The Ideal Soil Chart (Agricola's Best Guess v 2.0 January 2014)

Based on a Soil Test using the Mehlich 3 method

Organic Matter (OM)	2% — 10%	Depending on climate
pH	6.4 – 6.5	Balance the minerals and pH will take care of itself

Primary Cations as % of Cation Exchange Capacity (CEC) **See appendix "Calculating TCEC" p 125**

Calcium (Ca)++ min 750ppm	60% — 85% (Ideal 68%)	Ca & Mg together should add to 80% of exchange capacity in most agricultural soils pH 7 and lower
Magnesium (Mg)++ min 100ppm	10% — 20% (Ideal 12%)	
Potassium (K)+ min 100ppm	2% — 5% (Ideal 4%)	See Phosphorus (P)
Sodium (Na)+ min 25ppm	1% — 4% (Ideal 1.5%)	Essential for humans and animals
Hydrogen (H)+	5% — 10% (Ideal 10%)	A lone proton. The "free agent"

Primary Anions

Phosphorus P- min 100ppm	P = **Ideal** K by weight (ppm) **BUT: phosphate** (P_2O_5) should be **~2X potash** (K_2O)	Needs a highly bio-active soil to keep it available.
Sulfur S - - min 50 ppm	1/2 x **Ideal** K up to 300 ppm	Need for Sulfur amino acids Conserves soil N and Carbon

Secondary elements

Iron(Fe) + min 50ppm Manganese(Mn) + min 25ppm Zinc (Zn) + min 10ppm Copper (Cu) + min 5ppm	Fe: 1/3 to 1/2 x **Ideal** K Mn: 1/3 to 1/2 x Fe **Zn: 1/10 x P** (up to 50ppm) Cu: 1/2 x Zn (up to 25ppm)	Iron and Manganese are twins/opposites and synergists, as are Copper and Zinc.
Boron $B^{3+ \text{ or } -}$ (cation or anion) min 1ppm	1/1000 of Calcium (max 4 ppm)	Essential for Calcium utilization. Calcium transports sugars
Chlorine (Cl)- min 25ppm	1x to 2x Sodium	Essential, but ages clays rapidly when used in large amounts
Silicon $Si^{4+ \text{ or } -}$ (cation or anion)	Ideal unknown. Si is the most abundant mineral in most soils. Active soil biology and balanced mineral chemistry will ensure availability.	

Micro (trace) Elements

Chromium Cr- Cobalt (Co)+ Iodine (I)- Molybdenum Mo- Selenium (Se)- Tin (Sn)+ Vanadium (V) + Nickel (Ni) + Fluorine (F) –	All of these are essential in small amounts. 0.5 - 2ppm is enough. Some of the micro elements (e.g. Mo, Se) can be toxic to plants and soil organisms in quantities above 1-2ppm. Use Caution when applying micro/trace elements in purified forms	There are probably 30 or so other elements needed to grow fully nutritious food. Sources are amendments such as seaweed, rock dust, ancient seabed or volcanic deposits, rock phosphate, greensand etc

Plants need at least 17 of the 23 elements listed above, as well as Nitrogen, Carbon, Hydrogen, and Oxygen.

Typical Mineral Content of USDA Organic Fertilizer Ingredients (%)

Animal Source	N	P as P_2O_5	K as K_2O	S	Ca	Mg	Fe	Tr
Fish Bone Meal	4	20		0.6	19	0.3		Tr
Fish Meal	10	4.5		0.6	2.3	0.3		Tr
Crab Shell	3	3.25	0.3	0.2	23	0.3		Tr
Blood Meal	13	1						
Feather Meal	12	0.1	0.4	0.4	0.6			
Bone Meal	3	15			20	0.4		

Mineral Amendments and Kelp

	N	P as P_2O_5	K as K_2O	S	Ca	Mg	Fe	Tr
Ag Lime					32-40	1-5		
Dolomite Lime					22	13		
Gypsum*				16	22			
Oyster shell					36	0.3		
Epsom salt**				14		10		
Potash sulfate**			51	17.5				
TN brown phos		3 (23% total)			40			Tr
Calphos		3 (20% total)			20			Tr
K Mag*			22	22		11		
Greensand		1	7		1.3	2.2	9	Tr
Kelp Meal	1	0.7	3	2	2	0.7		Tr

Tr = Good source of micro (trace) minerals

Purified Source	Sulfur S	Boron B	Iron Fe	Mang. Mn	Copper Cu	Zinc Zn
Ag Sulfur	**90**					
Borax**		**9**				
Solubor™**		**20.5**				
Fe sulfate $1H_2O$	**18**		**30**			
Fe sulfate $7H_20$**	**11.5**		**20**			
Mn sulfate $1H_2O$*	**19**			**32**		
Cu sulfate $5H_2O$**	**12.5**				**25**	
Zinc sulfate $1H_2O$	**17**					**35**
Zinc sulfate $7H_20$**	**11**					**22**

****Highly soluble in H_2O** ***Varies in solubility in H_2O**

Soil Report

Job Name **Jeremy Silva** Date 2/14/2019

Company Build A Soil LLC Submitted By

Sample Location			BAS Farms	BAS Farms			
Sample ID			Farms	AA 8.2			
Lab Number			133	134			
Sample Depth in inches			6	6			
Total Exchange Capacity (M. E.)			20.02	8.96			
pH of Soil Sample			8.1	8.1			
Organic Matter, Percent			3.44	3.44			
ANIONS	**SULFUR:**	p.p.m.	59	59			
	Mehlich III Phosphorous:	as (P_2O_5) lbs / acre	142	142			
EXCHANGEABLE CATIONS	**CALCIUM:** lbs / acre	Desired Value	5444	2438			
		Value Found	5972	2676			
		Deficit					
	MAGNESIUM: lbs / acre	Desired Value	576	258			
		Value Found	796	350			
		Deficit					
	POTASSIUM: lbs / acre	Desired Value	624	279			
		Value Found	654	310			
		Deficit					
	SODIUM:	lbs / acre	125	56			
BASE SATURATION %	Calcium (60 to 70%)		74.59	74.64			
	Magnesium (10 to 20%)		16.57	16.27			
	Potassium (2 to 5%)		4.19	4.43			
	Sodium (.5 to 3%)		1.36	1.35			
	Other Bases (Variable)		3.30	3.30			
	Exchangable Hydrogen (10 to 15%)		0.00	0.00			
TRACE ELEMENTS	Boron (p.p.m.)		0.96	0.96			
	Iron (p.p.m.)		75	75			
	Manganese (p.p.m.)		35	35			
	Copper (p.p.m.)		6.23	6.23			
	Zinc (p.p.m.)		8.14	8.14			
	Aluminum (p.p.m.)		127	127			
OTHER	Cobalt ppm		0.324				
	Molybdenum ppm		0.02				
	Ammonium (p.p.m.)		0.3				
	Nitrate (p.p.m.)		73.7				
	Selenium ppm		0.36				
	Silicon ppm		20.1				
	EC mmhos/cm		0.71				

Logan Labs, LLC

Saturated Paste Report

Job Name **Jeremy Silva** Date 2/14/2019

Company Build A Soil LLC Submitted By

Sample Location			BAS				
Sample ID			Farms				
Lab Number			128140				
Water Used			DI				
pH			8.1				
Soluble Salts		ppm	538				
Chloride (Cl)		ppm	36				
Bicarbonate (HCO3)		ppm	111				
ANIONS	SULFUR	ppm	13				
	PHOSPHORUS	ppm	0.14				
SOLUBLE CATIONS	CALCIUM	ppm	117.00				
		meq/l	5.85				
	MAGNESIUM	ppm	21.30				
		meq/l	1.78				
	POTASSIUM:	ppm	14.58				
		meq/l	0.38				
	SODIUM	ppm	9.39				
		meq/l	0.41				
PERCENT	Calcium		69.55				
	Magnesium		21.10				
	Potassium		4.50				
	Sodium		4.85				
TRACE ELEMENTS	Boron (p.p.m.)		0.14				
	Iron (p.p.m.)		1.14				
	Manganese (p.p.m.)		0.03				
	Copper (p.p.m.)		0.03				
	Zinc (p.p.m.)		0.02				
	Aluminum (p.p.m.)		0.73				
OTHER							

Logan Labs, LLC

Soil Calculator Shopping List

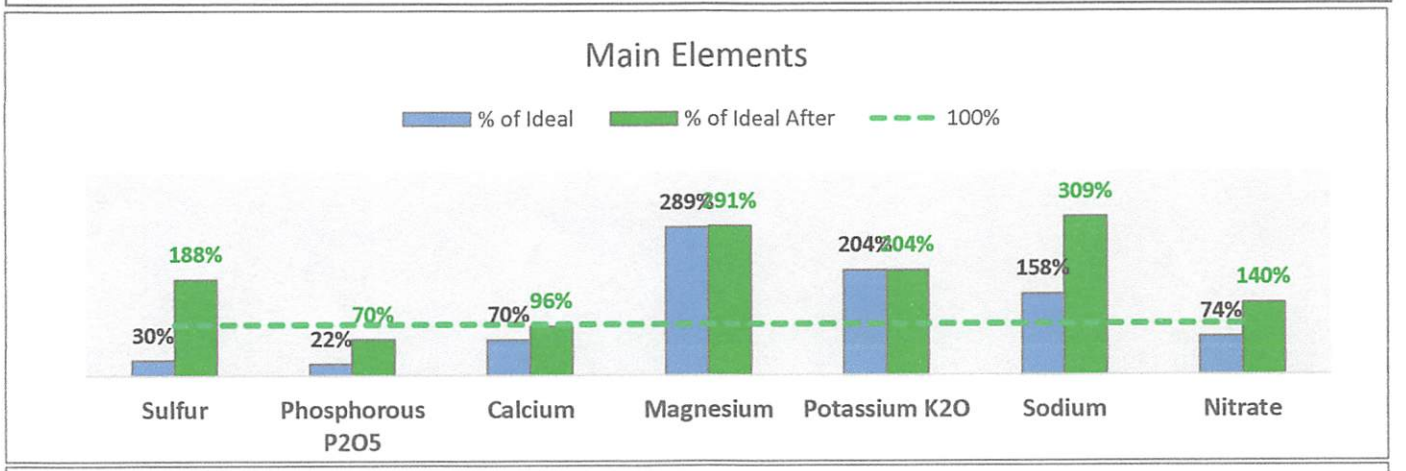
Sample Name: BAS FARMS

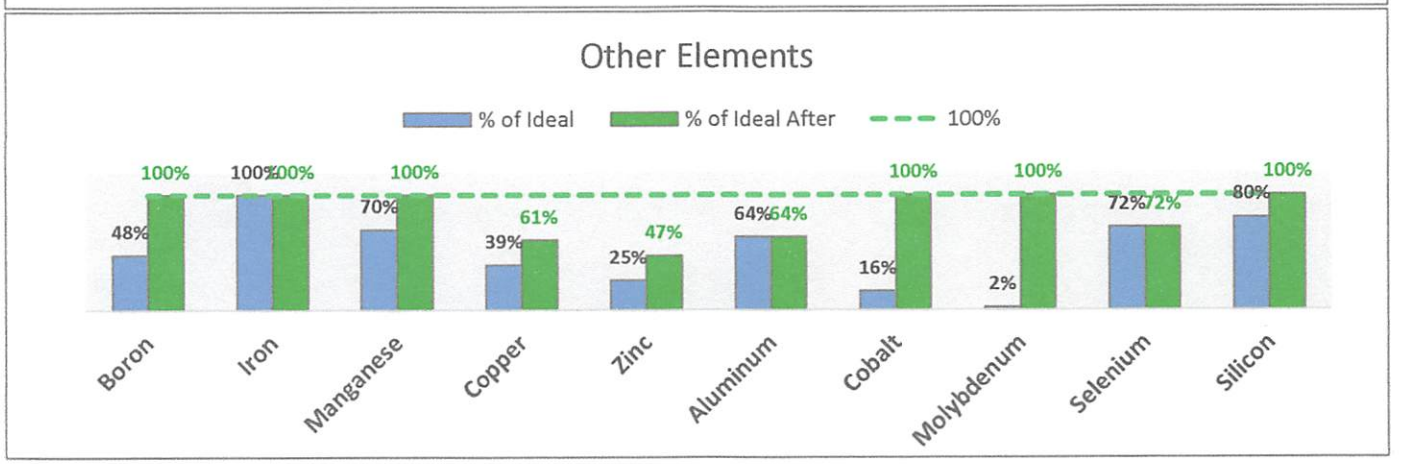
5016 N. Townsend Ave.
Montrose Co. 81403

855-877-7645
Instagram: BuildASoil
YouTube: @BuildASoil

www.BuildASoil.com
support@buildasoil.com

Ingredient	Lbs Per Acre	Grams Per Cubic Yard
Fish Bone Meal	1,500.00	843.87
Gypsum 20% Ca	2,956.00	1,662.98
Crustacean Meal 23% Ca	537.50	302.39
Big 6 - Optional	203.92	114.72
Manganese Sulfate	58.32	32.81
Copper Sulfate	26.55	14.94
Zinc Sulfate	37.58	21.14
Cobalt	10.67	6.00
Sodium Molybdate	4.83	2.72
Silica	12.89	7.25





BuildASoil DIY Report: COF

How To Make Your Own Complete Organic Fertilizer

All Credit to Steve Solomon from his Book, "The Intelligent Gardener"

Here is his background: https://soilandhealth.org/steve-solomons-home-page/

Note you can purchase these amendments anywhere in the world. If you are in the United States we do offer direct order online.

To make enough complete organic fertilizer to generously cover 100 square feet, mix:

If making potting soil add to 100 Gallons of soil or use 1.5 cups per cubic foot of final soil mix.

- 6-12 Cups Seed Meal
- 3-6 Cups Fish Meal
- 4 Fish Bone Meal (Or other high P source)
- 2 Cups Kelp Meal
- 2 Cups Basalt, Montana Grow, Glacial Rock Dust, Granite Dust or other rock dust

If you garden where the land originally grew a forest, add these two:

- 2 cups oyster shell flour
- 2 cups agricultural gypsum

or if you garden where the land originally grew prairie grass or is a desert add:

- 4 cups agricultural gypsum

If you are organic potting soil

- 2 cups oyster shell flour
- 2 cups agricultural gypsum

Optional Items:

- 1 teaspoon laundry borax or a smaller quantity of Solubor (1/2 gm actual boron)
- 1 1/2 teaspoons zinc sulfate
- 2 teaspoons manganese sulfate
- 1 teaspoon copper sulfate

Without knowing everything about organic fertilizer this recipe will work phenomenally well, but when you start to understand each component, you can really tell how well thought our his recommendations are.

BuildASoil has made it's own version of this recipe named, "Craft Blend" and we are very proud of it. Normally the above recipe is excellent but when you have a warehouse full of rare and high quality soil amendments you can really add some diversity to the recipe.

Our recipe is:

Thorvin Premium Kelp Meal Wild Flax Seed Meal Alfalfa Meal BuildASoil Organic High P Bran Camelina Meal Crustacean Meal Fish Meal 3x Fish Bone Meal	Soybean Meal Sul-Po-Mag (Also Known as K-Mag or Langbeinite) Organic Malted Barley Volcanic Tuff Micronized Basalt - Blue Ridge Meta Gypsum Oyster Flour

If you like content like this, be sure to checkout our Youtube Page and website

YouTube.com/BuildASoil www.BuildASoil.com

Sincerely,

Jeremy Silva

line of resistance will allow the earth's electric current to flow in the top soil.

Today's agricultural practices are not allowing the build-up of carbons. Instead, the carbons are being oxidized out of the top soil faster than they are being replaced. This situation allows the calcium to be moved downward in the soil by water movement leaving only the inorganic salts free to upset the osmotic gradients. Then water runs off and the soil compacts instead of the water moving into the soil to interreact with the carbons and bacteria. Soil oxygen is cut off and the freed salts along with the lack of oxygen cause the bacteria to go dormant. Plow pans and hard pans develop increasingly poor drainage problems, so it requires larger and higher horse-powered equipment to work the land. This situation rivals the hydroponic techniques. The problem is that the farmer does not realize that this situation has developed. All he may know is that it is getting more and more expensive to farm; the soil is getting poorer and poorer, and increasing disease problems are presenting themselves.

One other factor that needs addressing here is soil temperature. The more even the soil temperature, the more even the movement of energy into the plant, and the faster the germination process. Soil temperature is a function of solar radiation and the amount of ammonia nitrogen present in the soil. (Cold + NH_4 ------ Heat + NO_3) This tells us that the more ammonia nitrogen (NH_4) present in the soil when it is cold will boil and give off heat and nitrate nitrogen (NO_3). Ammonia was used for many years as a refrigerant because it has the unique characteristic of freezing when it is heated and boiling when it is cold. Its reaction in the soil is very similar. Ammonia not only buffers the soil being too cold, but also keeps it from being too hot. When at proper levels during hot weather, it will do its refrigerant act and absorb heat. So the farmer's soil that has the proper ammonia nitrogen present will have a warmer soil earlier in the spring and a cooler soil during the heat of the summer. Besides that he will have a warmer soil in the fall when the weather turns cold. Some have seen how they have had some garden vegetables late into the fall when others had all ready been frozen out.

BASIC PROGRAM - first year

What follows is suggested as the **ideal procedure** to follow for the **first year. Remember that it is "ideal."** This means that it is an **irrigated situation and the soil amendments and plant food materials that are used, are used here for the first time in this particular style.** This is the reason for the basic quantities used.

The ideal is presented first because it will give a **reference point** from which modifications can be developed for the individual needs, plus the closer one can follow, in principle, the ideal basics, the better the probability of faster results. Keep in mind that compromising on the basics is a fact, but the more the compromise the more the need for having all the required and needed information at your finger tips all the time. The more the compromise, the greater the potential for not getting the reactions one is seeking.

STEP ONE:

As soon as the crop is off in the fall of the year do a **complete soil analysis.** This means a complete soil test procedure for the available major and minor elements as spoken of in earlier chapters. It also means that you would be wise to have a mineral assay done of the top and sub-soils so that you know what minerals, major and minor, may

be there but unavailable. Knowing what is in your ground and unavailable may mean less soil amendments needed later if you make them available by your farming practices.

Do not let your soil dry out during this time of year if at all possible. Dry soil can adversely effect the ongoing bacterial activity that is so important. The bacteria will go dormant thus cutting back on the total yearly blending time. It is very similar to shortening the growing season, as if you had moved the plot of land further north. Letting the soil get dry will affect the soil test results on soluble elements like nitrogen. **Remember that a decrease in moisture is an increase nitrogen and vice versa.**

STEP TWO:

Plow your soil with a **mold board plow in the fall** of the year. **Why the mold board plow?** The reason goes back to the way the mineral moves in the soil, particularly carbon, calcium, and phosphate colloid. As you will remember, calcium is a ninth-tenth layer element. It tends to move deeper into the subsoils. On the other hand, the carbon and phosphate colloids will want to move toward the surface into the topsoil. The mold board plow is the only implement that actually flips the soil upside down without mixing. In other words, it does not mix the soil. This is important in the fall of the year, **firstly,** because the flipping of the soil puts the carbons and colloids that were moving to the surface back down under the calcium that was heading down in the soil. As these elements start their migration process in the soil, the carbon and phosphate colloid moving upward will pick up and hold the calcium that starts moving deeper in the soil. This is very important for proper top soil building and preventing calcium leaching and plow pan formation. Using the mold board plow is important **secondly,** because it leaves a roughened surface that will promote water retention and not run off and cause erosion.

The **only exception to the use of the mold board plow** is in a tree crop situation as in mature **orchards, groves,** and **vineyards.** In these cases do not cultivate at all. Just apply the plant nutrients to the ground between the trees and vines. The reason for this non-cultivation is to not cause the loss of energy from the plants bleeding through roots that get cut by cultivation equipment.

STEP THREE:

Apply 1 ton of Soft-rock Phosphate per acre (see Chapter 8 to review understanding). This is not rock phosphate, but Soft-Rock Phosphate, also referred to as colloidal phosphate, or waste pond phosphate. This is the first layer of plant food to be applied to the soil. Because Soft-Rock Phosphate contains the very important phosphate colloids that grab onto and hold other mineral for transporting them to the plant, it must be laid down before any other plant food substance. It is very important to remember that most soils usually have an excess of potassium. Since potassium has to work in a proper ratio with phosphate for the best energy reaction, it means that the farmer has to do everything he can to get that ratio to come into line as fast as possible. This is why a minimum of **1 ton per acre, on irrigated land**, is recommended at the beginning. More is better provided that the calcium is not at real high levels all ready.

Keep this one principle in mind. The shorter the growing season, the less time for having active bacteria involved in the proper soil nutrient blending. This is because

of the temperatures dropping below the level at which soil bacteria function, thus putting them into a dormant state. Because of this, on irrigated land at high altitudes or quite far north, it is best to use less on the first and any subsequent applications. Otherwise the bacteria cannot handle the larger amounts in the shorter season. In other words, you will not see the ratio come into line any faster by using more in those areas of the world with short growing seasons because of the shortened bacterial activity.

STEP FOUR:

Apply 1-2 tons of High Calcium Lime on top of the Soft-Rock Phosphate. The Calcium is applied on top of the layer of phosphate. This is so that a bonding reaction takes place between the Calcium and the Phosphate. Soft-Rock Phosphate can hold 6 times its weight in extra Calcium. This means that each ton of Soft-Rock Phosphate can hold up to 6 tons of High Calcium Lime in the top soil.

Apply the Lime as soon as possible on the Phosphate. This is to make sure that the bonding gets underway as soon as possible. The bonding that takes place between the Phosphate and the Lime causes energy to be given off. The reaction produces enough energy that it can actually have a small sterilization effect in the soil under it. This is the reason that the farmer should not plant any seed for 14 days after the Phosphate and the Lime have been layered together. If he does, he will find that there will be very poor germination because the initial Phosphate-Lime reaction will destroy some seed. And by applying these substances in the fall of the year, it will not only assure that seed time will not be interrupted but will give extra time for allowing for bacterial blending somewhat before spring.

This bonding will also play a part in the prevention of water and wind erosion on any land it is applied to in the layered method.

It should be emphasized that the best Liming substances to be used for this step are: High Calcium Limestone Flour (the finer the grind, the better), Beet Lime, Basic Slag, and Araganite. (see Chap. 7 for review of these substances) **Remember, do not use dolomitic limes!**

The first three liming substances mentioned in the previous paragraph have a significant amount of carbonate in them. Carbonate contains the element carbon. This means that these types of limes contribute to building the carbon (water holding ability) of the soil.

If your soil contains plenty of available calcium, then you do not have to add any. So just skip STEP FOUR and go on to five.

STEP FIVE:

Once in a while, a farmer will have land that does not have an excess of potassium. When this is encountered, one of the best and cheapest materials to add is sawdust. Apply according to the ratio needs demonstrated by the soil test. It may require upwards of 2 tons in some cases. Sawdust will have about 4 units of potassium per ton. Again, the best time of the year to apply sawdust is in the fall of the year because of the time it takes for release of its potassium. That is, 60-90 days is needed before the potassium is released depending on the temperature and bacteria.

STEP SIX:

Apply as much manure as possible to apply as the next layer. The preferred ma-

nure is chicken because of its mineral content. Chickens are very well fed animals. Yes, chicken manure is a very hot manure. This is why it is best to apply it in the fall of the year. Apply 4 to 6 tons per acre It has time to blend and mellow over the winter.

Remember that chicken manure is high in Boron, so for crops that it may effect adversely you should go easy with it. Strawberries are an example of a sensitive crop.

Cow or Dairy Manure is about the cheapest, so apply as much as is possible to get hold of. Twenty tons per acre would not be too much. For overall best result with manures use about 90% cow manure and 10% chicken manure and apply about 10 tons at least per acre. The more the better. Remember we are talking about and irrigated situation.

Some, I am sure, will wonder what the difference is between steer manure and cow-dairy manure. The cow-dairy manure is usually a better manure for two reasons. One is the way the cows are fed, and two, this manure usually has much higher levels of urine residues which can carry higher levels of phosphate.

Other manures like horse, rabbit, and sheep manure can be used also. Horse manure is high in boron like chicken.

In an **orchard or vineyard** where you should not cultivate, just apply the manure on top of the other plant foods in the centers of the rows between the drip lines of the trees or vines. Keep the manure away from the trunks of the trees and vines a few feet. Some of the thinner barked trees and younger vines can be burned by the manure being next to them.

Where the farmer can develop a high powered compost, this can be added instead of manure. A high quality compost will be more active and accomplish as much as manure with less amounts used. Remember how we have alluded to the fact that high, high bacterial activity is a key to high level mineral blending in your soil. Composts, if made right, can be the source of this high quality bacteria, so that 1000 lbs. of high quality compost can be equivalent to many tons of manures.

Example of a formula for a high quality compost is as follows:

--1 ton of manure, or mushroom castings.
--1 ton of sawdust (avoid using pine sawdust).
--100 lbs. of Soft Rock Phosphate per ton.
--200 lbs. of High Calcium Lime or other high grade lime source.
--40 lbs. of sugar, or better, 4 gallons of feed grade molasses.
--20 lbs. of fish meal, or 2 gallons of liquid fish.
--50 to 100 lbs. of beet pulp or citrus pulp.
--10 lbs. of blood meal.
--2 lbs. of Iron sulfate.
--2 lbs. of Copper sulfate or powdered Blue Stone.

These ingredients are combined and mixed well and heaped up in a high stack. Moisture is added during this process of mixing if there is not enough in the ingredients that go into the mix. Other agricultural wastes can be added in with this mixture as a part of the compost process.

Moisture is very, very important to the composting process. Not enough moisture can cause the compost to get too hot and end up with too much ashing of the ma-

terials. Dr. Reams always made sure the temperature of the compost never exceeded 144 degrees Fahrenheit. This means a tremendous lose of biologic carbons as well as chelated mineral bacteria. Lack of moisture will also prevent the composting process from getting started properly.

A simple way to test the moisture in the pile is to take a couple of unfinished broom handles and push them into the middle of the pile after it is mixed. Leave just enough sticking out of the pile so they can be located and pulled out. Go back in a few hours and pull them out. If they are darkened from moisture absorption the full length that was in the pile, then there is sufficient moisture to start the composting process. If they are not showing any signs of moisture absorption, then more moisture must be added and the pile mixed again. Leave the broom handles in the pile between mixing so that the moisture can be monitored on a regular basis throughout the compost process.

The stack is turned, remixed, and stacked every 7 to 10 days. The only time it is necessary to cover the stack is to keep off excess rain.

When the heating of the mix subsides in about 21 to 31 days, depending on the air temperature and adequate moisture, check to see if the composting is digested. To do this, pick some out from the moist layers and squeeze it through the fingers. If no stain appears on the hands then the process is considered complete. If your hands stain, then the compost is not completely digested. Somewhere during the process there was something that interfered with its completion; either the temperature was not right, or the moisture was not sufficient during the whole time, etc.

Compost of this quality is many times more beneficial than the usual composts. A thousand pounds per acre can be more effective in many cases than tons of poorer types.

A lot of commercial composting is being done now by using special machines to turn the material that has been put into wind rows. The major concern about most commercial composts is that they do not have any extra phosphate, calcium, or trace mineral added into the process to make the end result much more potent.

Sometimes it can be helpful to inoculate extra bacteria into the compost mix.

STEP SEVEN:

In this step add extra Iron Sulfate and/or Copper Sulfate if the tests show that there is not enough of these elements. You can add up to 100 lbs. per acre if needed. This is applied on top of the manure.

STEP EIGHT:

Leave the above layered plant foods undisturbed though the winter until spring. You will note, if your land is located where you get winter snow, that when you have treated the ideal way, the snow will be off of your land before it is off of the neighbor's. This faster warming is due to the higher level of ammonia nitrogens being generated in the top soil by the bacterial action in the manure and/or composts you have added.

STEP NINE:

In the spring of the year, when the land is ready to prepare for the seed bed, do another complete soil test for the available nutrients only. It is best to do this particular test about 2 weeks before your scheduled planting time; for a row crop and for a tree or

vine crop it would be about 2 weeks before the blossom time. Then whatever additions of fertilizers need to be made to give added boost to the seed bed should be put down about 2 weeks before planting. This test will show what parts of the nitrogen-phosphate-potassium-calcium-iron-copper soil nutrients that may need attention. It will particularly be the first 4 elements that may need some attention. The most common one at seed time would be the need for more (anionic) nitrate nitrogen. If so, then you would have to consider what fertilizer substance is going to be used to boost the nitrate nitrogen.

For example, if nitrate nitrogen is low and this field could use some extra calcium, then Calcium Nitrate could be considered for the seed bed. Or let's say that you have sufficient calcium but the nitrate nitrogen is low. Then you could consider using ammonium sulfate in the seed bed. You say, "Wait, that is an cationic nitrogen and I want anionic nitrogen at seed time." Why Ammonium Sulfate?

The reason it can be used at seed time is related to calcium levels. If the available calcium is above 3000 lbs. per acre, then the ammonia nitrogen will follow the line of least resistance and become a nitrate. Study out the options and remember that the exact same adjustments or fertilizers will not necessarily be required every year. Remember that there are liquid as well as granular plant food materials that may work in your situation from time to time depending on the tests and environmental circumstances.

STEP TEN:

Prepare the seed bed. It is important to remember to keep your soil preparation shallow. If the soil is prepared too deep in the spring it will spread the energy too deep, too fast. This would mean that there would be too great a dilution of energy for the maximum needs of the newly developing plants. The more of the basic soil treatment materials added, the deeper the seed bed can be worked. But it is best to keep it less than four (4) inches. Any additional plant foods added to stimulate the seed bed, as spoken of in step nine, should only be worked into the top two (2) inches of the seed bed. Remember that the deep soil preparation should be in the fall of the previous year.

In tree and vine crops keep in mind that there should not be any cultivation. This is because the feeder roots will be coming into the top soil and cultivation will begin to cut more of these and this would mean that energy would be lost out of and from the plant. This would reduce crop health and production.

STEP ELEVEN:

Planting time. Obtain the best quality seed available. This means the seed that has the lowest count per ounce or pound. In other words, as an example, bean seed that has a count of 1100 seed per pound is better than seed of the same variety that has a count of 1300 per pound. Remember, the higher quality seed will take in energy faster so it will germinate faster.

When it comes to seed-plant populations, it is advisable to plant more seed per acre than is usually recommend or you have been used to using in the past. But first check the germination rate. If the germination rate is less than 85% then plant 20 to 25% more seed per acre. Otherwise, plant 15% more seed per acre. Remember, if it is possible to save your own seed for future years planting, it is best to do that. Then you will

be developing a very high quality seed that will germinate faster.

Another consideration that can be of value along with the program is the use of seed treatment. Seed treatment has been found to be beneficial for protection and stimulation of the seed. But seed treatment will not work miracles on seed and soil that are poor. The type of seed treatment and how it is used should be relative to the soil-seed needs. Do not just use a seed treatment because it is popular to use. That would be just an unnecessary expense. Because carbon is a moisture attractor and holder, the best seed treatment would include sugar (liquid or granular) as one of the ingredients to coat the seed.

STEP TWELVE:

Check **Ergs** and **Nitrogen** at planting time. This will give you one final check to see if the soil energy is shaping up as planned. **Ergs** will tell you if there is enough energy reaction going on in the soil to germinate and feed the seed properly. **Nitrogen** will tell if there is enough electrolyte present to carry the electrical force in the soil to the seed. By running a check at this time it will allow for time to correct some deficiencies that may interfere with the maximum anionic growth.

STEP THIRTEEN:

At 10-14 days thereafter check **Ergs** and **Nitrogen** and make sure the information is kept on file for future reference. The tests can be done more often if you feel it is necessary. In fact it is a very good learning experience to test quite often so that you get a clearer idea of what is happening to the soil reaction throughout the growing season the first year.

It is also suggested that you record soil and air temperatures. By checking soil and air temperatures you will be able to understand indirectly how the soil bacteria and ammonia ions are working. You will also start to see a correlation between **Ergs** and temperature at times as discussed in Chapter 5.

It is usually only the **Ergs** and **Nitrogen** that are done throughout the growing season. **Ergs** should be no lower than 40 at seed time and no greater than 150. If too low, it means not enough energy is being released. If too high, then there is more energy coming out of the ground than the plant can handle. This means a waste of energy and money. At pollination time the **Ergs** should reach the maximum needed. It should not be less than 100 and bounce up to 400 at certain times but is best to keep an average around 200. Remember that the **erg** reading is established by the level above the "baseline." (see Chapter 9)

Increasing **Ergs** is done by the use of catalysts. The main catalyst is the fertilizer called Single Super Phosphate also known as 0-20-0. Other fertilizer materials that can be used as catalysts in certain situations include: Ammonium Sulfate, Ammonium Thiosulfate, Ammonium Phosphate, Calcium Sulfate, Calcium Nitrate, Potassium Sulfate, and Potassium Nitrate. The primary catalyst, Single Super Phosphate is used at the rate of 100 to 200 lbs per acre, depending on the amount of available calcium per acre. If there is less than 2000 lbs. of soluble calcium per acre, use 100 lbs or sometimes less in two applications 2 weeks apart. If over 2000 of calcium is available per acre, then use 100 to 200 lbs. If you want to make two applications for better sustained reaction, then use less at each application.

STEP FOURTEEN:

As a cross check during the growing season, use your refractometer to check the developing sugar levels in the plant sap. In fruit it is best to check the sugar in the early stages of ripening. In checking the sugar of the annual crop, check various parts of the plant. You will find that the poorer the phosphate - potassium ratio, the greater the difference between the top of the plant and the bottom parts of the plant. When the sugar is quite similar all the way up the plant, it means that the phosphate is up to what it should be in relation to the other minerals in the soil.

Catalysts for increasing ERGS can also be applied through irrigation, especially sprinkler and foliar sprays.

STEP FIFTEEN:

Moisture control is very critical to your crops proper progression. During the growing season it is ideal to work toward maintaining 50% moisture at all times. However, the lower the biologic carbons in your soil the more difficult it will be to maintain the ideal moisture.

Since biologic carbons are able to hold as much as 4 times their weight in water, it behooves the farmer to build the humate structure, containing the biologic carbons in the soil toward a level of 10%. This takes time, minerals, bacteria, and good husbanding.

In the meantime irrigation practices need to be evaluated in order to maximize the carbons that are present.

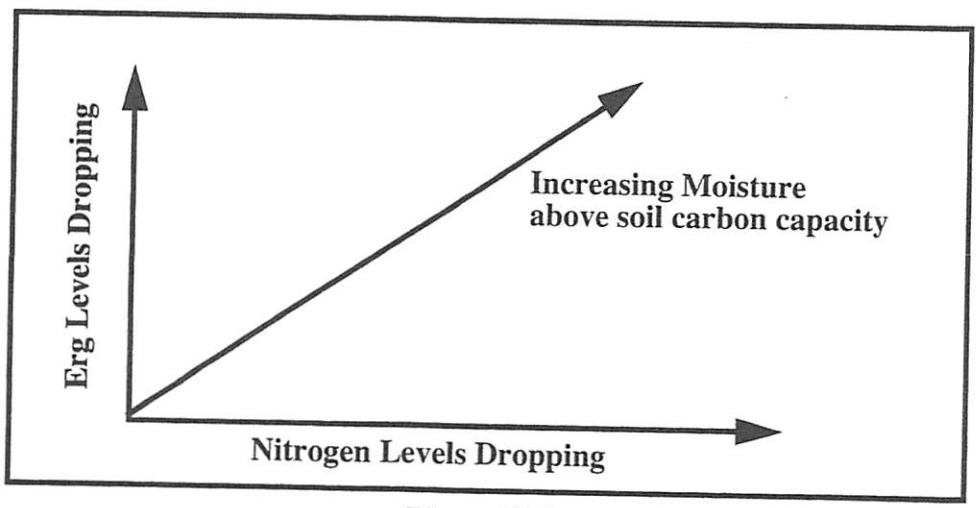


Figure 10-2

As you learned earlier, the lower the biologic carbons in your soil the more often you will need to irrigate, but with less water each time. This is because any water in excess of what the soil carbons can actually hold will move to the aquifers or subterranean ground waters or just run-off the surface of the field. Run-off into the surface and subsurface water means leaching and loss of mineral energy. In other words, excess irrigation water will dilute out nitrogen and ergs so that crop growth and development are impaired.

Look at Figure 10-2 to see how this problem is illustrated.

When carbons are low, the result is erratic instead of steady Ergs. This is because as the moisture rises and falls, changes in Ergs are also activated. The ideal growing condition will deliver very steady energy throughout the growing season. Figure 10-3 shows two ways irregular moisture can effect Ergs. First, the narrow line shows how Ergs can suddenly rise when the moisture increases and then gradually taper off as the soil drys out. The bold line shows how Ergs can decrease with sudden large influxes of moisture due to a drowning of the soil, so the Ergs are diluted out and drop suddenly.

When the carbons are high, the see-saw effect is not as pronounced, meaning that energy delivery is steady. In other words, growth is steady not erratic.

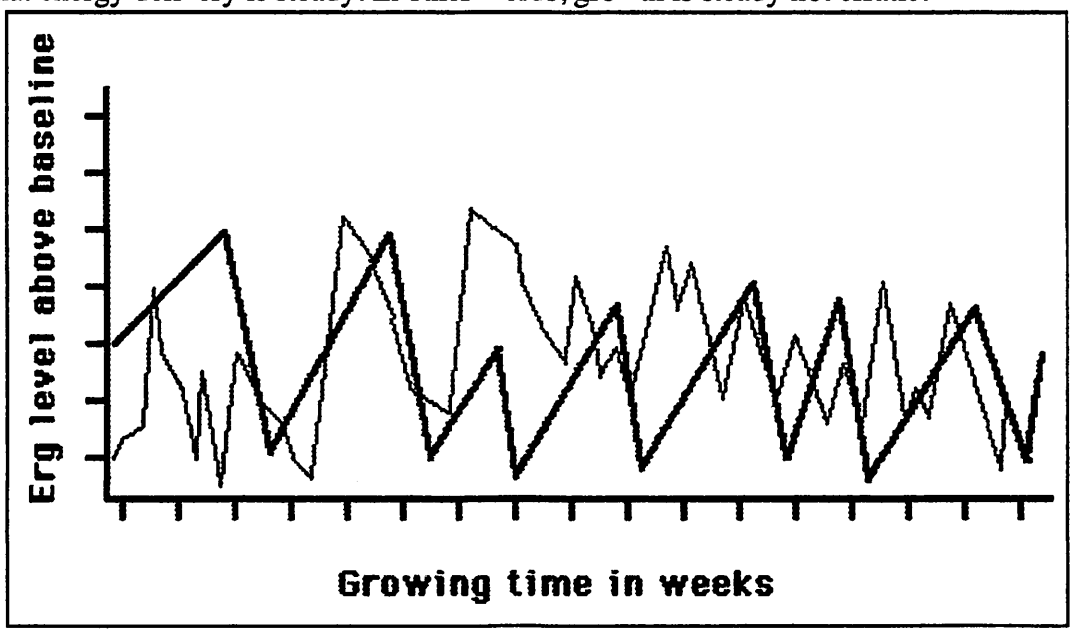


Figure 10-3

There are two preferred ways of irrigation that probably give the best potential for controlling moisture, one is sprinkler and the other is drip.

Probably the poorest way to irrigate for good energy control is flood type of irrigation. This is because so much water has to be run over the land in order to get the water across a certain distance.

STEP FIFTEEN:

It should be planned to apply 200 lbs. per acre of a substance called Sul-po-mag between July 15 and Sept. 15, in the northern hemisphere. This is to work as a catalyst for the uptake of phosphate of copper in the plant. If copper is not available to the plant, the bark or cuticle of the plant does not grow properly. When that happens it will either contribute to problems like fungal infections (such as damping off mold) or sap oozing from the bark (such as gummosis). Or it can cause the tree to become "hide bound" so that the growing layer of the bark will not expand properly and sap flow in interfered with.

STEP SIXTEEN:

In the fall of the year after harvest, another complete soil test should be done. This will then supply the information necessary to further define the needs of the soil as you work toward the ideal working ratios of mineral energy.

Again do cultivation with the mold board plow and add what is shown to be necessary for the next year's crop. This will be left the same way over this winter time as the previous one.

BASIC PROGRAM - second year

Procedures in the second year will follow the same general outline as covered in the first year. Planning for the second year should have started during the latter part of the first year in the fall. When the complete soil test is done, then what materials and methods that will needed can be outlined. If more Soft Rock Phosphate and/or lime is needed in the fall, then it needs to be ordered to be applied in time for the fall application. If there is a need for more substances to increase the biologically active carbons, then these also need to be applied so that the winter months will allow for as much blending as possible. Of course areas where the ground freezes will, as was mentioned earlier, limit the bacterial activity to the active growing season. Nevertheless, it is best if it can be gotten on in the fall just for the time savings when spring comes.

In the spring of this second year, again run a complete soil test. Determine what will need to be done to get the seed bed in the proper structure, energy, and condition. Any granular plant food materials that need to be used in the seed bed preplant should be applied two weeks before the planting and worked into the top 2-3 inches and no deeper.

Monitor ERGS and Nitrogen and adjust them with top dressings as needed through the growing season.

BASIC PROGRAM - third year

The third year will be as the first and second years. Be sure to do the complete soil tests so that current information is available to give time for applications of needed additions of plant food materials.

You should begin to see the phosphate potassium ratios begin to come into their proper relation by this year, providing you have done your homework.

DRY LAND VARIATIONS

Let's consider possible variations to the BASIC PROGRAM in situations where it is not possible to have moisture control through irrigation.

After reading through the various steps of the ideal procedures it may look a bit impossible to apply these principles where there is unpredictable moisture. However, this is not the case. Even though moisture control is extremely vital, the assumed "dry land" farming programs can also be benefited. This is because the assumed "dry land" situation is not as dry land as it may appear on the surface. Yes, there is not the amount of available moisture as in irrigated situations, however, there is moisture available. And these principles can capitalize on it to the greatest possible extent if they are understood and applied in their broadest sense.

So we will go back through the various steps in the ideal program and point out modifications or possible variations to give an understanding of what can be done to implement changes in the ideal program to fit the "dry land" farm situation.

STEP ONE:

This is basically the same as in the ideal procedures. All of the soil analysis