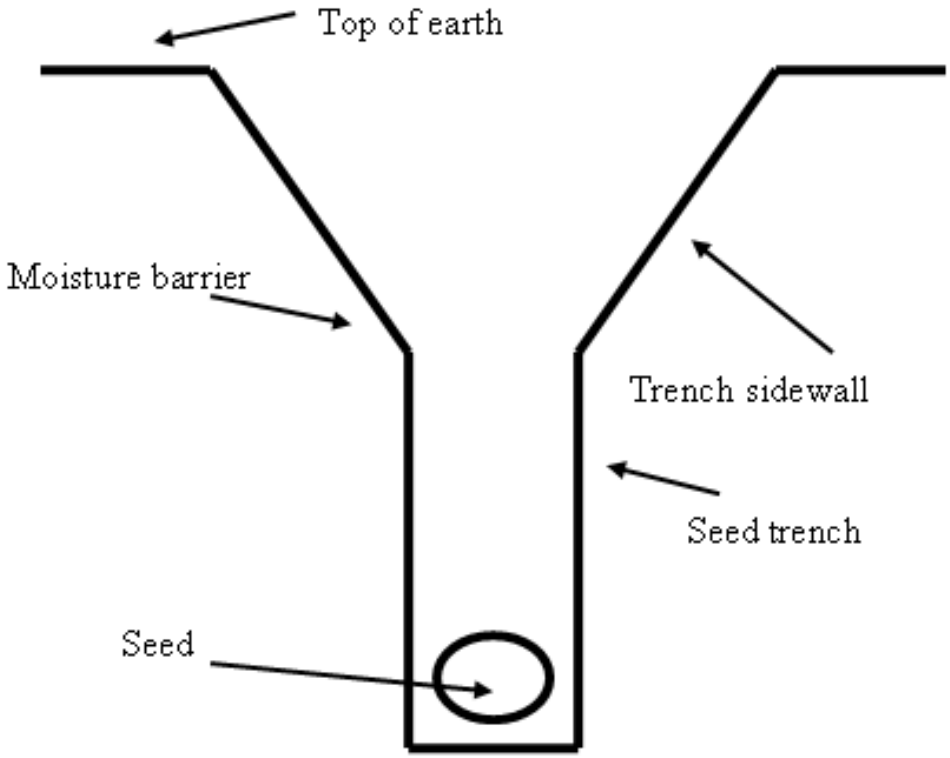
How to Grow Corn (or almost anything else) Anywhere in the World- Even in a Desert

A treatise on using natural moisture cycles, hydrostatic tension and minimally invasive methods in farming dry regions- while still making a healthy profit.

The Trench Method



Foreword

I should like to thank three specific entities for their help and guidance in discovering this method.

First, to the Hopi Indian and the other Indians of the Southwest. They showed me that with diligence and understanding, one could indeed not only grow enough corn to survive in the desert, *but thrive.*

Further, the Indians have shown me that the desert lends itself well to minimally invasive methods. One does not have to break ones back to produce large surpluses of corn and other crops. Neither does one need disturb the land much.

Second, I should like to thank Professor John A. Widtsoe, of the Agricultural College of Utah in 1910. In this year, he published a book called, "A System of Agriculture for Countries Under Low Rainfall." This work was a true awakening to my understanding of what the Indian and by chance myself, knew instinctively to be true. Specifically, he outlined the theory, methods and practicalities of desert soils and really all soils.

He foresaw over a hundred years ago the need for deserts to produce food. He knew not the exact methods by which the deserts would bloom, but he laid down the bedrock principals by which desert farming would become a reality. He was sure in the foresight that one day his understanding would be used to make the desert bloom. It is upon his broad shoulders that I stand, confident that his thought and wisdom shall not allow me to fall.

And lastly, but firstly, thanks are to be given to God. Whom, in his wisdom, designed deserts in such a way that they would one day rise to valuable lands, as valuable as the corn rich lands of the American Midwest. That day is not here yet, but this book seeks to hasten that day by means of understanding what desert soils really are- banks that deal in moisture.

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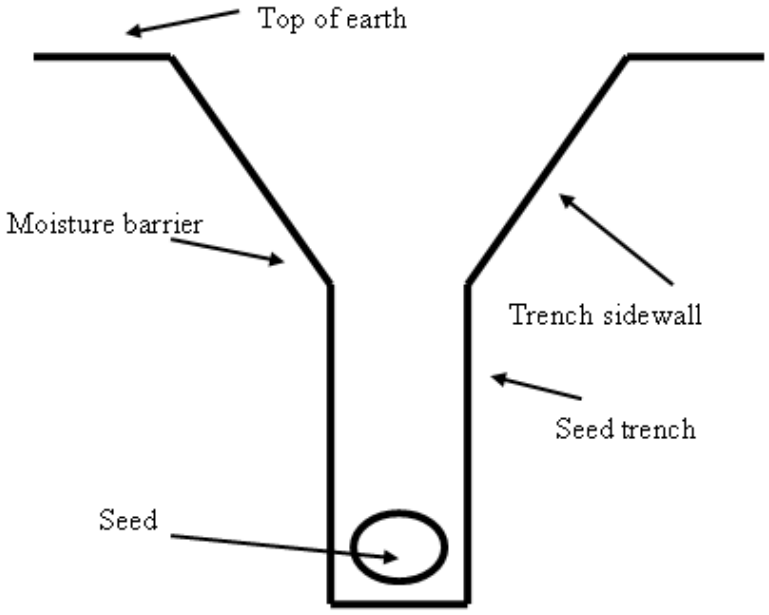


A trench is carved into dry soil in the shape of a funnel. The bottom neck of the funnel sits four to six inches into the soil, depending upon the type of crop and the soil. The upper half of the funnel is between two to four inches in depth.

Once planted, the method takes advantage of natural forces that backfill the trench with pebbles and sand, though the top portion remains open. This backfill protects the seed from pests and it prevents the passage of evaporation of moisture from the trench.

During rain events, the funnel concentrates water where it will do the most good- in the seed trench. As the season progresses and the soil dries out, the sidewalls harden to form a moisture barrier. This barrier operates at a depth of around three inches for most soil, but especially desert soils. The seed resides below this three-inch barrier. Roots of the plant grow even deeper, branching out in both horizontal and vertical directions.

This root depth assures the plant will never run out of moisture and is identical in effect to the long tap root of native desert plants.

Using this method, I was able to grow corn and other crops without any irrigation.

Chapter One

The Need for New Approaches

One would do well to look upon and question the need for marginal lands and even deserts to be pressed into use by a farmer. The Midwestern United States and indeed the worlds existing farmland supply seems adequate, even given the Earth's large population growth. One might truly say that starvation is a monster of humanity's own creation. Governments may be corrupt and sell grain on black markets that was intended to feed their hungry people. One group may be rebellious and fight against a government or charity trying to provide humanitarian relief. It can be argued that the world grows enough food, especially corn, to cover our dietary needs. One could say that a new seed needs to grow in man's heart, rather than his fields- a seed of kindness to his fellow man.

But,

A simple overview of history will show that man does not have enough of that seed in his heart. Further, there will always be waste and abuse in any human system. So even though supply in theory meets demand, we see massive shortages and the compounding of natural famine by man's own mistake or even design. It is then for those that go to bed hungry, that I offer this freely.

The need is obvious that the world in this time of high commodity prices, needs more supply. Or at least the potential to increase supply- in order to help lower commodity prices to something more affordable by the common people of Earth.

Further, when one looks at the increasing use of corn and other agricultural commodities as fuel, we can see that use placing huge strains upon our agricultural systems. Debate remains as to the viability and wisdom of using food as fuel, but no one sees that use going anywhere but up. In the Western world, we often sell our excesses to foreign countries. Yet with these excesses becoming ever more of a valuable commodity, the common people of Earth will suffer. I do not mean this as an appeal to use food for food, not fuel. Markets will do what they do, regardless of any attempt to control them. What I am saying is that we need to see the justification for the increase of capacity. We need to think about and plan for developing of what one might consider "marginal lands" or even *wastelands* into production.

And what of the great prairies of America, the family farm and the corn sick land? How long can we go on shoving chemicals into the ground to make up for what we take from it? How long can we continue to pump

water from aquifers that may or may not be replenished? Some say forever, some say we are doomed. I do not know who is right, but I know that America and the world would benefit from small local farmers growing fresh food close to the demand, rather than the monolithic corporate farms we see spreading across the world. Mega farms are not bad, they have their place and indeed my methods are adaptable to them too. But the small farm has a place in human futures as well.

The small farm and the small farmer, this is a calling. I believe it is an inalienable right to be able to feed oneself, one's family and one's community. I believe that every human must have the choice to sustain themselves directly, to eat from the bread of their own hand and to profit from farming their own land.

One should not have to be at the mercy of even a good government to simply put bread in their child's mouth. Some men and women are called to farm. To do else is a wasted life.

And what of grain prices rising five to eight times their average just a decade ago? What does this do to the common people of Earth, the humble billions of Earth? The person who has no savings, no office to work in, no factory in which to seek remuneration for their labor- what do they do? Indeed, I could fill a book with the reasons for increased food production.

But anyone considering the current trends on this Earth will see that sooner, rather than later, supply will not match demand.
And what of the world's desire to live as many do in the West? Can we mumble to them through mouthfuls of food, that they have no right to eat meat? That they cannot have chicken, pork and beef as a daily meal? Oh granted, our overabundance of these meats come with its own curse, but is it ours to say to our brother that he must not eat meat? This whilst our barbeques roast, our hamburgers sizzle and our corndogs fry. This alone is reason enough to increase production. The standard of living is on the rise across the globe- good. We can do little to stop it- nor should we! So we must prepare for it. Higher standards of living mean more demand for meats which mean more demands for grain which means more farmland must be placed into service.

But is the path to more production paved in the stone of Western style agribusiness? Is it to be realized with chemicals, fertilizer, insecticides and herbicides? Is big dollar science like gene swaps, hybrid grains, and poorly understood amendments to our seeds the path to a greater world yield? Is the mega machinery of the American Midwest with its mechanized giants churning across vast swaths of land the only way we will feed the world?

Do not misunderstand, high dollar science and technology have increased yields and do meet the foreseeable demands. But let us not forget that Western agribusiness is not something that can just be setup overnight- or even in the space of a decade. Greater yields led to the need for better and cheaper forms of transportation in America and Europe. One was responsible for building the other. And once better yields caused transportation to link to America's farms, tools, chemicals, technology and ideas flowed back along those same lines.

When one thinks of Africa and its lack of transportation, one sees that a simple yield increase will have drastic effects for the betterment of humanity living there. It will take time, but even small increases in yield will bring better transportation links to people in Africa- just as it did in Midwest America.

And what of countries recovering from the upheavals of revolution?

A good example of a country in revolutionary upheaval is Zimbabwe. Farms were owned nearly exclusively by white farmers for generations. White farmers held not just the land and the tools, but the knowledge and particular experience of how to grow a surplus of grain on their farms.

The new government stripped the white owners of land and equipment. But knowledge and experience simply can't be appropriated by law. As the white farmers left, so did the surplus of food. The new farmers were willing enough in spirit, but unable in knowledge. A country that once was a net exporter of grain and a friendly farmer to those around them, has decayed to the point that this once proud farming nation must beg her neighbors and the Western industrial farm nations for enough food to simply survive. Please understand, I make no judgements as to the reason and intentions of the revolution overall, only the results that have stripped Zimbabwe of her food independence.

Imagine what gains could be made by teaching new methods to the new farmers of Zimbabwe? Could this nation not rise to feed herself again- and become a net exporter of food?

Zimbabwe is likely not on the friendliest terms with Western nations, but the language of starvation and of hunger, know no nationality. It speaks but one language, that of gnawing pain as the stomach eats nothing but itself. It speaks in terms of suffering and surely can be heard by the capitalist as well as the communist. In this, mankind has no political party- and speak only one language.

Let us turn away then from helping only these that meet out political ideals. These things are well and truly important, but in the face of

hunger, what do they mean? I would help any man increase his living and his food intake- be he a socialist or capitalist, Christian or Muslim, Atheist or Agnostic. Feed the people of starving nations by teaching them these methods and perhaps they will see their way clear to a new form of government. Or perhaps what we thought was an enemy is really a cry for help, a cry for relief from injustice. In the opinion of some it took a wrong form, but change is better made- and better informed- upon a full stomach. A change of government and the betterment of government cannot always come about by an increase of misery upon a populace. Instability in any government leads to death.

So let us now teach the humble farmers of the world and those that would befriend them, how to green the desert and use less of everything to produce a larger yield on productive farmlands. Let us turn our will and our intellect from the debate of whether to increase planted acreage, to the understanding of a better farming method for all acreage. Let us turn our thoughts to an understanding of better, less invasive, less mechanical, less capitalized ways of increasing yield- without placing undue stress on the natural systems that sustain that acreage. The need is obvious. More land in production means a better life for man. Better yields that do not stress the land means a better life for everyone.

The Trench Planting method can be used by the mega corporation to increase yield, regardless of rainfall in any one year or place. It will decrease operational costs and decrease stress upon the land involved.

Trench planting can be used by a small family farm to obtain better yields even in a time of drought- without using expensive chemicals, equipment and machinery.

And it can be used by a farmer with oxen or donkey or even an individual with a shovel, to grow food in the driest of deserts- with little to no water save that which God gives from the heavens.

Chapter Two

The Indian

For untold eons the Indians of the Southwest United States have lived upon the face of this dry country- and thrived. How was such a thing possible?

And why is no one farming the deserts of the Southwest today? If experts are to be believed, it is neither economically or technologically feasible to farm the Southwest.

Yet the Hopi Indians and the other tribes of the Southwest had no tool shops, no metal foundries, no means of mass transportation, no science, no chemicals and no machinery as we know it today. Yet they had a clever understanding of the environment they lived in. This cleverness allowed them to turn the deserts of the Southwest into a farm empire. That cleverness still surpasses all the technical advantages we have today. For who today dry farms in Arizona, New Mexico and the American Southwest?

The Indians of the Southwest discovered ways to grow grains, beans and other foods in this harsh environment, turning it to a paradise.

To them I bow and without their efforts and graciousness at allowing their methods to be cataloged by the United States Department of Agriculture in 1918, I would never have developed the understanding and techniques needed to perfect a modern, mechanized version of their *dry* farming system.

Lest you think me mad, please bare with me as I present evidence of the large amounts of grain grown from this region in the 1918 study of their dry farming methods.

The Indians processed massive amounts of corn from dry land where no one since has had the intelligence, temerity or wisdom to do so. As evidence I take you to the last century and the efforts of US Department of Agricultural to document the very life of the Hopi and other Indians of our region. In their 1918 Yearbook, The United States Department of Agriculture documented the planting methods and results of the Hopi Indians in and around the state of New Mexico.

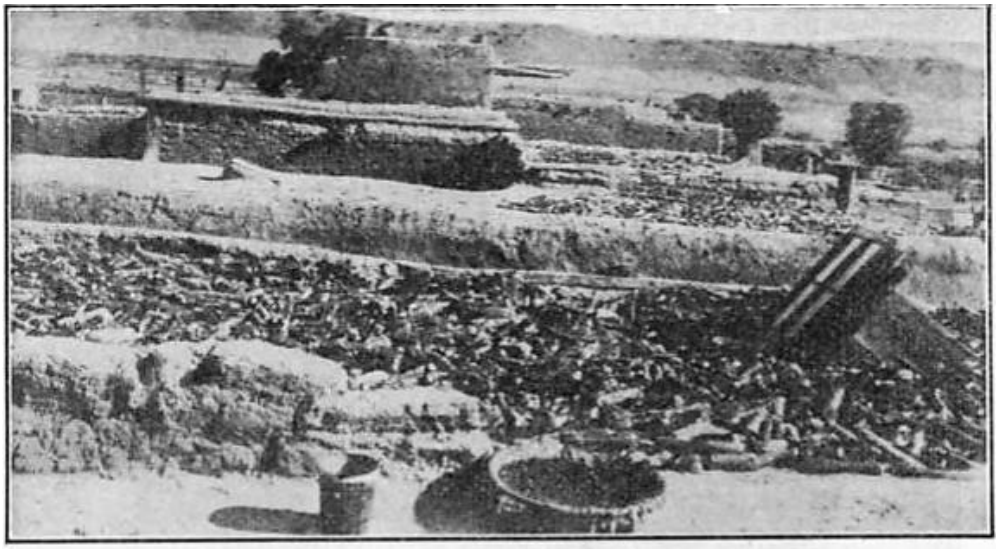


FIG. 1.—PUEBLO METHOD OF DRYING CORN ON THE ROOFS, AT SAN FELIPE, N. MEX.

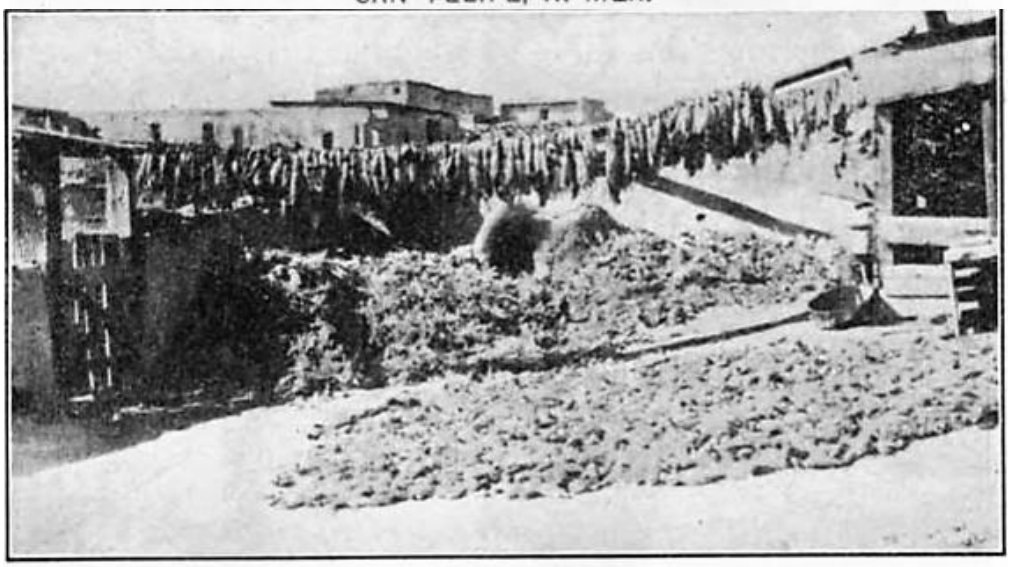


FIG. 2.—CORN DRYING IN A YARD AT LAGUNA, N. MEX.

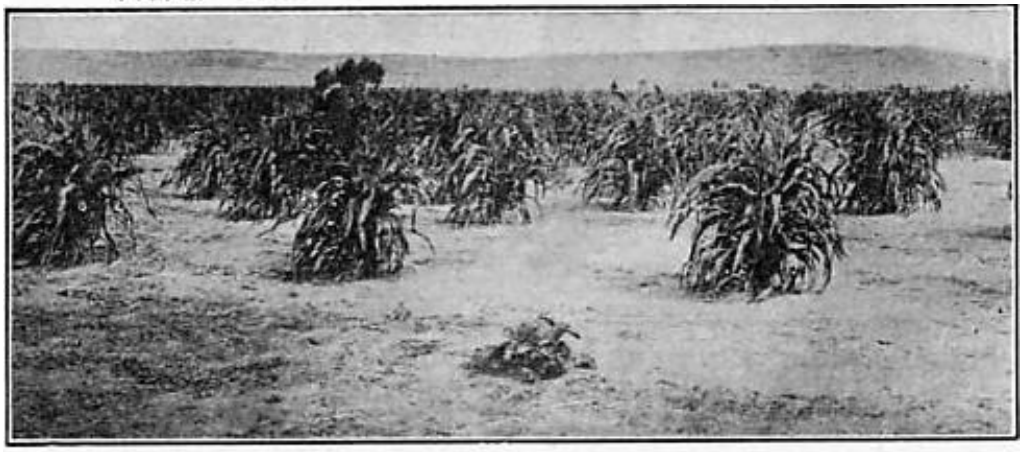


FIG. 3.—AN INDIAN CORNFIELD IN NEW MEXICO.

The hills are far apart, and the large number of plants in a hill afford protection from wind and sun.

This visual evidence shows that dry farming is not only possible, but can produce rich yields. The corn plants above are standing six feet plus in a region where it has not rained for months. To this day, Hopi and others still practice this method of farming on a limited scale. Though tried and true, it does not lend immediately lend itself to the mechanized production methods of Western style farming.

But no one ever considered if it might be adapted to work with automated production methods. Neither was the value to small scale and organic farmers considered in 1918. This was simply the USDA documenting a dying method of food production in deserts. I often wonder, did they know the ramifications of their journal and how important it would be to humanities future? I think some did and some realized that deserts are far more common than perfect farm fields.

Project Deep Roots was an idea that sprang from my understanding and instinctual agreement with the Indians of the Southwest. They knew it was indeed possible to grow corn and other vegetables in this harsh desert environment. In fact, the Indian does not see the desert as harsh at all- but a true and rich paradise.

In my first attempt to perfect the method, I applied for a grant from the Arizona Grain Council. At the time I was attempting to mechanize using more modern tractors, not realizing the real advantage of small-scale farming to change the world. I was trying to reproduce Iowa in Arizona. Project Deep Roots was an attempt to combine the wisdom of the ancient Indian with our modern production methods to bring rich yields form the dry desert. As such, it drew me ever closer to the discovery that I shall reveal to the reader.

History of Dry Farming in the West

To understand the history of dry farming in the West is to lay the foundations of success. A brief overview is in order.

Use of the Moisture Cycle, Moisture Barrier & Moisture Bank by the Indian.

The ancient Hopi and his Indian brothers understood how and when to use the moisture cycles.

The enterprising gentleman above is using a planting stick to penetrate the moisture barrier. Sticks were made that penetrated up to a foot into the ground. Once a hole was made, up to two dozen corn seeds were dropped into it. This produced a "corn bush" rather than the row of the modern method.

A typical Indian would plant two crops per year. One with the Spring rains in April and one with the Summer monsoon rains in mid Summer. The corns were different in nature from each other, with differing amounts of time until harvest. The Indians had a total understanding of the moisture cycle, moisture barrier and the moisture bank.

It should be noted that the Hopi would plant beans and squash along with their corn, the three working together in a triple braided cord of strength.

Beans affixed nitrogen to the soil and provided protein and minerals to the Hopi. They understood their was something about beans that made corn grow better. Squash acted as a ground cover, preventing weeds and retaining moisture. It further provided the vitamins of a balanced diet. With corn providing the calories,, they were known as the "Three Sisters."

These Sisters cared for the Hopi well. It was only after the introduction of modern transportation methods and cheap multiple food sources that the Hopi largely abandoned their dry farming methods.

Upon my examination of multiple Indian planting methods, I found that the Indians of the Southwest used variations of either the Hopi dry farming method, or the Apache "waffle block" method.

The totally dry method of the Hopi relied on the use of arroyos and channeling what water did come from the heavens into specialized "moisture banks." The Hopi Indians knew without knowing that planting in these washes with their fine sandy loam base, covered by pebbles and gravel, gave them a way to keep the soil moist for most of the growing season. Rarely did the Hopi Indian starve, for they knew how it was that nature made her deposits of water in the moisture bank.

The Hopi understood that something special was happening in the arroyos. Indians are and were naturally observant people. They likely observed nature growing her own crops in the arroyo and noticed that something unique was occurring in these wide, gentle flood like plains.

Likewise, the waffle square method used by Apache and other Indians was of interest to me.

The Apache had an immense range and once confined to reservations, had to use their clever understanding of the soil to grow much of their food. They seemed to somehow know that desert soils have a unique ability to gather and retain moisture- just as a bank does capital. They understood at some level that one could charge the soil with moisture, just like depositing capital in a bank. Further, that the soil would pay interest upon that deposit, just as a bank does upon capital.

The Apache used two types of soil in order to build their planting waffles. A waffle was approximately three feet square. The sides of the waffle were made from clay soils, which tended to bake in the sun and became nearly impervious to the passage of moisture from their sides. Presented with nowhere to go but down, the water was available for the anything inside the waffle to use at its leisure.

But there was a second secret at work here. The type of soil inside the waffle is very fine particulate. This particulate hardens when not kept relatively wet. The Apache would simply fill a bucket with water and pour it into each waffle square as he thought the plants had need. As a rule, Apache never "mono-cropped." They would plant different plants in adjacent rows of squares. Since each square had its own moisture requirements, it never occurred to the Apache to connect waffles and pour water in only at one side, allowing it to flow to connected squares in succession. (Or at least this was not documented anywhere in journals of the time.)

But it occurred to me that if interconnected squares were flooded at one end, the hard clay soil would conduct water very efficiently along its length, directly to the plants that needed them. If all the plants were the same, then they would all need the same amount of water. Further, one would need only irrigate the first "square" and let simple physics do the rest.

What eluded me though, was a principal understanding of the theory involved with the moisture bank. While I understood the fact that wet soils tend to stay wet, I had the same understanding that everyone does of Newtonian physics. Things in motion, tend to stay in motion. Not a big breakthrough. But Newton went a step further and asked himself why things in motion tended to stay in motion. This was the breakthrough question to lead to many more answers.

In some tiny way, I was asking why soil tended to stay wet. Why did the water not immediately sink down to the aquifer? The answer lay in the other end of the spectrum with a visionary Professor no one has ever heard of. Complete with a Lord's wig bleached white, this forgotten Professor would teach me the missing piece in my understanding.

Chapter Three

The Professor

John A. Widtsoe & Dry Farming - A System of Agriculture for Countries Under Low Rainfall

Mr. Widtsoe was the President of the Agricultural College of Utah in 1910 when he wrote the above mentioned book. In this amazing treatise, Mr. Widtsoe explains the why, the how and *the need* for dry farming in the West. Further he explains the science behind what Project Deep Roots terms, "the moisture bank." To him I am as grateful as I am to the Hopi, the Apache and the other Indians of the Southwest region.

What he could not have envisioned was the coming together of modern machinery, the chemically enabled farmer and modern transportation systems. These technologies made it possible for the agricultural giants of America to supply the country and the world with ample grains and other foods. What Widtsoe did envision -with unfailing accuract- was that someday the West and Southwest would bloom under the dry farmers hand.

And now, with grain prices spiraling ever higher, world populations rising, demand for meat products at an all time high and the rise of bio fuels, Mr. Widtsoe vision is proved right. The time of deserts providing for the world is upon us.

Widtsoe documents in his book a total understanding of the moisture cycle for no less than four major portions of the United States. (Indeed, these four may be applied to the world.) He recognizes various soil types, fertilities of each and how they became that way.

Further, he comments on how to use these moisture cycles to the dry farmers advantage. Now this may seem obvious that one wants to plant when it will rain, but Widtsoe's wisdom goes against all understanding. He sees the soil as a moisture bank, from which the farmer is able to make withdrawals and deposits- *at will.*

Mr. Widtsoe's wisdom was well based in fact, experimentation and communication with others of his time. We should well ask, "What caused this wisdom to pass from our memories?" Only the aforementioned trio of modern life- chemicals, machinery and transportation. Grain from the East and Midwest became so cheap and

so plentiful that all need or thought of farming in the driest parts of the West had slipped from mind.

This report seeks to reawaken our memories to a time when dry farming was practiced in the deserts of the American Southwest. I seek to reawaken the time when people thrived from the meager moisture available there. Imagine the potential acreage available for dry farming in Arizona, the Southwest and indeed the arid portions of the world. Imagine the profits and the benefits to be made to local communities if these areas could be opened to dry farming.

I am not saying all land can be farmed, but where the soil is deep enough, great fertility and moisture wait to be harnessed by understanding the West's most profitable bank- her soils.

Chapter Four

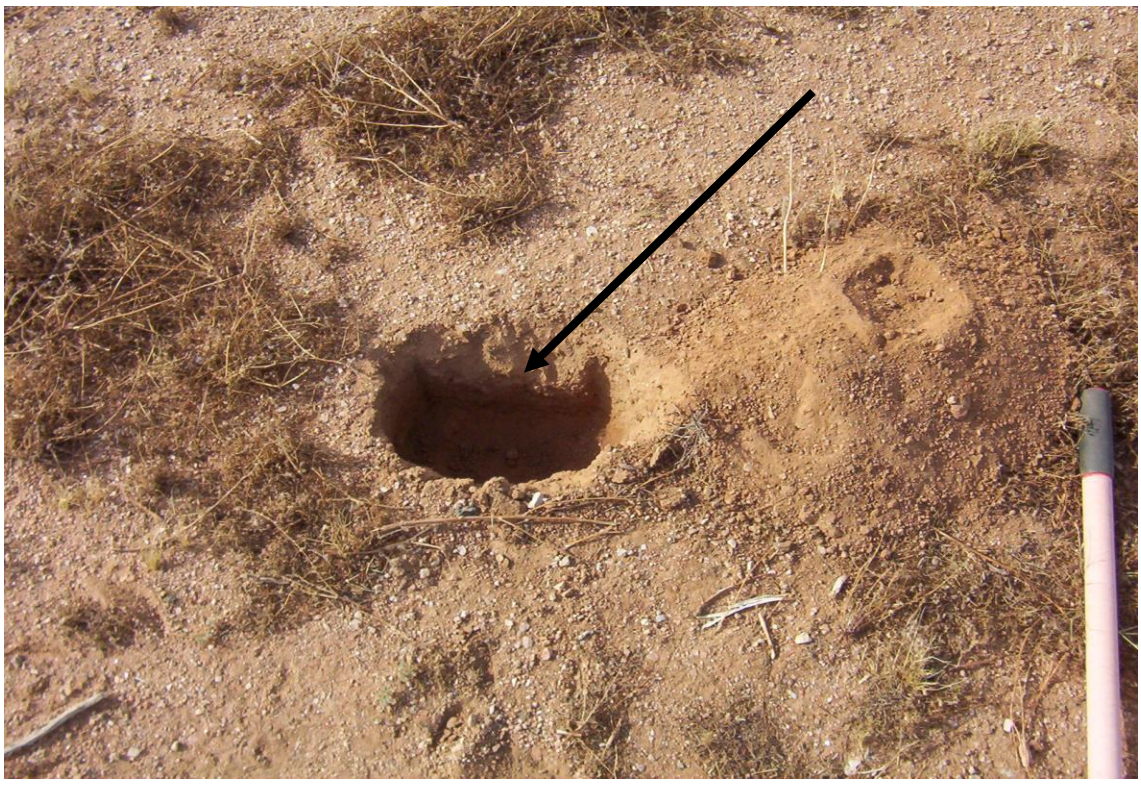
Understanding the Moisture Cycle

The appearance of much of Arizona gives an overwhelming impression of desolation. Yet spend an evening on the back porch of any desert dweller and you will be impressed and overwhelmed with how much life is here.

In the desert regions of Arizona, rainfall comes in cycles. Short winter/spring rains are followed by long months of dryness. Summer brings the sudden gifts of monsoon thunderstorms. Rain can fall by the gallon. To us, these cycles appear all too brief. But to the Indians they were seen as the trigger of the semi-annual planting events.

The Hopi and other Indians understood that the land had a natural defense against the long dry spells that pervade our state and region. They took notice of the ground and its moisture barrier.

Understanding the Moisture Barrier



Ground in Arizona is notoriously hard. Digging a simple hole for a fencepost can represent substantial effort. But as one digs down the ground becomes soft, moist earth.

This photo shows the existence of the moisture barrier. Taken in the month of June, the first two inches of soil show no discoloration. The soil is uniform and consistent in moisture content. It is hard, requiring a good deal of effort to get through. It is not unlike the notorious Midwestern prairie or Texas Deadpan.

At four inches in depth, there is a noticeable change in soil color and consistency. The soil becomes darker. This point is illustrated by the arrow in the photograph. *The change in brightness is not a shadow.* It is instead the beginning of the bank vault, a vault housing moisture.

The soil becomes loose below this barrier. It becomes cooler. Its odor changes to the scent not unlike that of a truly fertile piece of ground. *The difference is moisture!*

The ground above acts as a bank vault door, allowing the storage and protection of moisture capital accumulated during the brief rain periods in Arizona. Moisture is stored behind it as a bank stores capital in a vault, ready to be directed for the useful purposes of nature or man. One only needs to learn the combination to the moisture vaults door.

Understanding the Moisture Bank

In order to understand dry farming or low water usage farming in arid regions, one must first understand the soil and its moisture retaining principals. If you think of the soil as a bank that deals in the currency of moisture, the same principals of wealth apply. It is then not too difficult to understand the principals of the banks operation and rise to the level of Bank Director.

Many soils of the West have an abundance of microscopic particles. (This is especially true of Arizona.) One only need leave their windows open on a windy day to see the fine silt brought by the wind. Each of these particles is a miniature world with a potentially vast sea of moisture clinging to it.

Hydrostatic tension -the tendency of water to cling to objects- is Widtsoe's Bank Teller. All moisture passes through the Teller's hands, regardless of direction. This simple principal need only be proved by placing one's finger in water. Upon withdrawal, moisture clings. This is hydrostatic tension. Like one's finger, microscopic grains of soil have trillions of nooks and crannies that moisture will cling to.

In Widtsoe's treatise, he outlines how the microscopic soil particles charge themselves with water. Further, how these charges are not overcome by the forces of gravity and evaporation.

The Farmer as Bank Director

To understand hydrostatic tension is to become Widtsoe's Bank Director. The soil becomes the Teller, answering to your instructions. Whether or not one breaks the bank depends wholly upon their skills as a Banker.

In the West, water *is* capital. Its aggrandizement and safe storage in the soil *is the business of the Western farmer.* It is to the farmer as capital is to the banker.

Funding the Bank

We would do well to outline what dry farming is to the Western Farmer and use it as a contrast for this new process.

The modern Western farmer across Europe and North America churns the soil as a first step. The previous year's crop stubble and top soils are ploughed under in this process.

The modern farmer then often creates raised rows used as planting beds. The field is treated with mass doses of fertilizers, weed killers, insecticides and disease preventing chemicals. Seed is often coated in substances that provide protection and\or nutrients during and after germination. If irrigation methods are used, the raised row is planted and the valley is used to provide a conduit for irrigation water.

Now let us examine the implications of Western dry farming methods.

First, these methods provide economic benefit only in large scale operations that employ the advantages of scaled economy. The price for initial equipment alone can exceed $500,000 US.

This mean the acreage must be large. Here in North Dakota, a farm of 5,000 acres is seen as nearly average in size.

Chemicals and seed are bought in bulk for the highest possible discount. Everything is geared towards a massive scale.

(The reader should know that I am making no comment about the value of large-scale farming, but simply defining the practice.)

I ask the reader to now consider the small-scale farmer that exists outside the realm of corporate farms. Acreage varies from as small as one acre, to ten, forty or larger acres as the distance from a city grows. A fraction of these small-scale farmers may have access to a small farm equipment- but most use animal power. Many use simple hand tools. It is clear that the large scale agricultural practiced by corporate farming in America and Europe, will not be adopted by most of the world's farmers.

And what of organic farmers in the West and the world over? What of those that want to use their land as is, with organic growing methods? How will they prosper without the economy of scale so prevalent in Western farming?

And lastly, what of the would-be desert farmer? How do we allow these pioneers to do what their forefathers did across the plains of America and make the deserts of the world bloom?

It certainly will not be with the current methods employed in North America and Europe. We cannot ship water we do not have to the deserts of the world.

A new way of thinking for all farmers, be they large scale or one-man operations, needs to be developed.

The Water Economy

We have all seen photos of, (or firsthand!) dry, cracked top soils with withered plants due to drought. But what is drought? Is it really a lack of rain? Or is it a misunderstanding of the relationship between local soils and moisture?

In casual observations, water appears to slowly sink into the earth from above. We envision water traveling ever deeper, pulled downward by gravity. But is that what's really happening?

Widtsoe says no.

In his dynamic, hydrostatic tension is what draws water into soils- not gravity. It is the nature of soil particles themselves that are the force behind charging the soil with moisture and maintaining that charge. Gravity does play a part- but a far smaller part than most realize.

The physics of water and soil mean that the most abundant source of moisture is *below the first three inches of soil. (7.62 cm.)* Yet in Western farming, two inches is considered a normal to deep planting for corn.

This means that regardless of where we plant in the world, we doom our crops to fail in even a mild drought!

The picture above shows how the first three inches of soil tends to become cracked and brick hard. To all but the Indians of the Southwest, this land is a wasteland, utterly devoid of moisture.

But to the Indian and now myself, this pattern is front side of the moisture banks vault door- protecting the valuable capital inside.

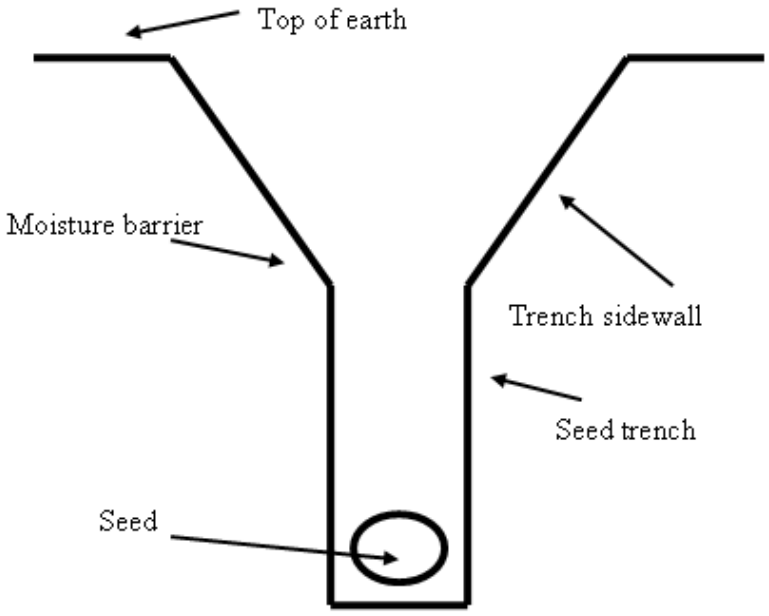
Unlocking the Vault Door

Hydrostatic tension provides the wettest soils deeper down. All desert hardy plants know this and have long tap roots. Drought never bothers them. In fact, there is no such thing as drought to native desert plants. There are only years of changing rainfall.

So how then does one dry farm a non-native, notorious "water user" like corn in a place with considerably less rainfall than farmlands considered best for corn?

First, don't fight nature and physics. There is a constant supply of moisture below the three-inch (7.62 cm) soil level. We must get the plants roots below this barrier, referred to as "Widtsoe's door" herein.

The Trench Method



I realized that the Hopi dry farming method and the Apache waffle farming method were both advanced understandings Western soils. Further, This method provides all farmers, everywhere, with the combination to the moisture vault. Truly, this is my contribution. I simply did what I am good at, "connecting the dots." The true praise goes to the Indians and to Widtsoe. I am confident that this method, or something very close to it, will make it possible to dry farm the deserts of the Southwestern United States and

indeed the world. It works regardless of farm size, soil rainfall or the farming methods employed. The method provides all farmers, everywhere, with the combination to the moisture vault and will change our vision of deserts from wastelands to paradise.

Trenches are cut diagonally to the flow of water across a field. As the water passes over them, they fill and hold moisture far longer than a ploughed field would. This technique allows charging the soil with moisture and allows concentration of water where it will do the most good. In dry times, the walls of the trench soon harden, closing Widtsoe's vault door. The precious moisture capital -and the seed- are both locked away in the vault. Here they are safe from insects, mice, birds and diseases that would feast upon the farmers harvest before it even germinates.

The drawing above is not to scale and do remember that the trench is easily three to four inches below the surface. (7.62 to 10.16 cm.) But what this means is that from a moisture perspective, we are deeply rooted in the moisture vault. Our seed has suddenly been transformed into a deeply rooted desert native plant! The seed's roots grow down, rooting ever deeper, but the leaves grow up to reach the plentiful desert sun.

But there are still more advantages to the trench plant method.

The Hopi and other Southwest Indians planted in wide basins known as arroyos. These arroyos are composed of several inches to many feet of a sandy loam. This loam rides atop a deep bed of small pebbles and rocks. The reader will see then that Western arroyos are simply large creek beds spread across a flat plain.

Winters rains and snowmelt charge these early in Spring. Summer thunderstorms recharge the arroyo at just the right time- resulting in huge corn and vegetable harvests. Further, the wind carries small pebbles and grains of sand into the trench, covering the seed and producing the same protective effect as a natural arroyo. The fine sand atop hardens like a vault door in the dry seasons, trapping moisture below. The small pebbles allow for excellent root growth, aeration and drainage.

Drowning of plants is nearly impossible, as the vault can only hold water in relation to its hydrostatic tension coefficient. Any moisture exceeding a "full tank" wicks further below and is not lost to evaporation. This should bring a spectacular realization that the vault size and its ability to store water capital are only limited by the soil depth! Transmission of moisture works both ways- the laws of hydrostatic tension trump even the laws of gravity. In many deserts, the vault depth can exceed 500 feet. (150 meters.) One soon learns the secret ability of native plants to

survive in places like the Gobi Desert or Death Valley. These deserts may only see rain once in a decade or less- but the size of their vault means they have more in common with freshwater oceans than deserts.

Farming has always been a good life, a God blessed life. There is no other profession on Earth that that brings a person so close to nature and indeed to God. Modern society needs more people close to the land and learning that wisdom. The Trench Method now makes it possible for anyone, with nothing more than a shovel, to eat the bread of their own hands and to profit from it. And it makes it possible for organic farmers to farm in the cleanest of places- the world's deserts.

Below, I answer some frequently asked questions about the Trench Method.

"What is the insect loss in deserts?"

Perhaps the single biggest advantage to desert farming is the near lack of pests. Nearly all desert insects don't know what to do with corn and other crops not native to the region. Insect affects upon yield rates were ridiculously low. I estimate that yield loss was less than one percent. At this rate, insecticides are pointless. Better even than organic insecticides is *not having any insect pests.*

"What about animal pests?

Growing of corn and other crops is timed with the seasons of abundance. This timing coincides with the abundance of natural plants. Native animals prefer the native plants and observable damage to crops resulted in less than a one percent decrease in yield. This rate is so negligible, it may be ignored.

"But what of soil quality?"

Soils of the Southwest seem tailor made for high nitrogen crops like corn. Remember that Indians numbering in the millions lived for countless generations in the American Southwest. The Indians had no Agri-chemicals, no nitrate fertilizers, no insecticides and no herbicides. Yet to call their harvests bountiful is an understatement. For three years I planted the same ground, adding nothing to the soil. The soil depth in Kingman AZ is measured in hundreds of meters- a huge reservoir of nitrogen and other nutrients. Practicing a simple rotation plan should be more than sufficient to guarantee both nutritional quality of crops and a good maintenance of the land.

"Can the method be scaled?"

Absolutely. A farmer could start out with a shovel and in less than a generation, rise to use automation like what is seen in the plains of America. The difference in margins would bring high profit. With no high cost fertilizers, insecticides, chemicals and ploughing, the cost of operation is reduced to taxes, labor and equipment. Trenches themselves need only a slight touchup every three to five years.

“What herbicides work best in deserts?”

I can honestly say that the sun is the single best herbicide for control of any and all weeds in a desert environment. As corn grows, it crowds out native and non-native weeds and they die. Fast growers are wiped out by dry conditions and only deeply planted crops survive. In short, I never used a herbicide in any operations, growing all sorts of vegetables.

“Can it be used in areas with greater rainfall?”

Absolutely. Soil is soil and what many call poor soils are really just misunderstood soils. It works in any place with any type of soil. It is especially good with areas prone to varying rainfalls and droughts. If Spring rains are heavy, a shallow trench is used. This prevents drowning of seedlings. In places with poor drainage and heavy Spring rains, a shallower trench is dug. Deserts use deeper trenches to maximize charging of the soil.

“Can I combine the Trench Method with tilling?

In areas with a history of tilling, (like North Dakota,) you certainly can. But as proved in the Arizona desert, you don’t have to. This is especially true in areas of high wind. The trench itself acts as a miniature wind barrier- a critical component used by the Indians of the Southwest to prevent evaporation. This method requires some simple tooling changes if using automation, but trenching truly requires far less effort than tilling. It is the ideal marriage of the Hopi’s arroyo and the Apache’s waffle square. Like the arroyo, it collects water when it is available, then conserves that water by not allowing it to evaporate. Like the Apache waffle square, all water is held strictly where it is most needed- and the plant cannot drown because hydrostatic tension will carry away any excess further below- where it is still available. Not just drought resistance, but drought serenity is achieved. Crops seem to simply not notice the heat and dry.

Once the vault has enough capital, it continues to store moisture further back in the vault. This is critical function, for once the top levels are depleted, the same works in reverse. Roots in this trench will naturally draw moisture from the banks below as needed.

“What if I need to apply fertilizer or irrigate?”

In some circumstance, one may wish to irrigate or apply fertilizer to a trenched crop. It could not be easier. Just flood the trench with water. If you need to apply fertilizer, load the water with it. The fertilizer goes directly on the crop and is used only by the crop. No loss to weeds, no loss to runoff and no leeching into waterways.

Development of the Trench Method

Development of the trench method started with my first attempts to grow corn for animal feed in 2006. I had a difficult time, even with irrigation, bringing corn to maturity. Heat seemed to be the biggest issue, causing wilting even when watered. However, I was aware of the areas rich agricultural traditions and knew it was possible to farm here. If the local Indians could do it- so could I. Sadly, I had to glean this information from a 1918 study by the US Department of Agriculture. The local Indians had no idea this was part of their heritage.

In 2007 I hit upon the idea of using water pooled in trenches to grow corn, sunflowers, beans and other crops. Original trenches were shallow and dug by hand. Over the next two years, trenches became wider, much deeper and a method of planting was developed that takes advantage of Widtsoe's observations on desert soils and their hydrostatic principals.

Project Deep Roots Future

For 2009, Project Deep Roots planned to continue development of two desert seed corns, adapted specifically to deep rooting in trenches. This was a three-year project, bringing a desert dry farming sweet corn for human consumption and a larger yielding corn for animal feed. (Either as silage or grain.) Further, this was my second year of sunflowers. Other crops slated to start that year were wheat, oats, barley and perhaps rye. (Dependent upon availability of a suitable seed.)

With an early spring and a summer planting cycle, it does not take long to develop a non-desert strain into an excellent desert dry farming crop. Already the sweet corn has been adapted to a dry farming desert variety. Root depth was excellent. Yield was very good and has been greatly enjoyed by friends and family.

Sadly, the economic crash of this era derailed the project and I was not able to finish the 2010 project plans.

However, this was a proven concept. I have grown up to a quarter acre of sweet corn with almost no added moisture. It is now up to the small-scale farmer, to carry this gift of hard won knowledge to its conclusion.

This is something the world needs. There is no reason why corn and other crops can't be grown in what we have shortsightedly termed "wastelands."

And to the organic farmer, I ask you embrace this method too. There is nothing in this but natural wisdom.

May you that embrace the ideas herein remember that my contribution was only to connect the dots- not to discover anything not already in existence. This was important, but I am not the inventor here- only the "ah-ha" person. The mantle of invention is laid upon the shoulders of the Southwestern Indians of America and upon the shoulders of a little known, nearly forgotten Professor from Utah.

Lastly, may you that embrace the ideas herein profit from them and become as large and as wealthy as you desire from my collection of thoughts. This is a free gift to the world, I claim no copyright, other than to be remembered once in a while for seeing the patterns and connecting the dots. Let no one sell you this idea- and teach others as freely as you can.

And of course you may ask any questions of me you have. Please don't hesitate! I speak and write only English, but if your language is other than English, we shall muddle through using Google Translate. Please ask anything and especially share any thoughts, failures and triumphs. We, the common folk of the world, are all in life together. Every success and especially every failure, advances us towards a better life. Don't keep either to yourself. My role in this process is to act as an information coordinator, promoter and educator. Help me spread the word and build our knowledge by opening a dialogue with me.

Most Sincerely,

Jeff Rash,

Inventor

My Business Website: https://verticalfarmmechanics.com
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