## ***Reporting in from Arid Tropical Victoria, Australia*** 4 April 2016

If that sounds like a contradiction in terms, relax, it is. Unfortunately, it is also very real and reflects a true and serious condition.

The basis for the terminology is a normal annual rainfall which approaches 18 inches per year. In reality, it has been no more than 11 inches for the last several years. The rainfall amount constitutes "arid". The latitude in which this condition exists is tropical.

The result on sheep production has been a reduction in carrying capacity of about 50 to 75% over the past 5-10 years. Wherever freshwater aquifers are available more irrigation is being installed in an effort to meet normal crop production requirements.

Meet the Weatherman, Kevin Long

Kevin is pictured here with my host and CurseBuster owner, Gregg Mortlock from Dunluce, Victoria. We were examining Kevin's charting of long term weather patterns for the central Victoria region. He did this before Excel was available so you know he has been involved in the weather for this part of Australia for a long time. You can see more of his analysis on his website and even subscribe to his service of weather forecasting at http://www.thelongview.com.au/

We were not visiting Kevin for his weather forecasting prowess but to get some welding done in his very extensive Machining and Welding shop. It wasn't long however before we realized that Kevin's consuming passion is the "weather". Like many of us another activity in life subsidizes the exercise of our real passion.

When Kevin finished a very exhaustive expose' of all of the conditions which existed in the Earth's environment and our portion the solar system it looked a whole lot more bleak than 10-11 inches of rainfall in the forecast for the next year or ten; like about 8 inches maximum.

This forecast which Gregg is paying to get added to his long and short term management strategies for his sheep and cropping operation of about 3000 acres, is fairly shocking to say it mildly. In Aussie-slang "Gregg just got stuffed". There's no way (in conventional wisdom) that he and his brother, Malcolm, could feed a flock with 1000 ewes on this rainfall even off of 3000 acres that has been chemical-free for over 20 years.

Then the dissonance began to really set in for me and Gregg. It led me to some calculations which I will share later here, too in an effort to resolve the conflict of the forecast and the performance we had

already seen with just 11 inches of rainfall for 2015.

Sourcing the Dissonance

I had just spent several days before visiting Kevin with Gregg feeding his sheep and walking over his cropping fields and pastures. The first thing that struck Gregg and me was the huge differences in soil conditions that we encountered from field to field with different tillage and cropping histories. It was so significant that we had even grabbed a plastic bag we found in the truck to put some soil into that we brought with us to show Kevin.

When Gregg and I had somewhat recovered from the "weather forecast" we both thought of the bag of soil that was still in the truck that we had driven to Kevin's shop. We brought it in and had Kevin open it to examine the soil. There was a prolonged and deafening hush that came over the Weatherman.

Then Gregg described the field from which this soil had been taken at a depth of from 7 to 9 inches. The Mortlocks' had harvested a Vetch haycrop which yielded 2.49 dry Tons/acre at the end of last September. It had been planted in the first week of May into a barley stubble field that had been fallow since the previous October when it was harvested.

At the time the Vetch was planted, no one in the neighborhood was planting because they all knew that there was not enough moisture in the soil to germinate the seeds. Gregg's field had received about 0.9 inches of rainfall one week before Vetch planting was attempted. I felt that if we could keep the 12-14 inch tall straw stubble on the surface there was enough moisture to be able to germ the Vetch. So we loaded the seed and tried to follow the CurseBuster tillage with the "combine" which is really a seed drill in Australia.

This approach left the barley straw clumped instead of uniformly spread and the seed depth was hard to control with the "combine" since it had no gage wheels or press wheels.

So we then tried planting first and following with the CurseBuster. It looked perfect on the surface but no one could know the fate of the seed which had been placed about 1.5 inches deep in the soil. My phone rang shortly after arriving home in the US about three days after planting. The seed was all germinating. A few more days and the rows were visible right where they were placed by the "combine".

The Mortlocks' also planted a strip of Annual Ryegrass next to the Vetch in bare soil using the CurseBuster and it yielded 2.8 tons/acre.

Back to the bag of soil that our friend Kevin has now got his hand in; it was still so wet that he could form a ball with it. How could this be!!! Virtually every other field that had not had the CurseBuster used on it was so hard and dry that digging more than 3-4 inches deep was almost impossible and it was as dry as dust. It didn't matter if a crop

had been grown on it or not either unless the CurseBuster had been run too.

Kevin, who has been involved with deep tillage in the area had never seen anything resembling this result from breaking deeper compaction or deeper soil density layers which are very commonplace.

Before I left the Mortlocks' I was given some of the yield data compiled by Malcolm's son, Lee. The most reliable side by side other yield data set was for plantings of oats. Three fields that were established without the CurseBuster tillage averaged .374 ton/acre. The CurseBuster tilled field yielded .5 ton/acre.

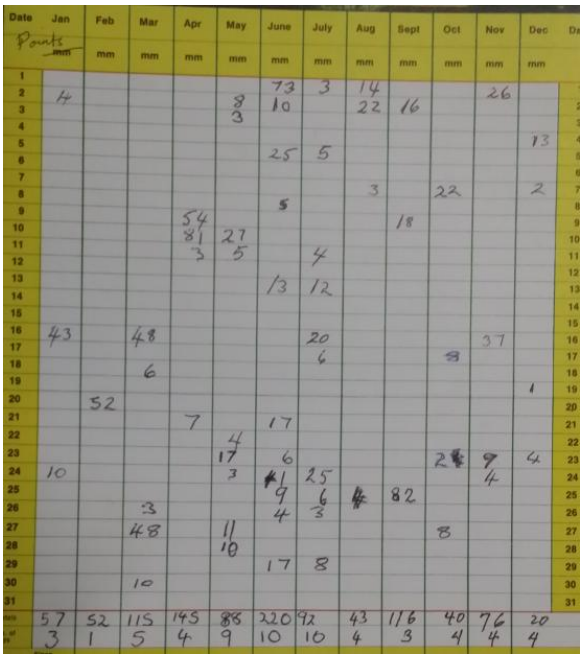
The Vetch yield was double that of the neighbor who planted no-till. Who knows what else might have limited the neighbor's yield.

What really resonated with us all was the amount of moisture that was found and the depth at which it was found after growing such a respectable crop of vetch. How can this be?

Water Consumption Calculation

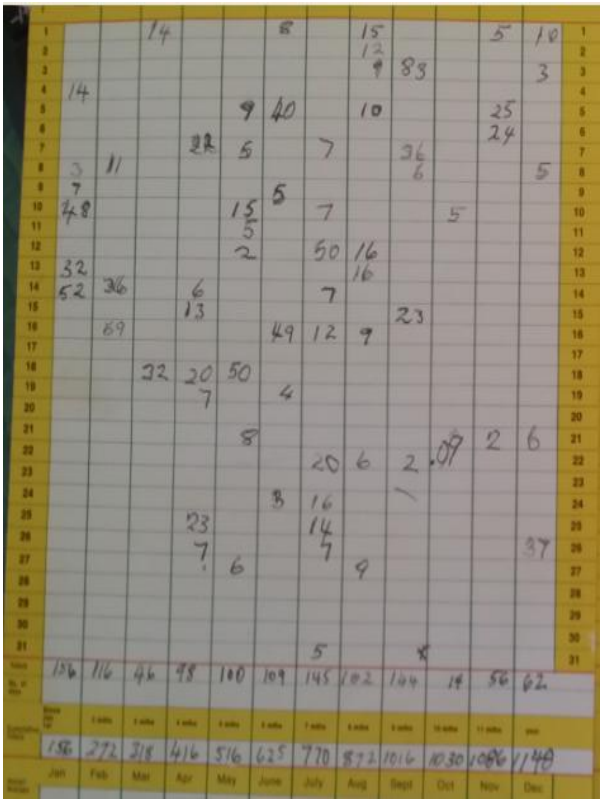
So I started doing some calculations of just how much water the vetch crop required to achieve the yield that was recorded compared to how much water was received while the crop was actually growing. The amount of water required was a minimum of 249,000 gallons per acre assuming a requirement of 800# of water per pound of Dry Matter produced. I used this number which is slightly less than what alfalfa requires for no particular reason, except easier figuring. The growing season rainfall on the Vetch was slightly less than 164,000 gallons per acre. That is a difference of 85,000 gallons per acre which had to come from someplace other than the precipitation that fell on the crop.

The numbers have my attention already now. So then I looked at the rainfall which occurred since the last crop which was barley. That came to about 158,000 gallons per acre. Well there we have our answer, maybe, or part of it. If the field was able to capture with no evaporative losses 100% of the precipitation recorded from the previous October through April then the Vetch was able to recoup over 50% of the water from the fallow period precipitation.




This is the rainfall record for 2014 which shows a total of 1.36 inches in October-December 2014. Adjust these downward for the rainfall events of less than .1 inch

because they likely evaporate. That applies to five rainfall events totaling .27 inches. Remember it starts getting hotter in October and it will be running over 90 F by early December.



This is the rainfall record for 2015. If we adjust the amount in January through April we might have accumulated a total of 3.56 inches to support the Vetch crop water requirement. So if we total the adjusted for evaporation October through April rainfall we find 4.95 inches of rainfall possibly available to the Vetch crop. If we assume zero run-off of this water (which was not the case) then the vetch needed almost 63% of the fallow period rainfall to achieve its yield.

Then when we examine the next fallow period rainfall from October 2015 through March 2016 do we have an explanation for soil which is “muddy enough to form a ribbon” at 7-9 inches in depth?

The adjusted for evaporation total for the fallow period is 3.7”. That would saturate approximately 7-8 inches of soil. It appears we have an explanation for why this field produced the yield that it did and how it may have accumulated significant subsurface moisture to the extent observed.

QUESTIONS THAT LINGER

Assuming that the rain fell fairly uniformly on adjacent (the just and the unjust) fields which resulted in this Vetch field being as wet as it was in late March 2016, why was it the only field found to be in this condition?

LESSON TIME?

- The ability of the soil to receive shading from the barley stubble may have helped cut evaporative losses.
- In the case of the barley field that went into vetch, we can be fairly cerain that the continuous mulching of the barley straw helped to preserve whatever moisture was present from the fallow period for the vetch crop.
- More questions….

Why would ONE Low  Organic Matter Soil Retain Moisture and another NOT?

Why should a legume such as Vetch possibly have been responsible for greater

soil moisture retention than a grass such as oats (with the same tillage and precipitation) as we had observed?

I'm going to cut to the core of what I think has been ongoing in the various situations at Mortlocks in the Arid Tropics. First of all, because it is a universal truth that "biology trumps chemistry" we have to look primarily at the things which have impacted soil biology to understand our observations. I think it needs to be said here that soils with highly stressed growing conditions for soil microbes will manifest big changes if growing conditions improve for the microbiome of the soil.

How does soil micro-biology develop by increasing in density? The Microbes need a house and food source. The house is represented by the root system of the plants and the food source is the carbon sources or sugars supplied by the plant through photosynthesis. Pretty obvious right?

What is not so obvious is the fact that the Vetch root system continues to develop and support rhizobium for nitrogen fixation from the soil atmosphere until the plant flowers and then attempts to grow even more lateral root mass before attempting to fill the seed pods.

In contrast the oats and other cereals terminate all new root system expansion at pollination. From that point forward in tiime the annual cereal root sytem is in a state of stagnation and ultimate decline as the crop matures and sugar production is directed toward starch formation in the seed.

Microbes retain water in the cell contents and do not allow it to escape into soil air spaces or to become capillary water which migrates toward the soil surface to be lost by evaporation.

Backdrop to the Situation- Not just in Australia

Modern farming technology has increasingly moved in the direction of less and less tillage depth. This has been generally accepted as necessary to reduce soil loss from wind and water erosion in virtually every environ. The problem with this approach is that the amount of soil which is accessible to root system growth keeps being reduced over time.

The problem with a reduction in root system depth and in may cases, mass as well, is that , the microbial world has lost housing and food sources in proportion to the root system reduction. This has resulted in a downward spiralling cycle of less begetting less which begetts even less.

A Terminal Patient needs Surgery- NOW!!!

Perhaps the pretty horrifying forecast from the Weatherman, Kevin, has produced a prognosis for the farmer which will result in a decision that surgery is needed if we are to save the patient. The question for the team which includes not just surgeons, but also pharmacists and psychologists, maybe physical therapists and many others is

WHAT DO WE DO FIRST? WHAT IS THE FIRST PLACE TO INTERVENE?

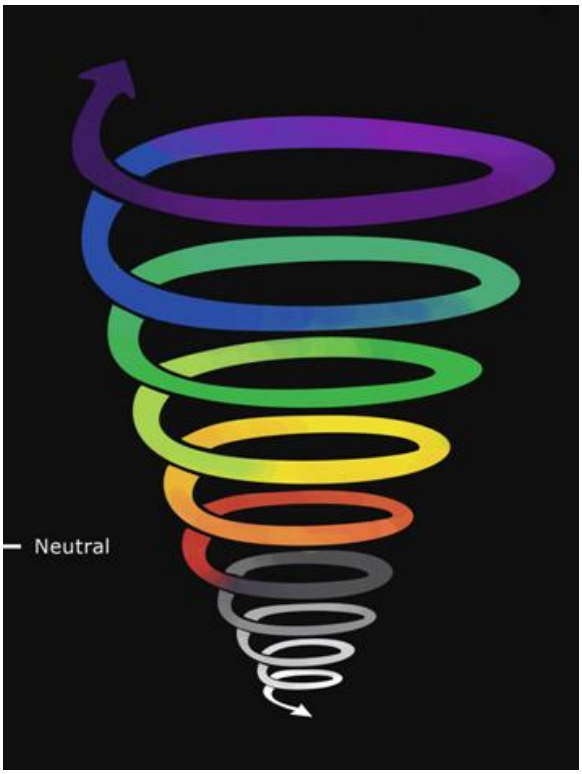
If the team agrees that restoring the soil microbiome density and diversity (to coin Dr. Lucero's motto) then we can move toward a decision fairly easily.

GO BUY A SOIL BIOLOGICAL AMENDMENT, RIGHT???

WRONG… If the soil is not providing shelter and food for the best bugs money can buy, how much can these microbes do to remedy the situation?

Yes, I was baiting you to tell me the answer which I think fits best. The problem with my answer is that in the marketplace today there are not very many choices for applying the fix. Yet the first incision in a surgical procedure is the most important one in most cases becauses it sets up all the rest of the procedures for the over-all success of the treatment. Making the wrong move first will be costly in more ways than one.

My bias is bound to come out so here you have it. The physical limitations of the soil to root development must be the first priority. If this is done right then the house (roots) can be built for the microbial world to live in and there will be a table at which to eat (sugars). This begins an ever-increasingly higher and broader spiraling effect of plant productivity, moisture retention and accumulating carbon resources for the future soil microbiome development.




Here's my favorite way to illustrate my take-away message.

If we start in the right direction first then the complimentary forces of God's Creation will naturally just kick into gear and keep things spiraling upward. If we make the wrong move first then the spiral with move downward as the complimentary "fallout" kicks into gear.

Of course our focus here has been toward folks with conditions that are limiting because of a lack of rainfall. Believe it or not the same principles apply to environs where there is at least seasonally excess rainfall. Keep the Biology alive and well and live well. The "connections" are inviolat. God Bless.



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