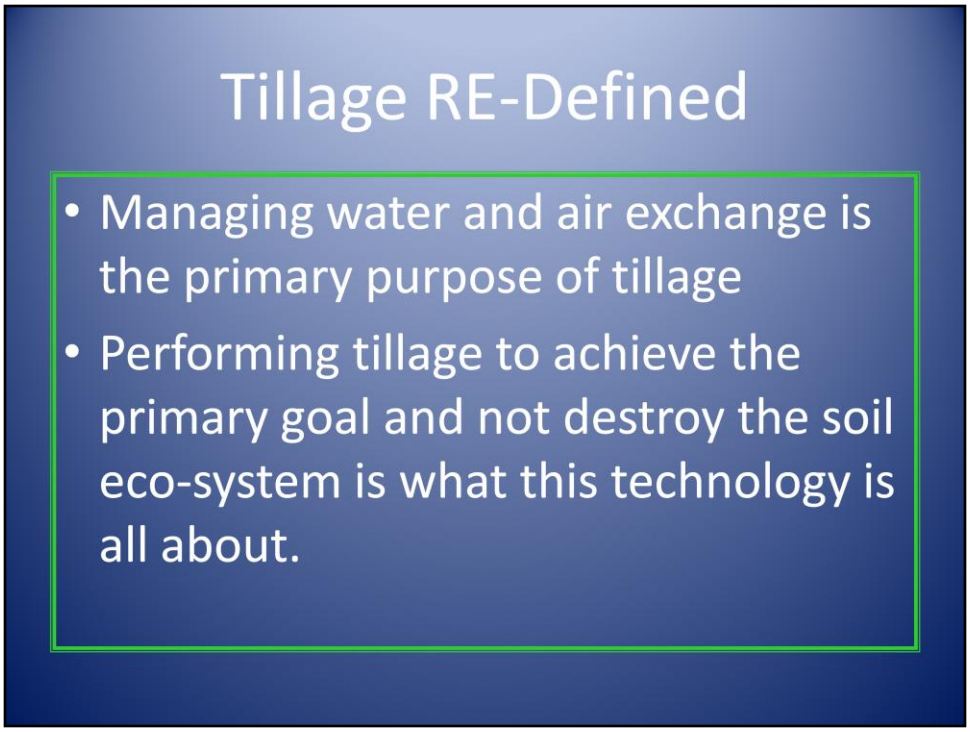
This is one example of how quickly parts of the eco-system can show us a response to changes in soil stewardship through tillage.

These three samples of corn stover are all 12 months old. They were gathered from three different fields on the same farm with the same corn variety grown in all three locations.

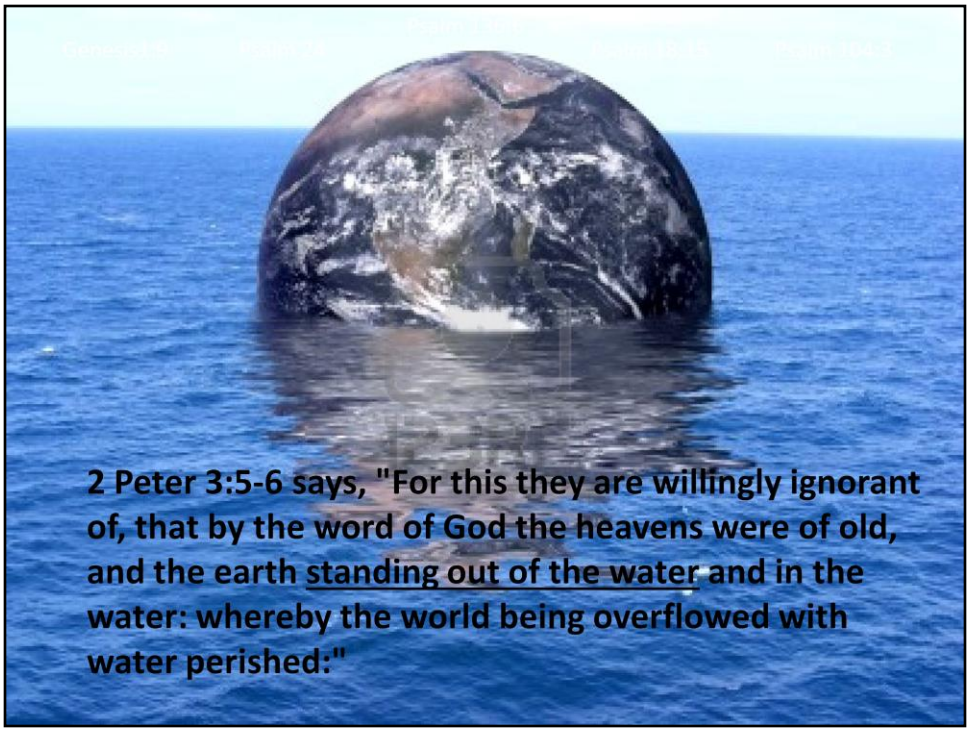
The numbers are the number of pounds of residue retrieved from one acre of field.

One field was offset disced when it moved to corn production from mixed aflalfa/grass haycrop forage. Another field was also a mixed forage stand but it was defoliated twice and still failed to kill the alfalfa. At harvest when these stalks hit the ground there was at least three ton of dry hay equivalent from the alfalfa that grew inside the corn crop. The last field was like the previous which received no disking. Field two and three both were tilled plow–layer deep with a tine action similar to the Curse Buster Eagle tine action. The third field was 100% grass forage stand and it all died under the influence of the contact herbicide and residual weed control measures.

There you have it. Quiz time. Which field had the disking? Which field had the volunteer alfalfa? Which one had no disking and nothing but corn stalks left to rot behind the combine? Write me with your answers.



How about a new definition of tillage that actually helps guide us in creating topsoil and true sustainability in agriculture? The is the closest I've come so far. Want to try it on for size?



What we have been talking about here this evening is the result of a curse which Almighty God placed into the eco-system at the time of Noah's Flood. I'm sure Noah would not want the credit for the event but he gets it in part anyway.

The last poinmt I want to make is that the land masses of earth still are filled with water. It is this water which from of old was used to moisten the plants before the Flood and the inception of rain. The gravitation which is still used to create what we call tides is still raising and lowering the water table inside our soils.

This water serves yet today as a potential diaphragm which was used to change the soil air content from the beginning of creation. By the Grace of Jesus Christ we can move in obedience to the command to till the earth from which we were taken. We can do it in such a way as to bring forth the blessings of Almighty God and see the curse pass by us.