



Training Manual
Family – Plot / PFUMVUDZA
by Brian Oldreive –
“Foundation for Faming”

NOTE:

This is a recompilation from the information from “Foundation for Farming” complemented with material from Mindolo Training Farm (MTF), 2025.



www.mefedu.com



mefdirectoroffice@gmail.com



+260 964615236



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Mindolo Training Farm (MTF) has developed 14 workshops to teach PFUMVUDZA / Family Plots to students of sustainable agriculture.

In the workshops, the students actively participate in their local language, using Foundation for Farming videos as a basis. The videos are then analysed and discussed in groups, the results of each group are presented in plenary, and a summary is made in the local language.

This compilation is used as study material and as input for practical work in the field. Can we put water in each planting station of a family plot if needed?

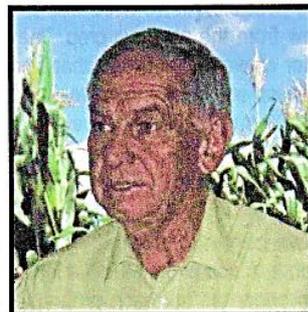




The Story of Foundations for Farming

By Brian Oldreive

In 1962 I left school and began a twenty-year career in tobacco farming, which I thoroughly enjoyed and in which I learnt much about the dynamics of farming. Not long after my wife, Cath, and I came to know Jesus as our Lord and Saviour in November of 1978, I began to have a real conscience about growing tobacco, a poison, for hundreds of thousands of people. One night when I couldn't sleep, I took out my bible and I read there from 1 Corinthians 10:31, "Whatsoever you do, do it all for the glory of God." I realized that my life's work of growing tobacco was not glorifying to God and so in the middle of the night I promised God that I would never grow another leaf of tobacco.



Here began our process of learning how to grow foodstuffs, but it was a great trial as God had a purifying work to do in us. God cannot use very ambitious proud people as I was at the time. Cath and I were under the impression that we would immediately be blessed if we decided to grow food instead of tobacco, but God was wanting to test us and prepare us for what was to come. We had two terrible droughts, which resulted in poor yields, and we lost a lot of money. The bank inspectors came and said that if we continued to grow tobacco, they would support us, but if we would continue to grow foodstuffs on our sandveld farm in a low rainfall area they would have to sell us up. I was even taken before the governors of the bank in Harare and I again had to state my conviction never to grow tobacco again. They insisted that I was very irresponsible to take this decision with a wife and five children to feed and educate, but I felt that I had to trust God and seek to glorify Him. We went through a humbling time as we lost everything including our reputation and status; however it was a wonderful time in which God taught us to trust Him implicitly.

For a long time we couldn't find a job, but eventually we got a job managing a farm in Mutepatepa, north of Harare. When we arrived at this farm, it too was in financial difficulty. On this farm the common practice was to plough very deeply after having burnt off all the stover from the previous crop. This caused the soil structure to break down and large clods, the size of footballs, were being ploughed up, which then had to be broken down with two harrowings and two rollings, which was very expensive. The soil structure had collapsed resulting in water running off the surface and the topsoil washing away. Our costs were rising steeply, while our yields were going down and we were going out of business again. I turned to God in desperation for a solution to our problems.

I would go into the virgin bush for times of prayer and one day God began to reveal to me His ways in nature (Romans 1:19-22). There I saw that there is no mechanism in nature in which the soil is inverted and that there is a thick blanket of fallen leaves and grass which covers the surface of the soil. I realized that these two factors in nature prevented the soil from being washed away. I had heard something about Zero-Tillage, which had started in the Great Dust Bowl of Texas in the 1930s and spread to Europe, South America and Australia. It had been introduced into Africa in the early 70s and so I approached the research community to ask them how we could implement the system. They told me that they had tried it, but it didn't work because it wasn't feasible for our region; however, I was in such a desperate situation that I thought that I must try and God gave





me the faith to launch out.

I decided that as I began to experiment with this system, I would not allow it to fail from lack of good management. So I decided to begin small with just one hectare of maize planted into wheat straw to the highest standards possible. All we used was a small work force using a hoe to make planting holes straight into the wheat straw from the previous crop. The results on this small portion were so much better than the rest of the crops under conventional tillage that I had the faith to expand the area under Zero-Tillage to two hectares. This was again so successful that we expanded it further to one full land the following year and within six years the whole farm of 1,000 hectares was under Zero-Tillage. The success of the system resulted in profits every year and we were able to buy up surrounding farms until in 1995 we were growing 3,500 hectares under mechanized Zero-Tillage.

As we began to see the wonderful success of the system, God began to reveal to us the poverty situation in Africa and he told us that he did not reveal it to us just for ourselves, but for the rural poor of Africa. We then began an outreach programme in which we set up 58 demonstration plots throughout Zimbabwe in all natural regions and soil types. This resulted in the birth of Farming Gods Way. We saw that the system, when implemented well, could be successful in any region except desert regions where there simply wasn't enough rainfall. However, we began to see that as soon as we left an area the crops would deteriorate immediately and there would not be the same effectiveness that occurred under our management. This caused us to go to God to ask Him why this was the case. We began to realize that the people we reached didn't lack knowledge of the methodology, but that their ability to actually implement that knowledge into a profitable farming enterprise was lacking.

I could see that this lack was the cause of Africa being the poorest continent on earth, getting poorer and I went to God, wrestling with him in prayer about it. I asked how we could come out of poverty. He answered me in a way that doesn't sound very spiritual and he said, "Teach Africa to make a profit." This is our bottom line. If our expenditure exceeds our income, we are making a loss. That happens from the micro level for the individual in the field, right up to the corporate level, to national level and ultimately to a continental level. I then turned to the Father and asked Him how we can make a profit. He answered me in a wonderful way and said that there are three things to do to make a profit. Everything we do should be done:

- On time
- At standard
- Without wastage.

If we get those three factors right invariably, God willing, we will make a profit. If we must be honest that in Africa, we are often late, our standards are often way behind the rest of the world's and there is much wastage. God is saying to us that we should have faith to change those ethics and values and apply them in a Godly way to the whole continent. It is a huge challenge, but we have a huge God and there is no giant too big for the Lord.

God later on gave us a fourth principle, which deals with the work ethic, productivity levels and output from our labour. This is that we should do everything 'with joy'. We see from the book of Nehemiah that our joy is our strength. Once we understand that it's a joy to farm well and when we see our standards improving and our timing is good, hope comes into our hearts. Once hope is there, this results in joy and joy is our strength. Thereby wonderful productivity and energy is increased and our whole system begins to improve and to move forwards. Our very simple implementation management teaching then became centred around these four prin-





principles:

- On time
- At standard
- Without wastage
- With joy.

God began to reveal other things to us as we turned to Him for answers. We continued to be saddened by the desperate poverty around us and as we continued to turn to God to ask Him why Africa is the poorest continent on earth getting poorer. When I looked through the scriptures, two scriptures were highlighted for us, the Parable of the Talents (Matt 25) and Luke 6:38. Basically in Matt 25 Jesus talks about how if we are faithful with little God will add to us. If we are unfaithful like the servant with one talent, what little we have will be taken away from us. We have now travelled widely in Africa and we have come to believe that our basic problem is that we have not been faithful with the very first things that God has given to us in the soil, sunshine, rainfall and seed. If we are faithful with that, then that will be the beginning of our rebuild. Our unfaithfulness is the reason why Africa is getting poorer in real terms, and the Lord shows in Matthew 25 that if we are unfaithful he takes away from us. This is why we are getting poorer in spite of over \$2 Trillion of free aid over the last 60 years.

Luke 6:38 talks about how we must give to receive. We do not promote the prosperity gospel or selfish intent, but God loves a giving heart and He loves unselfishness. This outworks itself practically in farming in that we must feed our crops with some sort of fertilization if we expect it to give us a crop. We also receive a far greater yield when we are willing to give of our time, energy and extra effort to achieve excellent standards. Sadly, Africa has earned the reputation of being a begging continent, expecting to get without giving in return. This is totally contrary to the ways of the Kingdom: "...give, and it will be give to you. Good measure, pressed down, shaken together, running over, will be put into your lap. For with the measure you use it will be measured back to you." For Africa to begin to receive we must first learn to give of our time, energy, extra effort and finances.

By 2009 Farming Gods way had spread into 30 Nations in Africa and was widely recognised by both the church and secular community as a powerful tool to break the twin yokes of poverty and dependency in Africa. With this expansion I was prompted by the Lord to change the name to "Foundations for Farming".

God has graciously revealed these powerful truths to us and it is our prayer that through these teachings and their faithful implementation in farming, Africa will have a strong base from which to build thriving and sustainable economies.





Introduction

Principals

The four keys to making a profit are to do our operations

1. on time
2. at standard
3. without wastage
4. with joy

If we are honest with ourselves, we in Africa:

- are often late in and for whatever we do at every level
- our standards are way below those of the rest of the world
- there is a great deal of wastage of the things God has given us
- we grumble, make excuses and blame everyone else, and even blame our historical background

We may be tempted at this point to say that this is just how Africa is. We are relational and laid back and we haven't been caught up in the hype of the world. This may be true, but if our tardiness is one of the





major causes contributing to our status of being such a poor continent, we have to re-examine that thinking. That very tardiness is causing the number of poor people and their depth of poverty to increase at an alarming rate. We can say the same about our low standards and the wastage that we see around us.

Surely if we love the poor in the way Jesus did and does, we will want to do something about these problems. To most people the problems seem to be so huge and insurmountable that they stop thinking or wanting to talk about it. The humanistic secular world refuses to criticise man and makes excuses for us, and so the problem gets worse. The church system seems to lack the faith and inclination to do something about it. It is truly time that we run to God and implore Him, who is the all-knowing, all wise, all-powerful creator of all things, to show us His perspective and plans. Praise God that He is so approachable through the finished work of His perfect Son!

On time

This means that timeliness is very important and every operation that we do should be done at the correct time and in the correct season. Ecclesiastes 3:1-2 says, '*There is a time for everything, and a season for every activity under heaven: a time to be born and a time to die, a time to plant and a time to uproot...*' This means that there is a specific point in time such as the moment of death, but there is also a season of a more protracted time such as a summer season or a planting season

God has given us time and He has measured it for us in the way the earth and the solar system were created.

- We get our year from the 365¼ days it takes the earth to travel around the sun. (We have a leap year to make up the quarters every fourth year.)
- We get our months from the 30¼ days that it takes the moon to revolve around the earth. This happens twelve times a year.
- We get our day from the 24 hours it takes the earth to spin on its axis.
- We get our days and nights from the amount of time that our part of the world is facing towards or away from the sun as it spins on its axis.
- We get our seasons, summer and winter, from the fact that the earth's axis is slanted, which means that at certain times of the year our part of the earth is closer or further away from the sun.



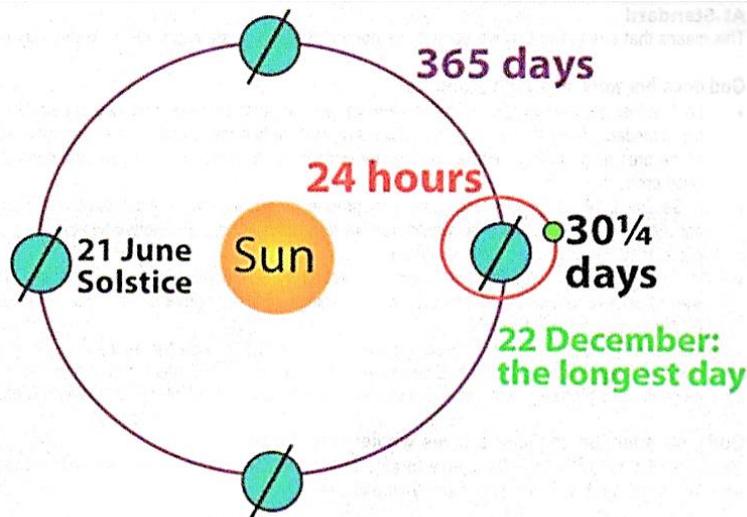


God is always on time and is never late!

We can trust Him with all our hearts. The date of the longest day of the year in the southern hemisphere is always 22nd December. It is never 26th one year and then 18th the next. There are markers like this, which we can hold to even though the rainfall does not follow a fixed time schedule

The 22nd December is a very important date because it is the day on which the sun will shine down onto our atmosphere in the southern hemisphere for the longest period per day in the year. This brings some important factors into play:

- Plants need sunlight to grow through the photosynthesis process and on this day there is the longest and most intense sunlight.
- Plants need warmth, which we measure in heat units, to grow and on this day we have the greatest likelihood of the most warmth from the sun.
- Plants need water to grow. On this date, as a result of the warmth, there is the greatest likelihood of evaporation from our water surfaces. This means that there is a greater likelihood of water build up in the clouds for rainfall to occur.



The diagram shows how we get our longest and shortest days of the year in the Southern Hemisphere.





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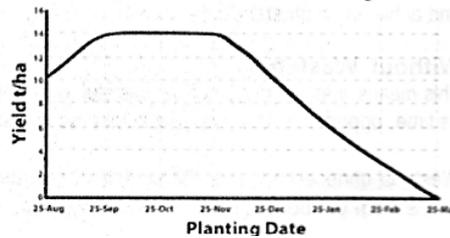
It is very important that we read the signs of the times and are ready and prepared to take advantage of, and faithfully use, this wonderful opportunity that God gives us!

The 25th November is another very important date for our geographical region in southern Africa. This is the best date to plant maize because if you do so, your plants will be just below knee-high on the 22nd of December. This is the ideal size for the plants to take advantage of the best growing conditions, just before the period in the plant's life cycle when there is the most vigorous growth and expansion of the crop.

The loss of yield, which we can incur as a result of missing this deadline, is starting! The graph below illustrates that for every day that we plant late after the 25th of November, we lose 120kg per hectare per day of our potential yield.

As we can see timeliness is so very important! Let's not waste the opportunities that God so freely gives us in his natural creation.

Crop Yields Based on Sowing Date





At Standard

This means that everything that we do must be done well at a high standard, which glorifies God.

God does his work at a high standard!

- Look at just about any aspect of nature and you will see that God has produced our world at an incredibly high standard! Genesis 1:31 says that God saw what he had made and it was very good. Just take a look at the breathing, seeing, hearing, tasting, moving, thinking person next to you. God certainly produces a good product!
- In Genesis 6:14-18 we see God giving very precise measurements to Noah in order for him to build the ark. God knew that a boat that would survive forty days of rain and house two of every animal on the planet would have to be built to standard.
- In 1 Kings 7:13-51 we see how Hiram was tasked by Solomon to furnish the temple. The bronze work was extremely beautiful and intricate, with moldings of lilies, pomegranates and wreaths being made. God loves beauty and aesthetics!
- In Ezekiel 40-42, we see that it takes three chapters to go through the intricate detail of the temple to come in the millennial kingdom. Ezekiel meets with an angel who has a measuring rod in his hand and he goes on to precisely measure every aspect of the temple. God is interested in detail & precision!

God pays attention to detail & loves wholeheartedness

Proverbs 3:5-6 says, "Trust in the Lord with all your heart and lean not on your own understanding; in all your ways acknowledge him and he will make your paths straight."

With how much of our hearts should we trust God? 50%? 90%? 99%? 100%! In how many ways should we acknowledge him? In all of them!

All our ways, whether very small and seemingly insignificant, or very large and seemingly crucial, need to be performed with God and his glory in mind. God knows the number of hairs on our heads. If he is concerned about that much detail, then perhaps we should be concerned about details too. It is in the small things done well that high standards are maintained.

Going the extra mile

In order to achieve high standards we need to be willing to give into our enterprise often over and above what we think is sufficient. If you read the Sermon on the Mount you will see that the Kingdom of God is all about release and giving, even to our enemies and those who oppress us (Matt 5:38-42). Jesus himself gave his very life for us.

If we take our minds and bodies and strength that God gives us and give effort to do things really well in a way that glorifies God (at standard), it is a form of giving that God sees. This is the whole basis of implementing and achieving high standards.

Without Wastage

This means that we must not be wasteful with anything that God has given us. We must not waste such things as time, opportunity, soil, water, sunlight, seed, nutrients, energy, etc.

Waste is unnecessary loss. Some losses are good and necessary such as the elimination of wastes and toxins from our bodies, but if we waste the good things God has given us it means that we are being unfaith-

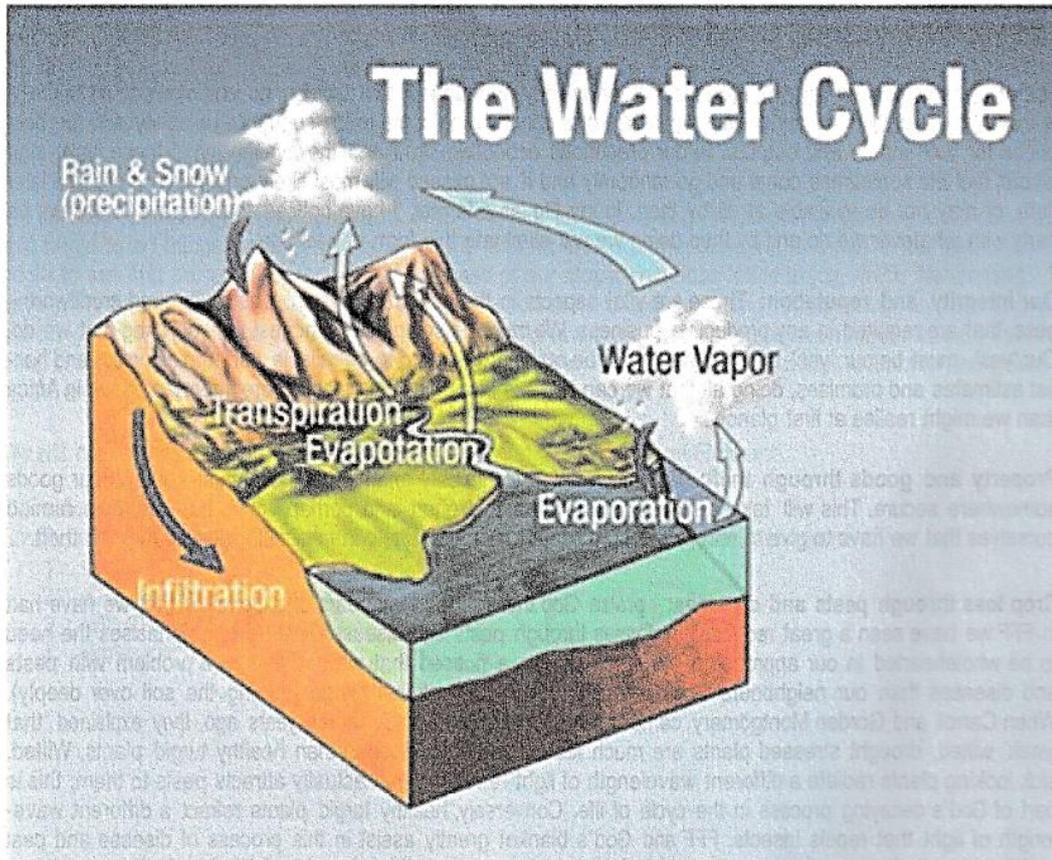




ful with them. It is very dangerous to be wasteful because this is a form of unfaithfulness and we have already seen that God will take away from us if we are unfaithful. So sadly wastage feeds on itself.

If we look at creation, God is not wasteful

The water cycle is an excellent example of how God does not waste a molecule of water.



This is further confirmed by the fact that no atoms are lost in natural processes that God has made in creation. Plants and animals die down and decay forming food for the next generation of plants to grow on. These elements such as nitrogen, phosphorus, calcium, magnesium, sulphur and the trace elements continue to exist and are recycled again and again in God's wonderful process of life.

Jesus was not wasteful

In Matthew 14:20 and 15:37 we see that both times that Jesus miraculously fed crowds of thousands, he asked the disciples to collect up the left overs. After feeding the 5,000 twelve baskets were collected, and





after feeding the 4,000 seven basketfuls were collected.

Some of the things we waste

Natural elements such as water, soil, nutrients, seed, time, sunlight and heat units: The technology and implementation of FfF helps us to conserve these elements.

Energy & labour: Contrary to most people's expectation FfF done wholeheartedly actually reduces the amount of labour and energy required. The whole system begins to work in our favour as the soil gets softer and the weed seed reservoir in the soil reduces dramatically. The wisdom of correct timeliness of all operations also contributes greatly to this blessing.

Opportunities: Another form of wastage is to miss the opportunities that God brings and offers to us in life. It is mostly to do with time, but certain windows of opportunity do come to us, such as availability and the best prices for both inputs and outputs. In our precarious economic situations the availability of these items and labour, fuel etc sometimes come and go randomly and if are missed will most likely cost much more at a later date, or may not be available at all by then. In my life as a farmer, I have noticed that it pays to always be early with whatever we do and by thus doing we will eliminate this form of wastage.

Our integrity and reputation: These are vital aspects in the good relationship, trustability and creditworthiness that are required in any productive business. We must be scrupulously honest in everything that we do. Our 'yes', must be our 'yes' and our 'no', must be our 'no'. We need to be reliable and make correct and honest estimates and promises, doing all that we can to meet them. This is a much more important issue in Africa than we might realise at first glance.

Property and goods through theft: This also relates to honesty and integrity. We must keep all our goods somewhere secure. This will take a little bit more time and effort and perhaps cost, but again we remind ourselves that we have to give to receive. Record keeping is a great help in minimising losses through theft.

Crop loss through pests and diseases: I praise God that in the many years of experience that we have had in FFF we have seen a great reduction in losses through pests and disease. This again emphasises the need to be wholehearted in our approach. Over these years we noticed that we had less of a problem with pests and diseases than our neighbours who were practicing conventional tillage (turning the soil over deeply). When Carroll and Gordon Montgomery came out from the USA to teach us ten years ago, they explained that weak, wilted, drought stressed plants are much less resistant to disease than healthy turgid plants. Wilted, sick looking plants radiate a different wavelength of light refraction that actually attracts pests to them; this is part of God's decaying process in the cycle of life. Conversely, healthy turgid plants refract a different wavelength of light that repels insects. FFF and God's blanket greatly assist in this process of disease and pest resistance and of course the very elements of drought loss are greatly reduced by following God's way.

With Joy

God revealed to us the first three principles, and they really do constitute the theoretical base of poverty alleviation by creating profitably. The miracle of actually implementing this technology and management theory is brought into being through a fourth principle 'with joy', which he gave some time later.

If we are honest many of us in Africa live in a great deal of despair. We scratch a living from day to day trying to make our crops succeed, but they often fail and we don't know how we will feed ourselves until the next growing season. We are often under a cloud of hopelessness, which saps us of our strength and energy, and a poor





work ethic ensues. BUT those of us who know God have a great deal of reason to hope and not despair. Though we will encounter trials and suffering, we have a great God who loves us and purposes good things in our lives. Jesus has won for us the hope of heaven and glory.

Matthew Henry commenting on Romans 15:13 says, "The joy and peace of believers arise chiefly from their hopes. What is laid out upon them is but little, compared with what is laid up for them; therefore the more hope they have, the more joy and peace they have."

John MacArthur writes: "Biblical joy consists of the deep and abiding confidence that all is well regardless of circumstance and difficulty. It is something very different from worldly happiness. **Biblical joy is always related to God** and belongs only to those in Christ. It is the permanent possession of every believer—not a whimsical delight that comes and goes as chance offers it opportunity. A Christian's joy is a gift from God to those who believe the gospel, being produced in them by the Holy Spirit as they receive and obey the Word, being mixed with trials with a **hope** set on future glory."

We can see that our joy arises from hope. When we turn to God wanting to 'acknowledge him in all our ways' and begin to do things on time, at standard and without wastage, hope begins to dawn in our hearts as we begin to see that perhaps we can make a success of our crops. This hope leads to joy, which Nehemiah 8:10 says is our strength. All of a sudden we will find ourselves no longer grumbling, complaining and blaming others for our demise, but we will have joy for our work and we will want to work even harder and be more on time, at better standard and with less and less wastage. Truly the 'path of the righteous is like the first gleam of dawn, shining ever brighter till the full light of day.' (Proverbs 4:18)

We will dwell more on this aspect of joy in the lesson entitled 'Eating an Elephant'.

Conclusion:

Simply end off by asking: 'What are the four keys to effective implementation management?'

1. ON TIME
2. AT STANDARD
3. WITHOUT WASTAGE
4. WITH JOY





The Folly of Ploughing

Our Soil and Water

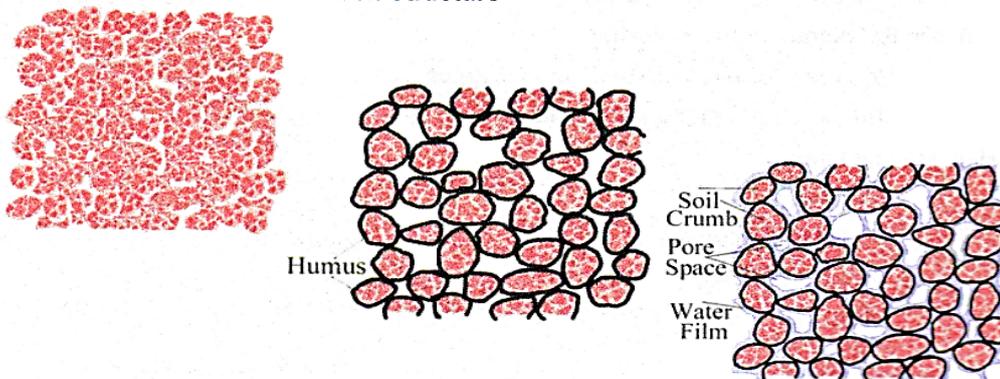
It is very important that we are faithful with what we are given. The soil and rainfall are two of the basic things that any nation is given. We should all learn how best we can be faithful with them.

We are wasting our soil and water!

It is said, that Zimbabwe loses enough soil that would fill a goods train long enough to circle the world twice (80,000km) every year due to sheet erosion. This soil is being washed away by water and so it stands to reason that we are losing a huge amount of water to runoff as well.

Understanding the structure of healthy soil and how it functions is essential to know how to protect our soil and water and conserve them.

Soil Structure





Humus:

Soil fertility is determined by the level of humus in the soil. Humus controls fertility by:

- Holding and storing **nutrients** and preventing them from being leached.
- Acting like a sponge, absorbing and storing **soil moisture** (drought resistance).
- Feeding and protecting **soil life**.
- Preventing **erosion** by holding soil particles together and encouraging infiltration.
- Contributing to improved growth and **plant vigour** through healthy roots structures.
- Buffering the soil from extremes in **temperature**.
- Moderating and rectifying **soil pH** problems.

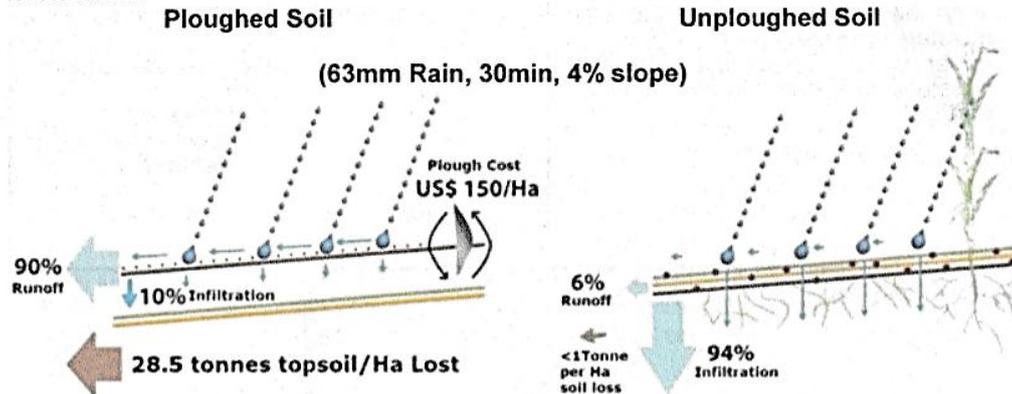
Principles of Conservation Agriculture.

These are based on maintaining and enhancing soil structure:

1. Minimum soil disturbance
 - No ploughing
 - Zero or minimum tillage
2. Maintain maximum soil coverage
 - No burning (prevent all fires)
 - Use mulch (crop residues)
 - Composting and manuring
3. Practice Rotations (using legumes)
 - Improve soil structure and nutrient status
 - Breaks pest and disease cycles
4. High Management
 - On time
 - To High Standard
 - Without Wastage
 - With Joy



Simulated Storm Trial – CEDARA Research Station, Kwazulu/Natal In the early 1980s a storm trial was conducted at the CEDARA Research Station in Kwazulu/Natal, South Africa. They set up two plots, one, which had been ploughed, and one, which had an undisturbed soil structure and mulch cover. They were set on a 4% slope and irrigated with a simulated storm of 63mm in 30minutes. See the diagrams below for the results.



Comparison of Soil Structures

Conventional Farming	Foundations for Farming
<ul style="list-style-type: none"> destruction of natural make up of the soil aggregates soil organic matter and humus are destroyed (due to oxidation) soil becomes fluffy and light, looking and smelling beautiful, but has no benefit organisms in the soil are destroyed as aerobic and anaerobic organisms are misplaced due to inversion water holding capacity is depleted. Most of a soil's ability to retain moisture comes from its macrostructure (the holding together of the soil due to the network of roots) and the ability of organisms to retain moisture. reduced nutrient storage. Nutrients easily leached. soil is prone to compaction high land preparation costs involved due to the need for tractors or other draught power soil becomes harder and more difficult to work 	<ul style="list-style-type: none"> soil macro and microstructure remains stable. soil organic matter and humus levels in soil increases. roots decompose leaving channels in soil profile for water infiltration. aerobic and anaerobic organisms are able to coexist in perfect balance and increase in number to enhance fertility. Water holding capacity of the soil is increased. increased fertility because the mulch provides a natural way for decomposition to occur. increase in nutrient storage ability soil is highly stable and will not slump highly cost effective soil becomes softer

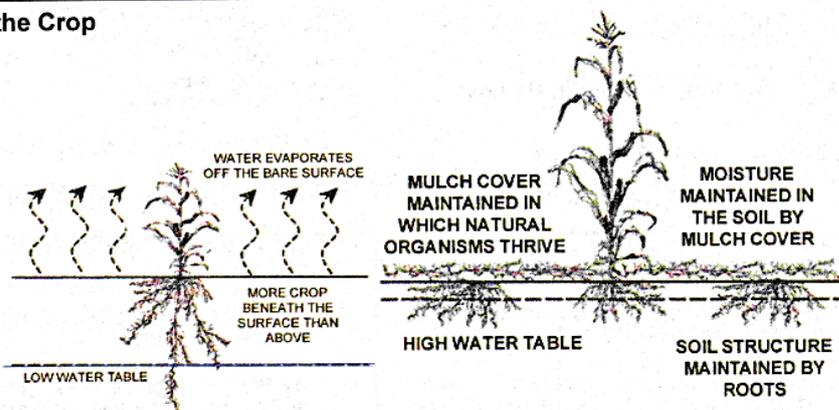




Water Retention and Runoff

Conventional Farming	Foundations for Farming
<ul style="list-style-type: none"> • penetration of water is very shallow - only the topsoil receives that water • very low ability to retain the little moisture it has received • upper moist areas lose whatever moisture they have received to evaporation 	<ul style="list-style-type: none"> • water travels slowly through God's blanket (mulch) • water penetrates deep into the soil profile • mulch acts as a shock absorber against strike action of raindrops • no crusting/capping of the soil • blanket helps to slow down the flow of water down hill (prevents sheet erosion) • blanket reduces evaporation

Growth of the Crop



Conventional Farming	Foundations for Farming
<ul style="list-style-type: none"> • Due to loss of moisture and nutrients in conventional farming, the plant roots need to go in search of these. • The roots grow large in search of moisture and nutrients • More crop under the ground than on top! • Less grain to stalk/foilage ratio. • Decreased yields. • High pest and disease pressure due to stressed plants and unhealthy soil. • Increased weed seed germination and thus greater weed pressure. 	<ul style="list-style-type: none"> • The high nutrients and moisture status are optimal • The roots are having to look very shallowly for their needs • Instead of a crop mostly under the ground it is above! • More grain to stalk/foilage ratio • Increased yields • Increased resistance to pest and diseases due to healthy soil and plants. • Decreased weed germination thus less competition from weeds. • Increased efficiency of Nitrogen fixing bacteria in legumes.

Eating an-Elephant





Introduction:

Take your group to your chosen piece of land, which is overgrown with grass or weeds. Tell them that they are going to need to prepare this land for planting. What should they do? Their first response may be that they want to set fire to the weeds or to plough them under. Insist that these would be the worst things they could do. Instead they must not burn anything, but chop down the weeds with a hoe and lay them down evenly as mulch. They may well look in disbelief at the apparent enormity of the task. Agree that it does look daunting but that God has a plan. Ask: "How do we eat an elephant?" Answer: "One bite at a time!"

Proceed to show them how to eat away at the task of sorting out their land.

Give a lesson on timing

Encourage the group that it is now long before planting season (if it is before the planting season!), hopefully after a good rest that God has told us to have. They are on time already. Having shared the vision and the plan verbally before, you remind them that 'on time', 'at standard', and 'without wastage' are the keys to making a profit. This is an ideal opportunity to apply these principles.

Find a baseline

Pick a line along which you can place your baseline, such as a road, fence or tree line etc. You must ensure

that this line runs across the slope and not down it. Here begins a lesson on the accuracy, precision, standards and timing that glorify God.

Precisely lay out the side of the field

This is an ideal opportunity to apply 'at standard' by encouraging a high degree of precision. For beginners, and for ease of management, it is best to keep the length of the base line less than 50 metres. Mark out the base line by putting a peg at each end and make sure that it is lined up as parallel as possible to the road or fence or edge of the field. Then tie a piece of string from one peg to the other and pull it tight to form a straight line.

Create a working area

Measure two metres from each peg in the direction away from the original baseline and place a peg in each location. Connect up these two pegs now with string. The working area should now be a rectangle 2m wide and up to 50m long. We make sure that it is a perfect rectangle by using an A4 piece of paper as a setsquare in the one corner on the base line.

Explain to the group that they have glorified God by giving a bit of extra time to place the side of their crop very neatly in line with the road or fence and to make sure that they have a perfect rectangle. It is a form of giving to receive and they are already applying the highest of standards, which glorify God.

Begin chopping out the weeds

Ask the farmer and some family members to now begin cutting down the weeds with their hoes, disturbing the soil as little as possible. As they are chopped out they must be laid down and left as mulch. If perennials such as Couch grass are present, these must be carried off, as we do not want their 'runners' to 'take' and grow up as weeds in the next season. The group simply works within the rectangle laid out previously and chops out all the weeds in this area.

Create a second rectangle

Once all the weeds have been chopped out of the first rectangle, create a second one. This is done by measuring another 2m away from the second two pegs away from the original baseline. In effect we take the first two pegs laid and 'leap frog' them over the second two, 2m beyond. We then stretch the string between the new pair of pegs and begin to chop out the weeds in the new rectangular area.





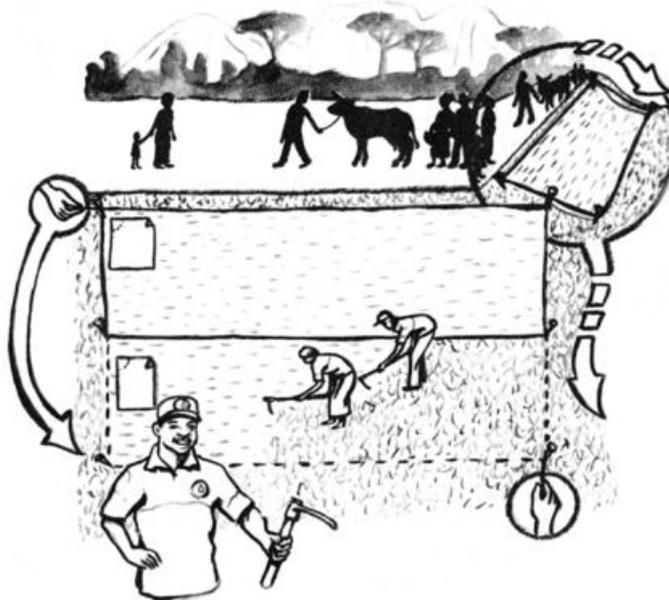
When they have diligently finished the second section, they can step back and look at a beautiful rectangle of 4m x 50m. The evenly spread mulch (God's blanket) defined by an accurately measured rectangle constitutes order and standards in amongst the relative chaos of the jungle of weeds. We keep reminding them of the truths we shared with them before.

- We show them that they have started early (preferably in July before the ground gets too hard and dry), so they are 'on time'.
- Then we point out that the careful and accurate measurements and evenness of the spreading of God's blanket means that they are now farming at a very high standard.
- Then we show them that they are not wasting time or moisture because the mulch cover is cooling the soil and reducing moisture loss by preventing evaporation.
- We also point out that we have now created the best environment for the soil fauna to condition the soil.
- We then remind them that they are performing 'on time, at standard and without wastage', and because of this 'faithfulness' and the 'giving' of extra effort to achieve this, God will honour His promise 'to add to them'. They are on their way to making a profit.

When they see and hear this a glimmer of hope comes into their hearts. The beginning of 'joy' follows this hope and we know that God says that our joy is our 'strength'. The incentive comes from within and there is no cajoling, threats, or slave driving.

Repeat the process

Simply repeat the process until the whole area has been prepared.





Planting a well watered garden (Maize)

Introduction:

Let everyone know that the WWG has a two-fold purpose today. We are going to use it to teach how to actually farm using the FfF methods, but it will also be a wonderful way to demonstrate the success of the methods to the rest of the community as it grows. We therefore need to start it well together and determine in our hearts that we will look after it right through its growing season.

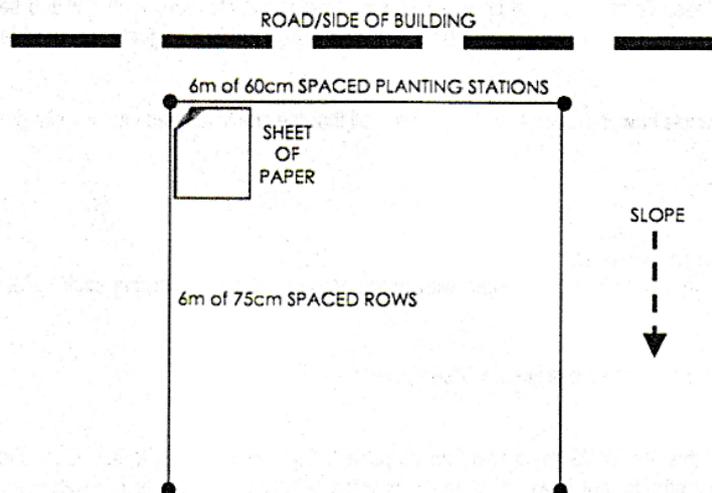
Pray and ask for God's Help.

Selecting the Site - Pray that God will show you where to put it.

- Where can the "light shine like the dawn" best? Where is it most visible and where will the greatest number of people pass by? i.e. at an entrance or at a crossroad, near the church entrance or administration block etc.
- Where would it be most aesthetically beautiful?
- Avoid too much shading by trees and tall buildings.
- For a winter garden it should be near a water supply i.e. garden tap, borehole, well or river. e) Are birds, i.e. chickens, francolin (chikwari) and animals a problem? Is fencing available?

Marking the Site

- Establish where your base line (side) will be. Make it parallel to the access road or the nearest building, etc so that it looks pleasing.
 - Look at the slope and make sure your 75cm rows run across the slope.
-
- Put in your base peg and measure out your 6m base line putting in another peg.
 - Measure out both perpendicular sides of the plot which should also be 6m. Use a sheet of A4 paper to make sure that the corners are an exact right angle.
 - Explain that to be so meticulous might appear to be "over the top", but we are trying to teach the principle of excellence, which honours God. Then explain that high levels of production come from high standards. You reap what you sow. It is possible to get 12 tonnes per hectare with the highest standards. Every degree of lowering of standards correspondingly reduces yield potential from 12 to 10 to 8 to 6 to 4 to 2 to 1 to none per hectare.





Remember to point out this Godly principle to the audience as you do it.

Get your training team to do the physical work enthusiastically and evenly. Evenly spaced holes of even size and depth are the foundation for a beautiful even crop, which makes it possible to achieve the highest possible potential yield. Pray for the Holy Spirit to move your audience's hearts to understand and accept this important fundamental principle. Remember that this may be used by the Lord to introduce higher standards of management in to all aspects of stewardship in our nation, be they agricultural, industrial, administrative, or governmental. Don't say this at this stage unless the Lord prompts you to do so. He may prefer you to say it at the end as part of your summary, if at all. Check your audience to see if this will cause offence – this should not be the case with church audiences.

Point out that we will seldom have fields that are exactly rectangular. However, we must endeavour to have carefully measured row spaces with evenly measured planting stations in our fields. This can be done by using measuring sticks or measuring strings. Straight planting rows are important, because they make this marking out easier and enable us to grow subsequent crops on the same lines (rows). This maximises the residual build up of fertiliser in the soil and also minimises compaction, by limiting the compression from human feet, animal hooves and tractor wheels, to the inter-row spaces.

Marking out the Planting Holes

Take your 6m wire at 60cm spacing and stretch it across the base line pegs. Dig the planting holes at the 60cm spacing. The holes must be about 8 cm deep if using fertilizer (15cm deep for compost and manure), and 15cm long by a hoe width. Make sure that the centre of the hoe blade is exactly opposite the 60cm mark.

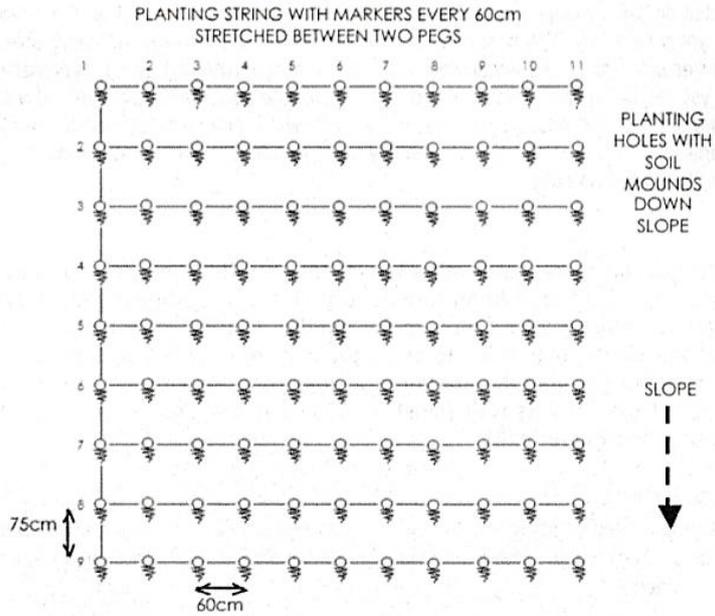
Then when you have finished the line (which will have 11 holes and 10 spaces) use the 75cm stick to move your pegs 75cm along your string down the slope. Remember that the 75cm rows run across the slope to prevent soil and water loss. Always dig the holes on the down slope side of the measuring wire so that the soil pile (borrow) is down slope of the hole. This prevents soil from being washed back into the hole, as might happen after heavy rain, if the soil were on the other side of the hole.

The soil pile on the down side of the hole helps to capture a bit more rain water by providing a small extra barrier to any overflow from the holes. These little details can make a real difference and is all part of reaching for the excellence that honours God (1 Samuel 2:30).





MARKING OUT PLANTING HOLES





Fertilization

a) The Necessity of Plant Nutrition:

The grain or produce from the field we also remove the nutrients from the soil that the plants have used to produce the grain. It is like a bank account. If you keep on removing money from your bank account without putting sufficient money into it, you will eventually have no money left in that account. You have to give to receive; you have to put this faith gift of seed and fertilizer/compost/manure into the soil for God to multiply it back to you. The amount of nutrition you put down should be sufficient to replace the nutrients that will be removed by the realistic potential yield you expect to harvest.

Lime and Fertiliser

When fertilizer is used an application of lime equivalent to the total topdressing application of nitrogen should be placed first in the bottom of the planting station. This is to counteract the acidifying effects of nitrogenous fertilizer in our soil. In very poor communities wood ash can be used as a substitute to lime.

According to research done by FfF over the past 10 years the optimum fertility rate is 200 kg/Ha of basal (No.8 cup/planting station) and 200kg/Ha of topdressing (2 split dressings of No.5 cup/planting station). This is placed in the hole by measuring cup. The levels of fertilisation can be adjusted according to the state of your soil and the standards of your management. If your soils are deficient it will pay you to put in a bit more fertiliser than you remove. This will build up your soil and give you a higher yield potential. For example: If you only have 4 x 50kgs of basal fertiliser and 4 x 50kgs Top dressing, it is better to put all of it on 1ha at 200kgs/ha rather than spread it over 2ha at 100kgs/ha. You would still have the same yield potential on 1ha as opposed to 2ha with much less labour. By doing 1ha at the highest standard planting on time, you would have the best chance of achieving maximum yield. By being able to carry extra mulch onto a smaller plot and by the investment of higher management and by the generosity of the higher level of nutrition, you would be giving God more to multiply back to you! Also in the event of a serious drought you would be more likely to get enough grain to feed your family. If one puts 100kgs/ha onto 2ha at a lower standard of management with less mulch and probably more weeds it is likely that one would get a complete crop failure and no food for the family.

Compost

The Lord challenged us to research alternative options which reduce our dependency on purchased inputs. The Lord lead Brian to the story of the Jesus feeding the 5,000 (Matt 14), where he exhorts us to see what we have in our hands. Thermal compost made as described in lesson 10 has the ability, over time, to be as productive if not better than inorganic fertilizer. The measure used per planting station is at least one 350ml tin of compost. This rate would apply to most manures as well (must be placed in the bottom of the planting station and not spread over the whole field).

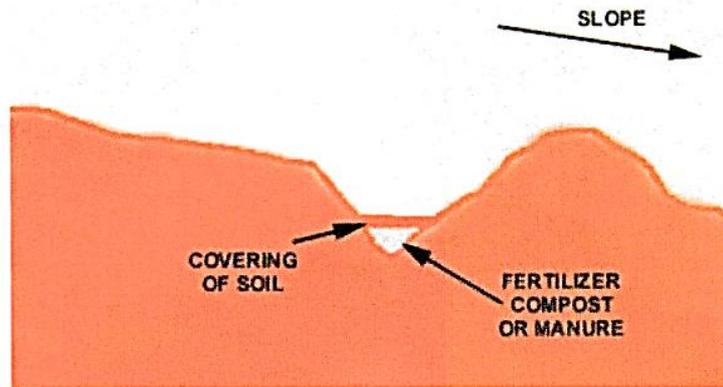
b) Placement of Fertiliser:

The fertiliser should be poured carefully into the lowest point of the hole. If you use manure/compost make the hole deeper (15cm as opposed to 8cm). Then a small amount of soil should be pulled over the fertiliser to prevent it from "burning" the seed.





PLACEMENT OF FERTILIZER



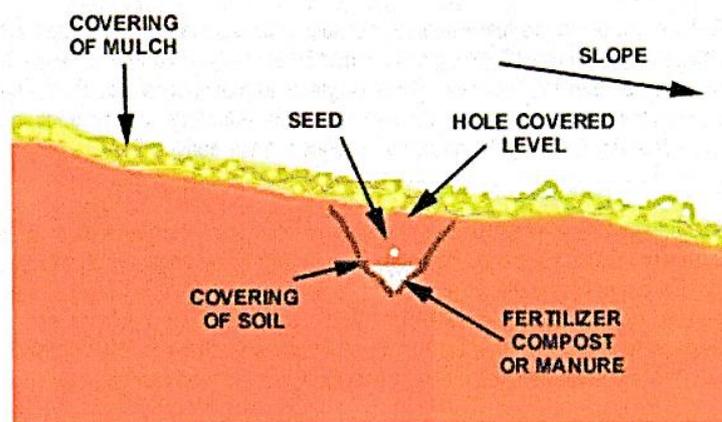
Seeding

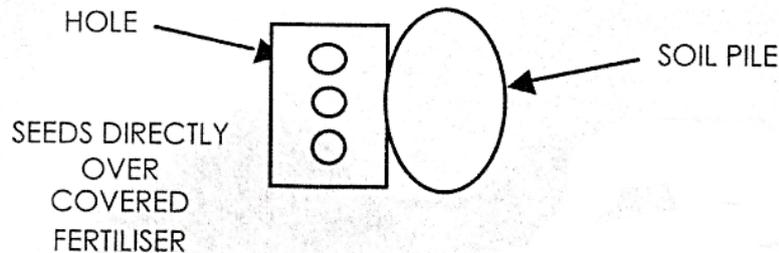
a) Placement of Seeds:

Put 3 seeds on top of the layer of soil directly over the fertiliser. This is the best place for the germinating seedling to be, for the earliest and most efficient uptake of nutrients.

Please have the wisdom and faith to put down 3 seeds per station knowing that at +/- 2 weeks after germination the plants **MUST** be weeded down to 2 plants per station. A good full even stand is an essential foundation to achieving a high yield. With the difficulties of the weather, capping soils, pests and all the opposition from the Evil One it is difficult to achieve this good foundation by planting 2's. The difference between a 90 – 100% Population rather than one of 60 – 70% can mean a difference in yield of between 1 and 3 tonnes/ha. Ask the Lord for a generosity of spirit and put enough seed into an area you can manage at the highest standard possible.

PLACEMENT OF SEED AND MULCH





b) Covering of Seed:

This is the single most important operation that you will do as a farmer. The standard of covering and the effort you put into this operation will determine whether you have a good or a poor crop. We have found that over the years 5 cm of soil covering the seed is best (hole is depth of matchbox). Don't plant too deep with capping soils. You can go a little deeper with soft friable soils. It is very important to carefully cover evenly with **clod free soil and no stones**. The planting station is covered back to ground level. NOTE: there should no depression left in the soil- The mulch is the water capture mechanism, NOT the hole!

The importance of a full, even stand cannot be over emphasised. This will achieve an early canopy of leaves across the rows forming a "roof" over the soil which creates the right microclimate for the crop. There is less evaporation from the soil and the weeds get shaded out (this is why a 75cm row spacing is optimal). When there are gaps in the rows the sun gets to the soil surface and dries it out and the weeds grow vigorously and start to really compete with the crop.

Evenness of growth is also important. If the crop is uneven the bigger plants overshadow the smaller ones, progressively stunting them. It has been proved that the worst weeds in a crop are plants of their own kind. These overshadowed plants don't produce a cob and yet rob moisture and nutrients from the bigger plants resulting in a marked reduction in yield. Careful, even covering of the seed helps to prevent all this.

Satan may suggest that we are being too fussy demanding such high standards. It has seen over the years that it is "the little foxes that ruin the vineyard" (Song of Solomon 2:15). They come in and cause low yields. A little lessening of standards here and there collectively cause our yields to plummet to a tenth of what they could be. High standards could mean the difference between life and death for hundreds of thousands, maybe millions of people, if we suffer another series of droughts, as we experienced in the early 1990s.

Mulching

The best and most convenient mulch in the field is the crop residue from the previous crop. This is why crop rotations such as maize and beans are good. Rotations help prevent any build up of disease and pests. The minimum amount of mulch cover that is effective is about 30% of the soil surface area, but the more the better. Mulching is very important for soil and water retention. When we look at the bush we see that God has designed that the soil surface is covered with a blanket of dead grass and leaves. We call this "God's blanket". Where there is no cover, the soil degrades and a desert ensues where no food can be grown!





The mulch blanket breaks the kinetic energy of the falling raindrops, cushioning the surface, and preventing it from sealing over from the impact. This also slows the rainwater down allowing it to percolate into the soil. By not ploughing the soil deeply the mulch is left on the surface and the roots of the previous crop are left in position to hold the soil in place. This stops the soil from slumping downwards and washing away laterally in a rainstorm. These roots eventually rot "in situ" making channels for other roots and water to filter into the soil. By not inverting the soil more beetles and worms move in the soil also creating these infiltration channels.

Watering

We hope to plant many "gardens" of 6m x 6m during the winter and before the rains in order to "teach the heart" to as many people as possible before the main planting season. We hope that this will inspire many who see the "gardens" growing during the winter, to be prepared in mind and spirit, as well as logistically to do their own fields "on time, at standard and without wastage!"

This will necessitate watering the crop up to the on-set of the rains. We pray that this will also stimulate the people to plant a portion of their crop with water prior to the rains. This will provide them with an early food crop and will also be a teaching prompt so that they will be ready for their own main planting with what rain the Lord will send. This may mean carrying water in buckets and cups, some distance, to the field, but "going the extra mile" pleases God and they will reap abundantly from every bit of extra effort.

Method

Having holed out and cupped in the fertiliser as described earlier. The best way to "water plant" is to fill the hole with water first. A normal rain-planting hole will probably take about 2 litres of water.

Allow the water to soak away and then immediately put the 3 seeds on top of the wet soft soil. Then cover with 5cm (Upright matchbox) of **clod free drier soil**. This dry soil will act as mulch, in itself and will prevent undue moisture loss. These 2 litres of water should suffice for 2 – 3 days. Thereafter 500ml per day for the 2 litre example should be enough to keep the soil moist. It is absolutely essential to keep the surface soft and moist from days 5 to 8 after first moisture to prevent hard "capping" of the soil and subsequent germination losses. The application of mulch greatly helps in this respect and prevents water loss from evaporation.

This accumulated water volume of about 4 –5 litres/plant should keep the new seedlings going for one to two weeks, depending on the heat and the general moisture status of the soil before planting. When the plants show signs of wilting, apply 2 litres per plant once per week, increasing to 3 litres per week as the plant gets bigger. At knee high and onwards the plant may need 4 litres per week in the extreme heat before the rains in October and November. In a winter planted crop (June or July) only half this amount will be necessary.

Stalk Borer Treatment

28 days after the first rains of the season is when the stalk borer larvae will hatch. This is when they are at their most vulnerable, and when a treatment should be applied. A chemical treatment is very cheap and easy to apply. Usually the chemical is in a granular form and a small pinch is applied to the funnel of each plant. This treatment can be applied any time after thinning, but preferably closer to a month after germination. Post harvest stalk lodging is encouraged to minimize the pupation sites of the moths. See FAQ's on page 73 for more details.



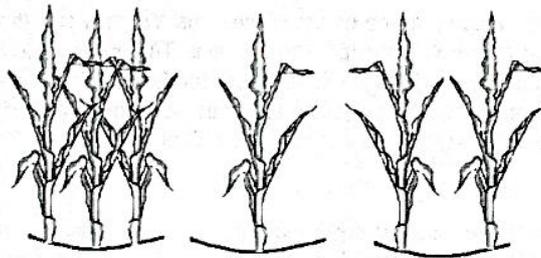


Thinning

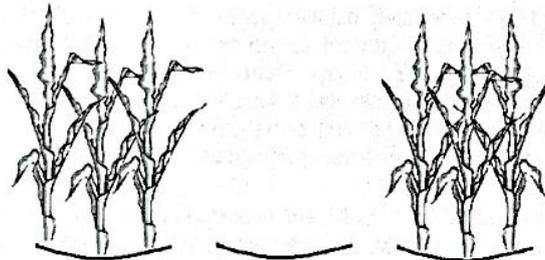
Between 2 – 3 weeks after emergence you must thin the plants down to 2 plants per station. Where there is only 1 leave 3 on one of the stations next to it. If there are no plants there, leave 3 on both sides. This will bring you back to an average of 2 plants per station.

On no account leave 3 plants per station. This will give you too high a population especially in a dry year. You will get excessive lodging in a wet year. In any event you will get a lower yield from 3 per station rather than 2. The temptation to leave 3 plants per station is very strong for beginners and may need extra prayer and emphasis to get the message through. (If you try and thin before 2 – 3 weeks after emergence, it will just break off above the roots and grow again. Try and make sure you pull the plant out with the roots.)

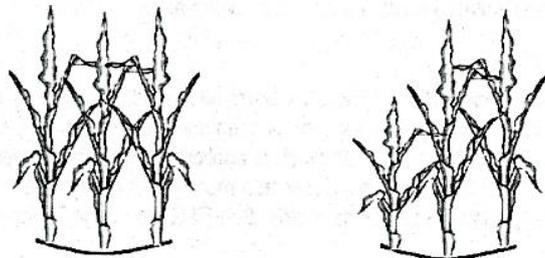
THINNING



IF ONLY ONE PLANT HAS EMERGED IN ONE STATION, LEAVE THREE ON ONE SIDE AND TWO ON THE OTHER.



IF NO PLANT HAS EMERGED IN A STATION, LEAVE THREE PLANTS ON EITHER SIDE



IF ALL EQUAL REMOVE CENTRE PLANT

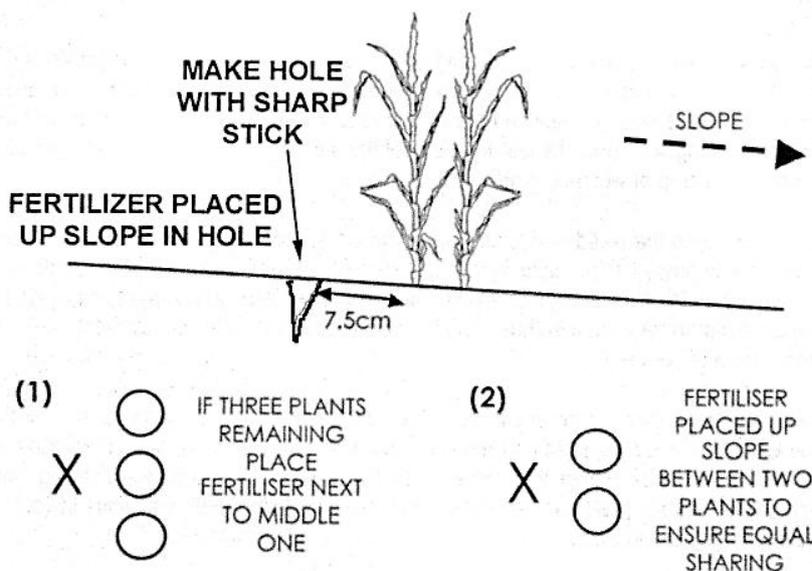
REMOVE THE WEAKEST PLANT





Top Dressing

Having applied our basal compound fertiliser before planting, we then come and apply the first nitrogen top dressing at about 3 weeks after emergence (at thinning) – no later (rather earlier than later). A No.5 cup is the recommended rate. The second topdressing (No.5 cup) is applied just before tasseling.



Method

Use a sharpened stick or hoe handle to make a small depression into the soil surface on the upper side of the slope about 5–7cm from the planting station. Place the topdressing into this hole and cover it. This means if there is rain the fertiliser will be washed towards the plant rather than away from it. This covering is much more critical when using urea, because it vaporises much more readily than AN.

In heavy clay conditions it is possible to get away with only one early topdressing of 200kg/Ha.

For an organic topdressing alternative see appendix 4.

Weed Control

This is one of the most important aspects of farming. Weeds are part of the curse (Genesis 3:17 –19). We need to turn to God and ask Him to help.

A jungle of weeds at the end of the current crop is the reason why most people either burn these weeds and the wonderful mulch or else they turn them in by deep ploughing in order to make a seed bed. This is not God's way in nature! There is no inversion of the soil in the natural bush. Instead the seeds fall onto "God's blanket" of protective mulch where some make sufficient soil to seed contact to enable them to germinate and continue God's precious cycle of life. Sometimes this is aided by the shallow disturbance of the soil by the hooves and feet of animals. This is why we dig shallow holes about 7–8 cm deep.





The Discourager will want to overwhelm us with weeds, but if we ask God for wisdom, faith and help, this need not be the case. In Romans 12:2 God says, *“Do not conform to the standards of the world, but allow God to transform you inwardly by a complete change of your mind. Then you will be able to know the will of God – what is good and pleasing to Him and is perfect.”* (GNB)

Method

We need a new way of thinking. Our weed control and land preparation must start in the previous crop. Most often we battle with the weeds until we see that we have a crop and cobs or ears have developed. We then stop weeding and the leaves senesce and the light comes in and reaches the ground. The weeds grow rapidly with this sunlight together with the last moisture of the season. We end up with a jungle of weeds that set seed for another huge crop of weeds the next year.

It is imperative that we keep the weeds out until the conditions are too dry for any of them to germinate. By doing this we are already preparing our land for the next season. All we have to do is knock down our stalks evenly and we have our mulch (God's blanket) for the next crop. It is tidier and neater for harvest and it gives you a psychological boost to persevere enthusiastically with the system. This also prevents late weeds from removing soil moisture and nutrients.

After planting your next crop look out for any early weeds and hoe them out as soon as you see them germinate. Large weeds have already removed soil moisture and nutrients and have started stunting the crop. It takes far less energy to hoe small weeds than larger ones. If you are on time and do everything well and your stand is full, with a good covering leaf canopy, you will only have to do four light weeding in your crop during the season. Again **timing** is the answer.

Three Keys to Effective Weed Management

- Hoe the weeds when they are small—Less energy required and they do not mature and reseed.
- Crop canopy—75cm row spacing and 100% crop stand provide the optimal canopy closure.
- Late weed control—This prevents reseeding.

Conclusion:

It is likely that everyone will be very hot and tired by the time you've finished this demonstration. Field any questions and then briefly encourage the people to see that they have just learned how they can put all the theory into practice. Remind them that one of Africa's great problems is actually implementing our knowledge.

Pray that God would help them to take what they have learned about the farming methods and implementation management and do it diligently in their own plots. Remind them that if they are going to do a Well Watered Garden as a demonstration area, then that will be their advertising of the system. If they want people to take up FfF methods they will need to ensure that they prove it works through the WWG. Encourage them to be faithful.





Making Compost

Introduction:

Compost is something most people have heard about, made or used sometime during their lives, but few really know how to make it to a high standard. The compost that we would like to see people making and using should be of a consistent quality, and should be free of weed seeds and any pathogens.

What is compost?

It is the **Aerobic** decomposition by BACTERIA and FUNGI of a mix of organic material.

This means that in the presence of oxygen, the plant material will breakdown by the action of the bacteria and fungi. (In many situations the definition of bacteria and fungi will need to be explained.)

Putrefying organic matter is not compost. Thus if your compost smells bad it generally means it is bad, and should not be used on plants.

Thermal Compost

There are many methods of making compost, but during this course we will only concentrate on thermal compost. This method takes slightly more management and diligence than other methods, but it is fast (approximately 8 weeks) and will be weed seed and pathogen free.

The minimum size of a thermal compost heap that should be made is about 1.5 m cubed, if built smaller than this you will not achieve the desired temperatures for the required periods. Thus the following teaching will refer to this size of 1.5x1.5x1.5m pile, which will ensure the required volume for the required tempera-





tures that must be attained. It is also small enough for a single person to work in a few hours. In a small-scale farm or garden situation it is also not too difficult to accumulate or gather enough raw material to build a heap of this size. This volume of compost, if made correctly and the right quality attained should easily be able to sustain a quarter hectare of maize. If you require slightly more compost a 2x2x2m³ is also very manageable.

Ingredients Required

All the ingredients and amounts below are for the construction of a 1.5x1.5x1.5m³ pile of compost.

1. Green material

Green materials are important for our compost due mainly to the sugars that they contain (These are good bacterial food). An important point to remember here is that if plant material is cut green then it should always be considered green, even if it has dried after being cut. Some good examples of green materials are: grass, leaves and weeds (don't worry about seed). Diversity of materials is always good.

The green material should make up 40% of the total material, or just over 2m³ of material. (An important note here is to take into consideration the fact that once we begin to construct our pile the materials will be compacted a lot more than they were whilst being stored. So you may think you have enough material but find you are very short.)

2. Dry material

The dry materials play an important role in your compost by supplying the woody or ligneous material. This is another food source for the microbes, mainly the fungi. Some good examples of dry materials are, maize stover leaves, straw or grass, wood shavings, used thatching grass, maize cobs, wood chips, pine bark, pine cones sticks and seedpods.

The dry material again needs to be 40% of our total materials, but needs to consist of some woody materials. By this I am referring to materials that are larger than 3cm in diameter, woody materials should not be too long (not more than 10-15cm). Of your 40% dry material it is desirable to have at least 5-10% of it woody. The reason for this is that these woody materials allow for better airflow in and through the compost pile.

3. Nitrogen Source

The nitrogen content is again an important feed ingredient for the bacteria as they grow in our compost. The nitrogen source can come in very different forms. The most easily available to most people is manure. The animal dung from kraal or an overnight pen is the best as it also has residual nitrogen from the animal urine. The other common nitrogen source is the material from leguminous plants; this can be cut fresh green (eg. lucerne or wattle), or be dried, as in bean pods or stalks. An important note here is to try not to get your high nitrogen plant material mixed with your other plant materials. If you do you may over supply nitrogen in your compost. This can cause unwanted wastage through an extended heat period and result in less product at the end of the process.

The final common nitrogen source is in the form of Ammonium nitrate or urea. In most situations in Africa it is not advisable to teach people to use this option as you will have resistance to mixing a commodity, which has cost a lot of money into compost. This however is a very acceptable method and is what is done in most commercial enterprises, so it can be introduced to experienced compost makers who are making larger



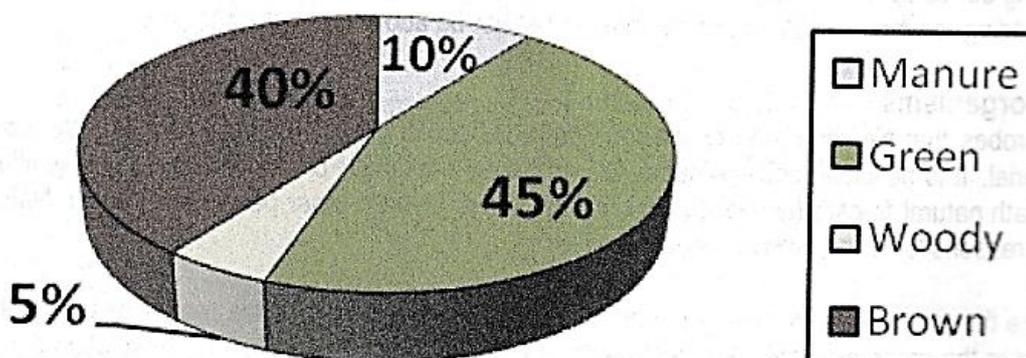


volumes and are finding it difficult to find enough manure or legumes.

Amounts of nitrogen source required:

- **Manure:** 6 to 10 bags, or wheelbarrows, (chicken is stronger than cattle)
- **Legume:** 20% of total material or slightly less than 1m³,
- **AN or urea:** 16-20kg (If this source is used please increase the green and dry materials proportionately to make up the desired 4m³).

Compost Material Breakdown



4. Water

Water is an essential for all life to survive. Our compost is alive and thus needs a lot of water. Water is possibly the most limiting factor in compost production. It is estimated that up to 1,000 litres are required over the 8-week period. Thus we need to plan the placement of our compost close to easily available water. Most of the water required is during the initial construction phase. The materials will need to be completely saturated. (Please refer to "building a pile" for more detail.)

Water is the only ingredient that we will add to our compost after construction. The amount needed should be assessed at each turn, then added during the turning process. It is common for people to try to wet their compost without turning it. This is not a good idea. The reason for this is that if you simply apply water to the top of your pile you will not get even penetration. In fact in most cases what occurs is similar to the action of a thatched roof where the water moves horizontally and comes out of the side.

By building compost during the rainy season we will find that most of the extra water is added for you through the rain. Excessive rain can have a negative effect, but a simple barrier such as thatching grass or cardboard can be placed on the top of the heap to displace excessive water. Please never cover the compost with a plastic sheet as it will suffocate and create an aerobic conditions.





An easy method of determining the moisture content of your compost is what we refer to as “the squeeze test”. Take a handful of your compost from the inside of the pile, during the turning process and squeeze it in your hand. If you are able to see droplets of water coming out of the material, through you fingers, it means that your materials are too moist (60% and more). If there is no visible water escaping from the material and when you open your hand the material retains the shape that you have moulded, then you are in the desired zone (50-60% moisture). If when you open your hand and the material does not keep it's shape, then it is too dry (less than 50% moisture).

5. Oxygen

Thermal composting is an aerobic process, so the presence of oxygen is necessary. As oxygen is in the air all around us all we need to do is ensure that conditions in our compost are suitable for air penetration.

We do this by:

- NOT compacting our compost
- Ensuring at least 5% ($\frac{1}{2}$ m³) of the material is larger than 3cm in size. (Discussed in dry material)
- Turning our compost on time.
- Not adding too much water to our compost (must not be above 60% moisture).

6. Micro-organisms

All the microbes that we require to create the heat and decompose our compost are already present on the plant material. It is possible, and advisable, to increase our diversity of our microbes by collecting compost from beneath natural forests (especially from distant areas) or from other people's compost. Naturally this is one of the reasons for using diverse plant materials.

Bacteria are the primary decomposers in our compost and initially feed on the readily available plant sugars, as supplied in the green materials. Bacteria reproduce rapidly and can double their population every hour. It is specifically the thermophilic bacteria, which create the heat in our compost.

Actinomycetes are the next type of organism that populates the compost, usually as it comes out of the high temperature phase. Actinomycetes are also a bacteria, but grow hyphae similar to fungi. They decompose cellulose and chitin.

Fungi only populate the compost once it cools to less than 40°C and they also decompose complex carbons such as chitin and cellulose.

Reasons for Temperature & Its Management

Temperature is the key factor, which is going to allow us to produce good quality compost. The reason for this is that the heat is responsible for killing all viable seed that may have been introduced with the plant material or the nitrogen source (especially manure). The temperature is also able to eradicate most pathogens that have been introduced from plant residue. This alleviates the risk of re-infecting your next crop with the same disease.

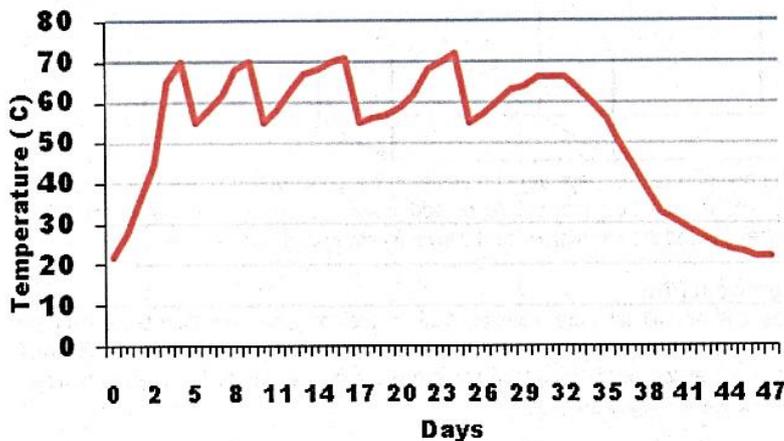
Temperatures that are produced in the compost are surprisingly high. Most people don't believe that 70°C is commonplace. There is a range of temperature that we are attempting to achieve. This is between 55°C and 68°C as shown in Fig.1 below. If our compost is able to achieve this temperature range for at least 4 cycles (turns) and for at least 3 days during each turn we will see the maximum benefits and potential of our com-





post.

Figure 1. Example of a temperature graph.

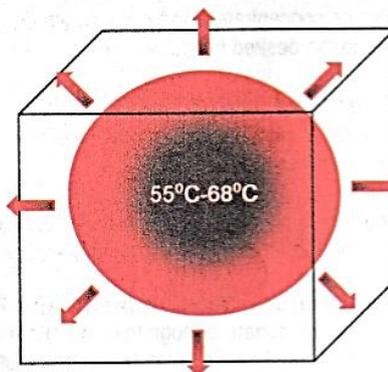


All parts of the pile need to be exposed to this heat. This heat however only exists on the inside of the pile (the outer 40cm is much cooler). This is one of the reasons why turning is important. Each time you turn the pile you should attempt to move material from the outside to the inside, and visa versa.

If the temperature of the pile is too high (ie. approaching 70°C) then the only way to reduce it is to turn the pile.

The turning process has thus achieved three things:

- Exposed new material to the required heat
- Aerated the pile with oxygen, essential for the heat process
- Allowed for the lost moisture to be replaced.



Planning of the Compost Pile

The collection of materials for the compost can be done over a number of weeks or even months. It is important to try to keep the different materials separate. As discussed earlier green material, when cut green, must be considered green even after it has dried.

There is a season for compost and if made on time it is much easier to collect all the necessary materials. The end of summer is the ideal period to begin collecting materials. At this time there is an abundance of green material, which is difficult to find in large quantities at other times of the year. Once adequate quantities of the three main materials (green, dry, and nitrogen) have been collected you are ready to begin.

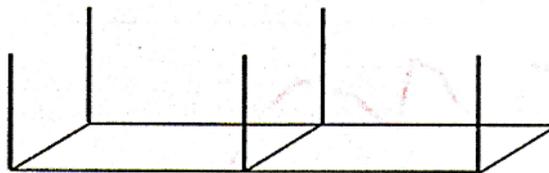




Water is the next resource to arrange and get to the site. Usually you should have brought the plant materials to the water, as they are easier to transport. A drum is ideal for use in drenching your materials. It also helps to not waste water if it is in short supply.

The six pegs or poles are then arranged in the shape of 2 squares adjacent to each other with a common border, as shown below. The compost will be turned from the one square to the other and then back again.

Figure 2.



In this explanation we are not going to discuss layering of material in the construction of the pile, but for the more experienced composter this is an aspect that should be addressed to produce a consistent quality. In other words a recipe can be created and then to reproduce it a layering method should be used.

Construction of the Compost Pile

To begin building our compost pile we will take dry material, dunk it into the water and then place it in the square where our pile is to be built. As already stated we are not attempting to make layers of the different materials, but to get a good blend as we build. Thus take some green material and high nitrogen material, dunk them in the water and continue adding to the pile.

Care should be taken to ensure that the sides or walls of the pile are straight and vertical. The corners must also be concentrated on to ensure we do not end up with a pyramid, but with a cube. Continue to build the pile to the desired height of 1.5m,

Once finished a cap or layer of thatching grass can be placed on the top of the pile. This is especially recommended in high rainfall periods. This cap will divert excess water away from the pile and thus prevent premature cooling.

Your pile is complete. We now must be patient and wait a few days for the temperature to rise to above 55°C, and for it to remain above that temperature for at least 3 days.

Temperature Measurement and Records

If you are fortunate enough to own a thermometer with a probe then it is a simple matter to measure your pile on a daily basis. Unfortunately though most people do not have a thermometer, thus we have devised a simple method of testing and recording the temperature.

A length of 10mm round bar at least 1.2m long is perfect for a makeshift thermometer. A piece of 8 gauge wire would also suffice. This rod or wire is inserted into our compost so that the end is in the centre of the pile. It is left there and periodically, preferably every day, checked.

Our range of temperature is between 55°C and 70°C. The higher temperature is very hot. Bath water heated in a geyser is normally controlled with a thermostat set at 70°C. So this is our top range it is hot enough to scold if we are not careful. Thus when our rod is removed be careful. If you grab the end of the rod and are





not able to continue holding it, it means that we are definitely in the required zone. If the rod is very hot, but we are able to hold it without letting go, then we may be just over the bottom zone of 55°C.

If the rod is warm, but not very hot, it must be somewhere between 35°C and 55°C. If the rod feels cooler than your hand then the temperature must be less than 35°C. Records can be kept in a simple form as shown in the figure below. In this example the pile was built on the 31 January. It can be seen that the heat rises and by the 3rd of Feb it has reached the required zone. It is allowed to stay there for 3 days. It is turned on the 6th Feb, the temperature normally drops temporarily after turning, but should rise again quickly.

When to Turn

It should already be clear in your mind that the compost must remain in the desired temperature zone for at

Date	Less than 35	35-55	55-70
01-Feb	√		
02-Feb		√	
03-Feb			√
04-Feb			√
05-Feb			√ Turn here
06-Feb		√	

least 3 days before we turn it. This means that turning is temperature dependant, not time dependant. So for those intent on trying to achieve the best results possible, check every day and decide when to turn your pile accordingly.

For those who need an easier method, it is possible to simply turn your compost once every week for 7-8 weeks. Under most circumstances this should give fairly good results.

How to Turn

The turning of the pile slightly more complicated than it may appear. The reason for this is that the material that is on the outside of our pile (at least 40cm) is not going to have been treated by the high temperatures. This means that there will still be viable seed and pathogens present. So to deal with this we should try to place the cool materials from the outside of the pile into the centre of our new pile as we rebuild it, and the hot material from the centre to the outside.

The easiest way for you to attack your pile (especially at the first turn) is with a pick. The materials by day 5 or 6 will not have decomposed very much yet, and will be strongly matted together. Thus dig at it with a pick and pull the material down onto the floor. Here you can use a fork to loosen it up before applying it to the new pile. This is the time to add more water if you think it is necessary. Do the squeeze test.

Continue in this same manner until the pile has moved to its new location. Remember this turning has achieved several requirements:

- It has stopped the pile from over heating.
- It has re-supplied the pile with oxygen.





- It has allowed for more moisture to be added.
- The outside (untreated) materials have been moved to the centre.

So it is important to be diligent and continue to turn our pile until the process is complete. If we do not, several things can go wrong:

- Our compost may over heat and kill our bacteria.
- Our compost may run out of oxygen and go anaerobic.
- The compost may also run out of moisture and cool down too soon.

Indicators of Good Compost

- **Smell** If it smells bad, it is bad! This is due to the presence of alcohols, acetic acid, butyric acid, valeric acid and putrescine. All of which are produced in anaerobic conditions.
- **Color** NOT BLACK
Deep, rich brown indicates humics
Tan, honey color means fulvics
- **Texture** Crumbs, air passages, aggregates visible
- **Fungal Strands** Visible thick threads in compost, not aerial, not fuzz

Conclusion:

Use this opportunity to exhort the group to see that farming is a something to be worked at throughout the year. During our dry winter months, we can be using them to make our compost in preparation for the growing season to come. Think ahead and continue to be diligent so that there is enough compost for the new season. Remind them that they will need to build their compost pile at least 12 weeks before they plan to plant.





Rotations and Cover Crops

Introduction

Rotations are an essential part of sustainable agriculture, and is one of the key components which defines Conservation Agriculture. Rotation of crops aids in the control of diseases, insects, weeds and nematodes. By including a legume crop in your rotation program additional nitrogen is added to the field, which will benefit the succeeding crops. Yields of crops grown in rotation will yield at least 10% higher than those grown in a mono-cropping system.

Within Foundations for Farming we advocate what we refer to as a "tight rotation". This means that in your field you would have a cereal crop one year and then in the next season on the same land a legume crop. Thus your field would need to be divided in such a way that you are still providing both cereal and legume crops for your family every year. It would be of further benefit if the types of cereal and legume could also be alternated within this system.

By growing a variety of crops on the field also protects the farmer from climatic or market fluctuations.

Soil and Organic Matter.

As already discussed earlier in this manual using conventional methods causes serious erosion and a drastic reduction in soil organic matter. This is due to mono-cropping, removing residues and ploughing in the residue, which greatly enhances oxidation of the organic material. Rotational practices in combination with Conservation Agriculture alleviates all these issues.

The organic matter is effected by the types of crops grown, what their yields are, which portion and what ratios are left as residue and also what volume of root material is produced by the crop. Thus all these factors are important when selecting what crops should be grown. In zero tillage systems it is important to note that the decomposition of organic material decreases. Legume crops, which generally have extensive root systems encourage high levels of microbial activity in the soil, which results in higher fertility levels. This is further enhanced by the barter/trade relationship between plants and micro-organisms, where the plants exuded high levels of nutrients into the soil from their roots.

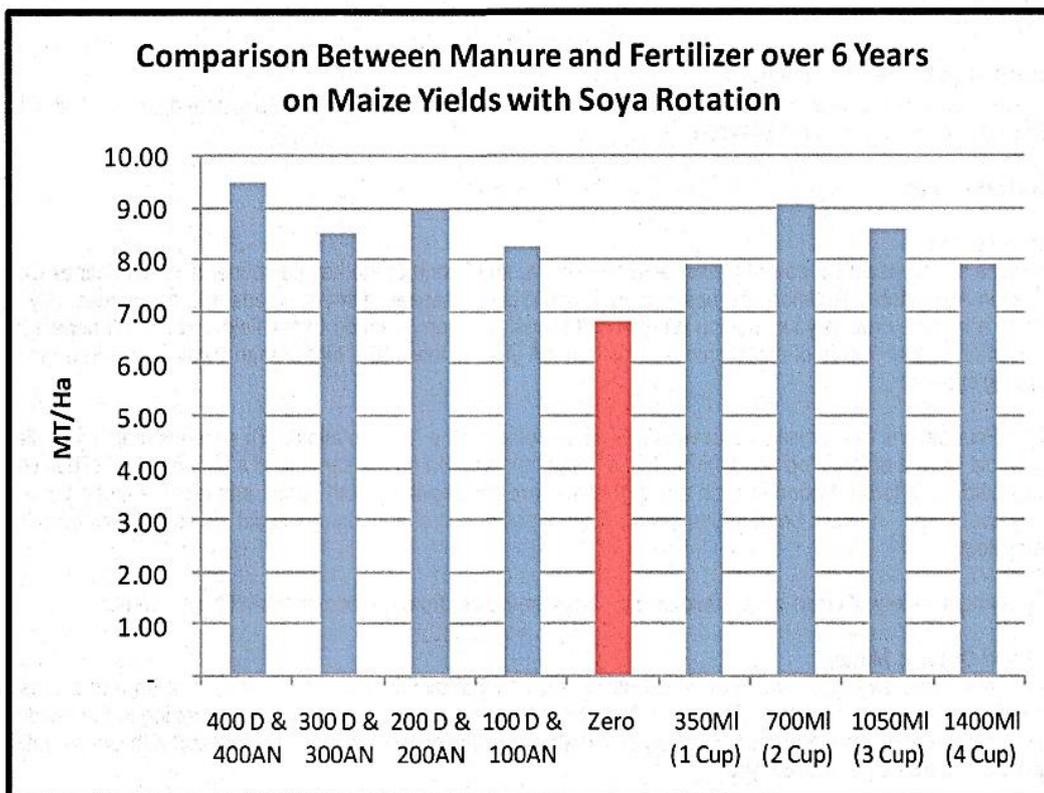
Soil structure is greatly influenced by the presence of humus (refer to Lesson 7). This humus, which is a microscopic gelatinous substance, which act as a glue to hold soil particle together and create soil structure. This humus is created as a result of continuous decomposition of organic matter by micro-organisms. Thus humus cannot be replenished without the replacement of organic matter and the presence of micro-organisms.

Results from 6 years of research are displayed in the graph above. Many interesting conclusions can be





drawn up from the data, but for this lesson we would like to focus on the rotational benefits. The trial was done in such a way so as to have a control. The control plots must be treated in the same way as those with the different treatments, except for the treatment which you are trying to analyse. In this case fertilizer at different rates on the left and manure at different rates on the right. The control plot is the central plot shown in red. This plot was not provided with any fertility year after year. Initially (2004) the maize yield of this plot was less than 3 MT/Ha, and it was assumed that over time this would stay at level, if not decrease. The situation howev-



er as can be seen from the results was quite different. There appears to be a supernatural adding in this plot. The yields increased year after year and as shown above averaged close to 7 MT/Ha. This astounded us and just shows how incredibly advantageous rotations can be for someone without the means to purchase fertilizers.

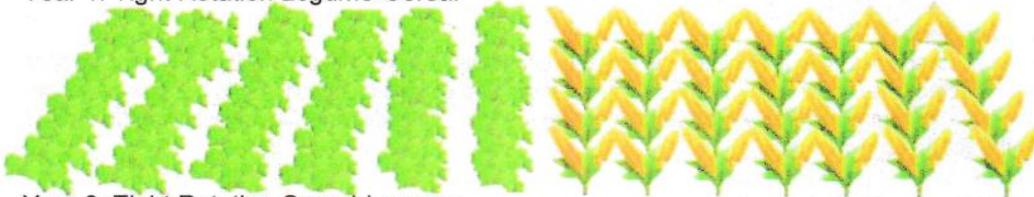
The following diagrams show 2 rotation examples, firstly a tight rotation, where a cereal such as maize is rotated every year with a legume such as beans. The second example is a three way rotation using sunflower, beans and maize. Remember to design your rotation to suit not only what will be best for your soil, but what would also be best for you in terms for food or cash crops...



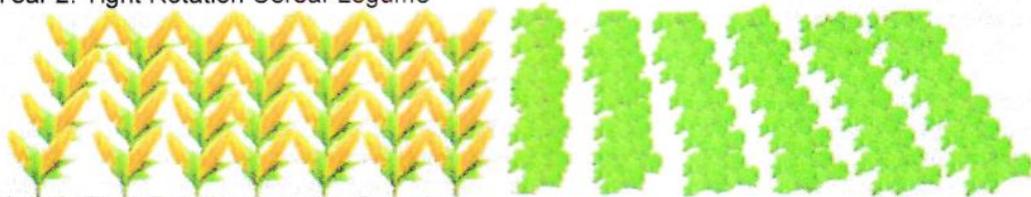


ROTATION EXAMPLES:

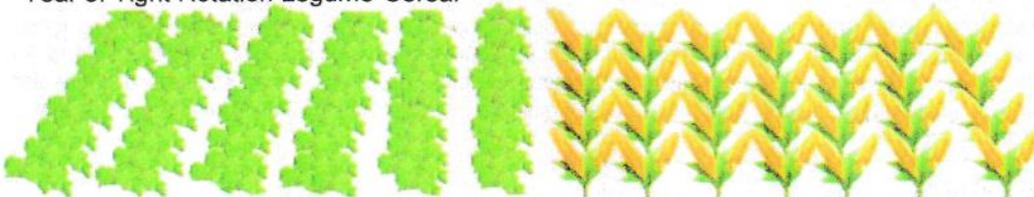
Year 1: Tight Rotation Legume-Cereal



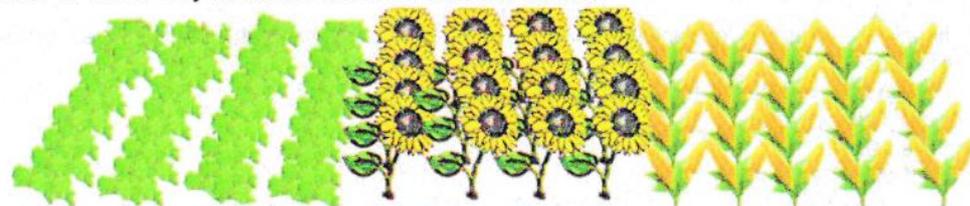
Year 2: Tight Rotation Cereal-Legume



Year 3: Tight Rotation Legume-Cereal



Year 1: Three way Rotation: Beans-Sunflower-Maize



Year 2: Three way Rotation: Maize-Beans-Sunflower



Year 3: Three way Rotation Sunflower-Maize-Beans





Cover Crops:

Introduction

The use of cover crops is an ancient farming practice, which has been practiced for millennia. Cover crops can also be referred to as green manure crops. The purposes of a cover crop are usually to increase soil organic matter, improve nitrogen availability, protect the soil from erosion and sometimes to retrieve available nutrients left in the soil by a previous crop.

Cover crops are often incorporated into the soil, but this would contradict many of the minimum tillage practices, which we are promoting. It is very acceptable to kill the crop prior to maturation and then allow it to decompose on the soil as a form of mulch.

Benefits of Cover Crops

The benefits of a cover crop depend on which crop is grown and how much residue is returned to the soil. An important aspect determining which cover crop to use is how much increase in soil organic matter will occur. Obviously crops with very high organic matter production, such as macuna (velvet bean) will achieve this. Most legumes however do not have high lignin contents, which means they very quickly decompose, an example of a legume crop with high lignin would be sunhemp. Cover crops also supply nutrients to the following crops, they suppress weeds and help to break pest and disease cycles. A cover crop provides an excellent habitat for all the insects involved in Integrated Pest Management and thus can act as a food source and a breeding ground for beneficiary predators. Importantly cover crops also increase water infiltration into the soil and drastically reduce erosion.

Selection of Cover Crop

Several important questions need to be asked before selecting a cover crop. Not only do we need to know which crop to plant, how and when to plant it, but also when to kill it and how.

More importantly the objectives for planting a cover crop need to be understood, what is it that we are wanting to accomplish?

- Do we wish to add additional Nitrogen to the soil?
- Additional Organic Matter?
- Control erosion?
- To effect soil pH and fertility?
- Reduce compaction?
- Suppress weeds?

We also need to know which crops would be best suited to our climatic zone and soil type.

The following 2 tables are examples of summaries created to assist in the selection of the right cover crop for your situation. Hopefully we all understand the importance of using both rotations and cover crops within our farming systems.





5 Most Commonly used Green Manures



SACCS

Common Name	Sun Hemp	Velvet Bean	Forage Sorghum	Saia Oats	Forage Oats
Scientific Name	<i>Crotalaria juncea</i>	<i>Mcuna pruriens</i>	<i>Sorghum spp</i>	<i>Avena Strigosa</i>	<i>Avena Sativa</i>
Legume / Cover Crop	Legume	Legume	Grazing / Cover Crop	Cover Crop	Cover Crop
Rainfall mm	400 +	400 +	400+	600+	600+
Waterlogging tolerance	Med	Med	No	Med	Med
Drought tolerance	Med	Yes	Yes	Med	Med
Frost tolerance	No	No	Med	Yes	Yes
Soil Fertility	Low	Low	Low	Low	Low
Texture	Sand to Clay	Sand to Clay	Sand to Clay	Sand to Clay	Sand to Clay
Sowing rate / Rows	35	30	35	40	40
Sowing Rate / Broadcast	50	40	50	50	50
Life Span	Annual	Annual	Annual	Annual	Annual
Grazing Value	None	High	High	High	High
Planting time	Summer	Summer	Summer	Autumn	Autumn
Soil Binding	No	Creeping vine	Tuft	Tuft	Tuft
Indigenous	No	No	No	No	No
Invasive	No	No	No	No	No
Establishment is Easy?	Yes	Yes	Yes	Yes	Yes
Planting method	Seed	Seed	Seed	Seed	Seed
Use	Green Manure	Green Manure - Animal feed	Pasture - Nematode Control	Cover Crop	Cover Crop





Agroforestry

Agroforestry: Is the introduction of trees in and around traditional crops.

Benefits of Agroforestry

Firewood, timber, fence poles, livestock fodder, fruit, mulch, shade, wind breaks, fertilizer, compost material, prevention of soil erosion, absorption of carbon dioxide, from the atmosphere, release of oxygen for us to breathe and medicine.

Agroforestry takes at least 2 seasons to introduce to a farming system (growing trees from seed and establishing them infield), take care to plan well and begin as soon as you are able. Agroforestry will enable you to get the maximum benefit out of your land and support the development of your home, your land and your family. Things that last and have great benefit require lasting effort and great vision for the future.

Committing to practice agroforestry is a wonderful way to be a model in your community. This process does not come without challenges and will require courage, strength, determination and passion. So with the skills that you have learnt stand up, take ownership and demonstrate that you have what it takes.

Agroforestry Planting Systems





Agroforestry Planting Systems

Boundary or Living Fence

Fencing is a common problem for many farmers, mainly because of the costs. By growing living fences not only is it very cheap, but your fence can have multiple uses. If you fence can provide not only protection from animals, but supply firewood, fruit or fodder for animals what a blessing this can be. The boundary fence can also act as a wind break for your fields.

Accacias and Erythrinas are best for animals protection, but there are many indigenous thorny fruit trees that may be used. Such as *Dovyalis Caffra* (Kei apple) and *Ziziphus mauritiana* (Masau). Trees should be planted in 2 staggered rows a meter apart and the branches intertwined from a young age to create an impenetrable barrier.

Alley Cropping

This system involves leguminous trees being planted every 40cm in a double, staggered row. The 2 rows should be 20cm apart. The next double row will be 4m further into field.

The best options for this are *Leucaena leucocephala* and *Gliricidia Sepium*. Trim down to a short hedge in the growing season to allow sunshine to each the crops. In the dry season it will grow to provide protection against wind erosion, moisture loss and provide firewood, mulch and cattle fodder.

Wind Break

A wind break is best created using legumes or fruit trees (not Eucalyptus) planted in double rows every 8-10m in an East to West direction (to avoid shading crops).

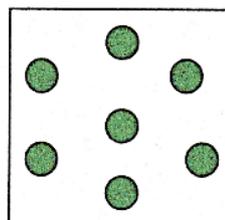
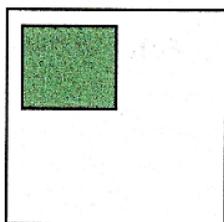
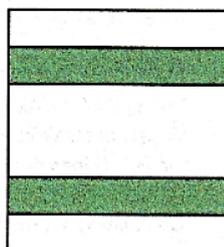
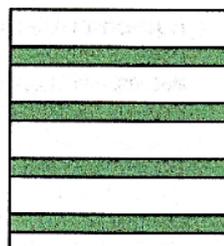
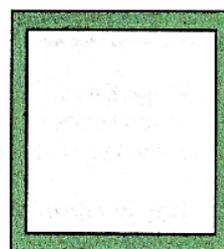
The purpose of a wind break is to slow wind speeds. This reduces damage to crops, reduces moisture loss and prevents wind erosion. It also provides fruit, firewood, mulch and cattle fodder.

Woodlot

Any tree may be used in this system, Eucalyptus is best used here as they are not suitable for any form of intercropping. Fast growing trees with straight poles, which coppice quickly are ideal. Woodlots should provide high volumes of firewood, and poles for construction and fencing. Woodlots need management, trees should be cut once they reach the desired lengths or sizes. If the trees are allowed to grow too large they become difficult to cut and manage. When stumps coppice 2-3 new saplings should be selected and the others removed, this allows for faster growth of the selected saplings.

Parkland

Trees planted individually at intervals throughout cropping and/or grazing area. Leguminous trees increase soil fertility and allow grass to grow well for uninterrupted grazing or improve soil quality for crops. *Fayderbia albida* is the perfect example of a leguminous tree for a parkland system. It loses its leaves in summer, so does not compete with your crop for sunlight. It has nitrogen rich leaves and pods, that are good for mulch and as high protein cattle fodder.





Growing Trees from Seed

Seed Collection

Access to good seed is the beginning of success and life - as any farmer knows!

In order to collect viable seed; first identify a healthy source and then follow a few easy steps to ensure that you obtain seed with the highest possible chance of germination and success.

Good Mother

Identify a good mother tree, or seed source, by looking at the health and age of the tree. Most trees produce an abundance of seed in their early maturity stage (after they have become well established and before they become too big and/or diseased.)

Collection

Once you have found a healthy source that is producing good fruit (good size, disease-free pods) you can use a variety of collection techniques.

This is the most reliable:

- Place a piece of plastic or piece of material beneath the tree.
- Shake the branches by hand or using a stick.
- Collect any seeds and pods that have fallen onto your catching material and separate them from the leaves and sticks.
- Remove the seed from their pods taking care not to damage the seed.

Alternatively you may climb the tree (only if you are qualified and can do so safely) or hand pick ripe pods. Pods can generally be considered ripe, or mature, when they turn brown – you will see when some of the pods begin to drop their seed and know the time when they are mature (falling or discharging naturally).

Avoid collection of seed that has been sitting on the ground for some time as it is likely to be rotten or infested by insects and is unlikely to germinate – it may also infest the rest of your seed.

Remove any seeds from your collection that have small holes in them – this is a sign of insect infestation.

Preparation

Once you have removed the seed carefully, and intact, from its pod you may need to 'treat' the seed in order to increase its rate of germination. In nature a number of things occur in the life of a seed to ensure that it germinates at the right time. These include being ingested by animals, soaked in water, heated and cooled, or trampled by animal hooves.

Seed with a soft outer shell (e.g. avocado pear) does not require pre-planting treatment – simply remove it from its pod and plant in fertile soil with compost and water.

In general if a seed has a hard outer covering (e.g. most acacia species, msasa, munondoetc) you may use either of these methods to increase the rate and success of germination and ensure a more uniform germination throughout your crop of seedlings:

Place seed in boiling water for no longer than 1 minute before the water is removed from the heat and allowed to cool for 24hrs with the seed soaking inside. The seed should expand, or swell, and the hard cover should burst, or crack, allowing the radical to grow out more easily. Plant immediately after removing from the water.





Alternatively:

Clip one edge of the seed using nail clippers to make a break in the outer cover – this will allow the radical to come out easily once it comes into contact with water and begins to grow.

Suitable Pots

Anything that will hold soil and support a small tree will make a suitable pot. Some of the finest pots I have seen were made using old sugar packets. Folded banana leaves work well, empty cans if they are large enough, plastic bottles cut in half – use whatever is most readily available to you. Ensure that your seedlings do not begin to grow into the ground beneath the pot as this will make it difficult to transplant later. Trim the roots using scissors if you notice them growing out of your pot.

Potting Mixture

In order to have success with your seedlings you must use a high quality potting mixture to ensure fast germination and a healthy start to life for your tree.

Depending on the origin of the seed and the individual characteristics of each species you will require different mixtures. In general you are attempting to replicate the ideal growing conditions of each particular tree.

Trees from dry, sandy areas require a sandier mixture and well-drained soil. Trees from more tropical regions require a greater percentage of decaying matter (compost) and fertile topsoil.

As a very general rule - observe the soil-type present in an area where you can observe a large stand of healthy trees of the same species you intend to plant and then attempt to replicate the soil-type.

Ensure that your pots will drain well: poke holes in the bottom and ensure free-flow of water down and out of the pot.

A typical potting mixture should consist of a mixture of 1 part topsoil, 2 parts mature compost, 1 part river sand. The topsoil will hold the mixture together, the compost will offer good nutrition for health and fast growth and the sand will ensure a free-flow of water down and out of the pot.

Planting the seed

If you have very fine seed (e.g. raw eucalyptus) make an indentation in the surface of your potting mixture and place the seed on the surface then cover lightly with fine sand. Water with a fine spray from a mister or knapsack only – larger drops will displace the seed.

Larger seed (e.g. leucaena, erythrinaetc) must be pushed gently into the soil and covered with 1cm of soil and then mulched. Water immediately using a can or sprinkler system – do not pour water directly from a tap as that will displace the mixture and may remove the seed.

Conditions

Avoid direct sunlight which may burn small seedlings. Rather place in a semi-shaded area under larger trees that minimizes amount of direct sunlight – place beneath shade cloth if available.

Irrigate the seed lightly everyday before germination and throughout the initial growing period. Ensure that the soil is moist at all times – mulch will assist you to achieve this.





- Protect from strong winds and cold conditions as these will cause drying out and slow growth.
- Keep weed-free and control access from any bugs and insects where possible to prevent destruction of your seedlings. Drench on appropriate treatment for cut worm, locusts and any other harmful pests as necessary.
- Protect from livestock using thorny bushes, branches and/or fencing.

Hardening off

After a number of months (3-5 depending on the species) begin to reduce the amount of water and allow the soil to become drier for longer periods without damaging the seedlings. If the leaves begin to shrivel or look unhealthy at any point add water immediately. Remove the seedlings from their shade cloth or sunlight protection to allow the trunk to become woodier and more durable while still receiving an adequate supply of water and remaining healthy – this will increase the rate of survival once the seedling is planted out.

Planting the seedling

Seedlings that are grown in any type of pot (empty can, plastic sleeve, wrapped in banana leaves, empty sugar packet etc) must be planted into their permanent position once they are large enough to survive on their own. In order to survive they will need to have been hardened off and at least 30cm tall depending on the species.

They may still require protection from livestock and/or frost for the first few seasons. Use small wooden pegs, dry, thorny bushes or fencing to protect from livestock and thatch or plastic housing to protect from frost at time of planting out.

The ideal time for planting out most species is at the beginning of, or just before, the rainy season.

- Dig a small hole - the same size as the pot that the tree has been growing in.
- Place 2 large hand-fulls of compost into the bottom of the hole.
- Remove the tree from its pot taking care to cause minimal disturbance to the soil and roots of the tree.
- Fill the hole with water.
- Place the tree upright in the hole and add soil pressing down firmly around the base of the tree..
- Add water and more soil to remove all air from the hole and ensure that it is firmly in place.
- Build a small ring of soil around the base (30cm radius round the trunk) and fill the space inside the ring with mulch (cut grass, leaves etc).
- Pour a large amount of water (5L) onto the mulch to ensure that the tree is able to get a good start to life and survive without water until the first rain.

Now you have all the information you need to start your own tree nursery – take a leadership role in your own life and manage your land well by taking the time to secure your future by investing in trees.





Appendix 2

Splash Pan Demonstration

Aim: to demonstrate the action of a raindrop falling on soil acting as a hammer causing a splash action to a greater or lesser degree depending on 'mulch' cover

Apparatus needed:

- a plastic bottle with a spray nozzle
- 2 pieces of A3 paper

Pan 1: a 'conventional tillage' pan

- a tin lid (in Zimbabwe a Cobra polish tin is ideal)
- soil

Pan 2: a 'Foundations for Farming' pan

- a tin lid (in Zimbabwe a Cobra polish tin is ideal)
- soil
- grass clippings to cover as God's blanket

Method:

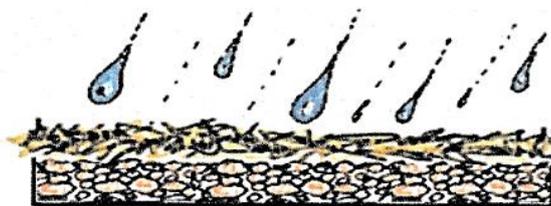
- Soil is placed in each pan.
- One is left bare without grass cover, while the other is covered with the lawn clippings.
- The pans are placed on a piece of paper each.
- Water is sprayed from a height firstly on the uncovered pan and then on the 'mulched' pan.
- It must be ensured that each pan receives the same amount of water, at the same strength and the same height.

Result:

Pan 1: Much soil is splashed out onto the surrounding paper from the pan.



Pan 2: Very little soil is splashed out on the surrounding paper from the pan.



Ask the class to comment on the splash pattern seen on the 2 sheets of paper.





Runoff Tray Demonstration

Aim: to demonstrate how God's blanket aids the effective infiltration of water into the soil profile and slows down the runoff of water from the soil surface

Apparatus needed:

- a watering can
- many glass jars (at least 10)
- transparent containers of any sort would suffice

Tray 1 – a 'conventional tillage' tray.

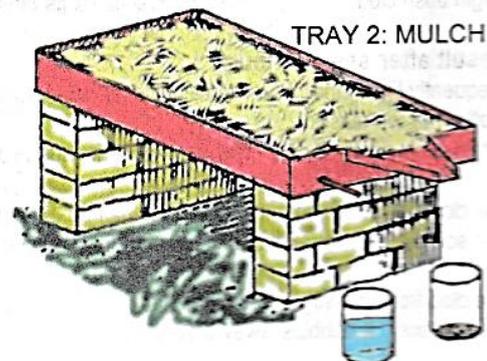
- A deep rectangular tray with an upper lip for runoff of water and a lower outlet for water to escape from the bottom of the tray. A 5litre container cut in half can also work.
- Soil.

Tray 2 – a Mulched tray

- A deep rectangular tray with an upper lip for runoff of water and a lower outlet for water to escape from the bottom of the tray.
- Soil.
- Grass clippings to cover.

Method:

- Place soil in each tray.
- Leave one tray bare without grass cover, and cover the other with grass.
- Place jars beneath the lips and lower outlets.
- Pour water from the watering can onto each tray with similar strength and quantity.





Result:

Tray 1: Water very quickly rushes off the surface of the soil carrying large amounts of soil with it.

- The fine microstructure of the soil collapses and slumps.
- A little water infiltrates the soil profile and comes out the lower outlet.
- Little channels are already seen on the surface where the soil has been washed away.

Tray 2: A reduced amount of water comes off the surface of the soil and is relatively clean.

- The soil maintains its structure and does not slump.
- Much water infiltrates the soil profile and comes out of the lower outlet. The surface beneath the mulch is intact with no channels formed.

Explanation:

- In the tray with no mulch cover, the raindrop causes an explosive action, which dislodges soil particles in water solution and causes the crusting of the surface. This does not allow the infiltration of the water into the soil profile and much water runs off carrying soil with it causing channels.
- The grass cover again acts as a cushion for the raindrops as they fall on the soil. They reduce the impact of the raindrop allowing the water to seep into the soil. The mulch cover does not allow for the crusting of the soil, thus preventing large amounts of runoff as 'sheet' erosion.

Soil Structure Demonstration

Aim: to demonstrate how Foundations for Farming aids the formation of water stable aggregates in soil.

Apparatus needed:

- two transparent glasses filled with water
- a clod of soil from frequently tilled land
- a clod of soil from virgin 'bush'

Method:

- Place each clod of soil into a glass of water each.

Immediate Result:

Frequently tilled clod: The clod almost immediately disintegrates and clouds the glass in solution.

Virgin bush clod: The clod maintains its structure and air slowly bubbles from the clod.

Result after several hours:

Frequently tilled clod: There is little of the clod remaining and the soil has settled into fine sediment at the bottom of the glass.

Virgin bush clod: The clod has remained intact almost perfectly!

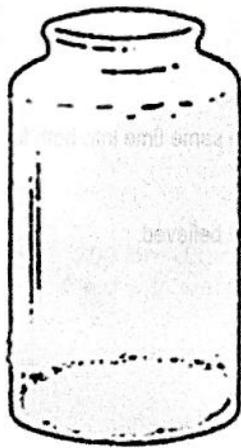
The clod from the frequently tilled soil has no structure to bind itself together. The plough supposedly aerates the soil, but there are no bubble coming from this clod showing that there is in fact no air within it!

The clod from the virgin bush, has had many years of being 'bound together' by roots and organisms beneath the surface. It bubbles away slowly because channels have been formed by burrowing insects and decayed

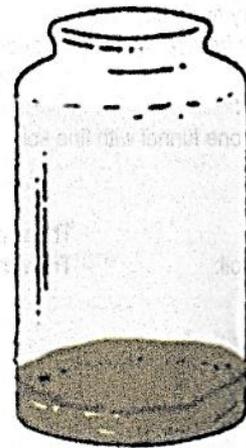




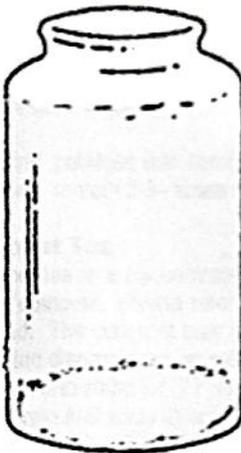
roots, which allow for the effective infiltration of water into the soil profile.



PLOUGHED SOIL



CLOD DISINTEGRATES WITHIN MINUTES.



UNPLOUGHED SOIL



CLOD IS STABLE AND WILL REMAIN SO INDEFINITELY.





Infiltration Demonstration

Aim: to demonstrate how ploughing causes the soil to infiltrate a lot more slowly.

Apparatus needed:

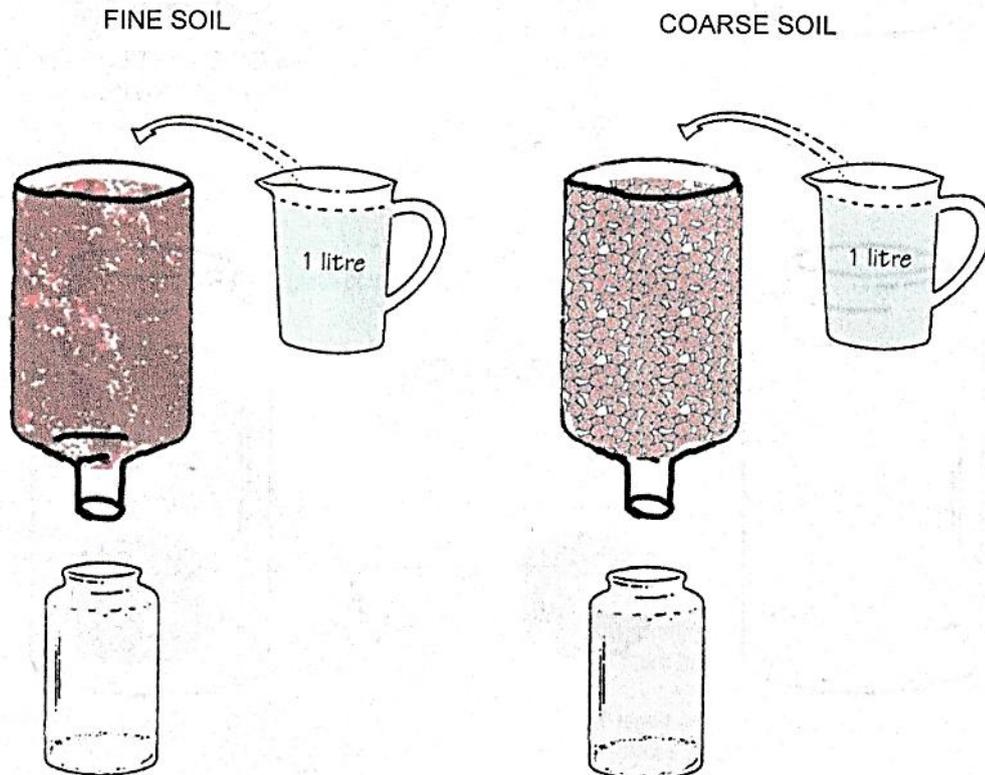
- Two 2 Litre bottles with their bottoms cut off.
- 2 jugs of water.
- Very finely tilled soil.
- Soil from untilled area, not broken into fine tilth but still very granular.

Method:

- Fill one funnel with fine soil and one funnel with coarse soil. Pour water at the same time into both funnels.

Result:

Fine soil: The water does not infiltrate into fine soil as is commonly believed.
Coarse soil: The water immediately flows through into the jar below.

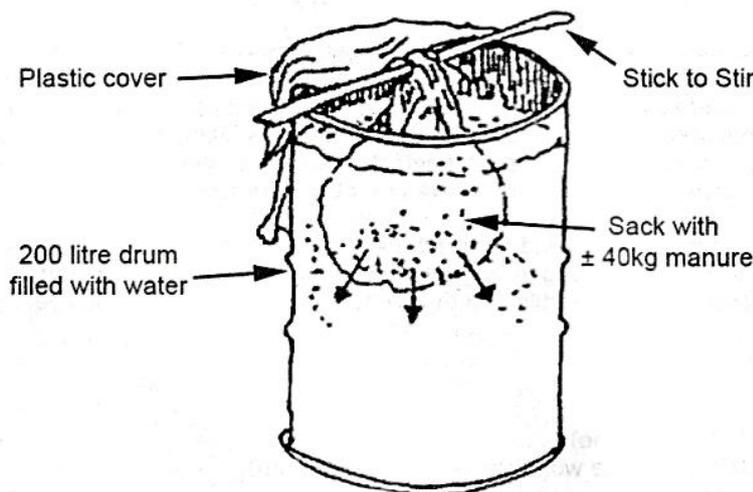




Appendix 3

Chicken manure soup

To make this you will require 30-40 kg of chicken manure. Place it in a porous bag and hang it in a 200 litre drum of water for at least 3 weeks. Stir regularly. After 3 weeks dilute 1 litre of the "soup" to 10 litres of water. This can be applied to crops at a rate of 300 ml per station.



Comfrey Tea

With its high levels of potash, comfrey tea can be used as an excellent fertilizer for tomatoes, Peppers, cucumbers and potatoes. The smell while it is "brewing" is very pungent. Pick enough leaves to pack them tightly into the container being used and top up with water. (1-2 kg comfrey leaves in a 20 litre bucket). Seal and allow to stand for 3-4 weeks. Squeeze to extract as much juice as possible, strain and dilute at a rate of 1 litre "tea" to 20 litres of water. Use as a foliar feed or a soil drench. Place to solid wastes through a compost pile.

Dried or fresh comfrey leaves have the following NPK ratios: N:0.75%, P:0.25%, K:0.20%.

Fertilizing potatoes with comfrey will provide the crop with an excellent source of potassium and trace elements. Its leaves contain 2-3- times more potassium than farmyard manure.

Compost Tea

Compost tea is a concentrate liquid version of compost. It is only advisable to attempt making this from high quality compost. Please refer to lesson 10 for instructions to make compost. Only a small amount of compost is required. The compost teas acts as a physical barrier on the leaf surface of your crop, competitively excluding unwanted disease causing pathogens. Add 4kg of good quality compost (in a potato pocket) to 20 litres of water.

- Allow to stand for 3-7 days, stirring daily.
- Strain and spray infected plants late afternoon or early morning.
- Spray every 2 weeks.
- Target pests: powdery mildew, botrytis, late blight and fusarium wilt.





Appendix 4

The Compost Parable

There was a farmer who inherited a field. This field was overrun by weeds, they were all that would grow in the field as the soil was very poor. The soil had been abused by a lifetime of poor farming practices. Thus, the field produced nothing of value.

A visitor passing by shared some amazing news about compost. This information sounded too good to be true, but the man was excited and in faith dedicated his time to doing something that went completely against his sense of logic. How could something dead bring life? He collected the materials required and made the compost as instructed. What a miracle to witness the heat produced by the invisible bacteria that exists naturally everywhere. After some months of patient waiting the compost was ready and he applied it to his field.

This material was put into the soil and restored the life, the soil was redeemed. Because of this new life in the soil the crops began to grow and beautiful fruit was harvested. Each year this soil became richer and more fertile and the amount of fruit increased each year.

Explanation:

Who is the farmer? (You and me).

What are the weeds? (Sin of the world into which we are born).

What is the field? (Our hearts).

What are the poor farming practices? (Poor life choices).

What was the "good news"? (The Gospel).

What was the compost? (Jesus Christ).

The farmer had to choose and in Faith decide to follow Christ.

The collecting the materials is the work involved on staying on the road of sanctification.

The bacteria is the Holy Spirit and His fire.

Jesus died and rose again so that our hearts, our lives, could be redeemed and made new.

Once the life has been renewed in us we begin to exhibit the fruits of the Holy spirit.

