

Trees in the farm to mitigate the effects of climate change.

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The climate is changing both at the global and the local level, and we can no longer depend on rain falling at the times of year that we used to be able to rely on. Because of this climate change, we need to adapt the way that we relate to the environment and the way that we farm. Since we can no longer depend on regular rainfall, we need to adjust the way that we farm so that we can make best use of the rain that does fall, and trees on the farm can be a particularly useful strategy for adapting to the reality of present rainfall patterns.

Climate has always been variable, and history tells us of years of drought and famine. There have always been variations from year to year and these have generally been in cycles, with variations within known limits. However, in recent years we have seen another factor, and this is a trend in increasing temperatures and more unpredictable rainfall continuing from year to year. This is what is recognised as global climate change.

Much has been written by the scientific community about the causes of climate change and global warming. One noticeable factor is that most of the causes are from the industrialised rich countries and most of the more serious effects are felt by the poorer countries. This has given the impression that the poorer countries and especially the small farmers are helpless in the situation of change caused by others. Although we all need to be responsible in the way we live, I would however like to focus on what can be done in the face of climate change rather than the problem.

There are many challenges resulting from climate change, but perhaps the three most significant ones for small farmers are:

- Unpredictability of the rainfall;
- More extreme weather conditions with rain coming in heavier storms and droughts being more severe; and
- Higher average temperatures.

Considering these three significant observed challenges, it is logical for farmers to rethink their strategies and the way that they farm. The years immediately following independence had an unusually predictable climate with unusually regular rainfall patterns. This led to many agricultural practices that were relevant for those conditions but are no longer so appropriate. They also coincided with a period of low oil prices and therefore low cost of external inputs for farmers.

With the changes in both global and local climate in recent years, agricultural practices also need to change, and new thinking is necessary. Ideas and practices that were developed during the time of independence of the nations in East Africa are being questioned and new practices

are needed. Amongst the most important of these are what crops are suitable and the role of trees in the agricultural environment.

Grevillea trees are becoming a common sight on farms

The widespread cutting of trees is one contributor to climate change on the global scale, but has further contributed to it locally. For example, the increase in flooding in some areas is clearly linked to the cutting of trees upstream in the catchment areas thus



reducing the penetration of water from rainfall and increased run off. Increasing the number of trees in agricultural land is one of the practical strategies in response to climate change. They can contribute to mitigating against the effects of the three challenges mentioned above.

Trees as a mitigating factor for unpredictable rainfall

In the period leading up to and following independence rainfall was fairly regular in East Africa and this enabled fairly accurate timing of agricultural practices. It also led to the more widespread growing of maize, which is one of the crops least well adapted to unpredictable rainfall. There has been a growing realisation of the need to grow more drought resistant crops such as sorghum and pigeon pea, especially in the marginal areas, as well as the value of perennial and root crops. Perennial crops can make use of rainfall whenever it falls, and are not so dependent on predictable seasons. The same applies to trees.

Trees of various kinds on a farm in western Kenya

Tree crops are thus particularly valuable in a strategy of responding to climate change. Tree roots go deep and can tap stored water in the lower layers of the soil, and these same roots also enable penetration of the water from rainfall to lower regions. Fruit trees, especially those with deeper roots, are thus a valuable addition to any farm.



Moringa Stenopetala tree in western Kenya

Moringa is a valuable tree crop that is of growing interest throughout the region for its nutritional value, and particularly relevant in terms of incorporating trees into the farm. There are two species of Moringa, both of which have similar nutritional value. *Moringa oleifera* is a smaller tree, which thrives in hotter, lower regions, and *Moringa stenopetala* is a much larger tree that does better at higher altitudes. Both have very nutritious leaves that can be eaten fresh as a vegetable or dried and made into leaf powder. When Moringa leaf powder is added to any meal it increases the nutritional value of the food and enables an easy balanced diet as well as boosting the immune system. *Moringa oleifera* is particularly suitable for incorporating into small



farms as it is very compatible with other crops.

Many other trees may also be considered as crops, and especially for long term investment. Timber trees include exotics like Grevillea, Teak and Mahogany but also indigenous species such as Markhamia and *Cordia Africana*. Unlike Eucalyptus which is very greedy for water from the soil and incompatible with crops, these can all be grown round the boundaries of fields or in portions close to crops. As well as a long-term investment, they help protect the farm from extremes of weather and increase the water penetration.

Mahogany (Khaya senegalensis) planted on the farm as an investment for the future

Trees as protection against extreme weather conditions

Many agricultural practices introduced into Africa have their origins in the temperate areas of Europe and North America. In the tropics however, climatic conditions are very different from those in temperate regions. Close to the equator the sun's rays are much more intense, and the rainfall tends to come in very much heavier downpours. The system that exposes the soil to the hot sun and heavy rainfall is particularly unsuitable for tropical regions. Many farmers are realising that it is important always to keep the soil covered so as not to expose it to the hot sun and heavy rain. This can be done through various agricultural practices including the use of mixed cropping, cover crops and mulch. Trees are an important contributor to this. Tree leaves can be a very significant contributor to soil cover and mulch.

With climate change we are seeing increases in temperature and longer periods with no rain, and when the rain does fall it is frequently in much heavier downpours accompanied by heavy winds. When trees are removed from an environment the winds can be very destructive and the amount of water running off the land can lead to serious erosion, including increasing incidence of gullies. Trees in a farm help reduce the power and effect of the wind, and with other measures can help reduce erosion. Although not technically trees, bamboo has been adopted by foresters as a fast-growing species particularly suitable for river banks. Trees and bamboo are a particular good way of using land along river banks.



Bamboo and trees planted on a farm along the banks of the Orobo river in western Kenya

Trees as a means of reducing high temperatures on the farm

One of the results of climate change is an increase in average temperatures on a global scale, and on the local scale an increase in the length of time with higher temperatures. Trees can be very significant in reducing the effect of increased temperature at the local level. It is well known that where there are more trees there is a cooler microclimate. The microclimate of any farm can be changed by planting appropriate trees. Trees help reduce temperature in two main ways. The first is through shade and the second is by moistening the air through transpiration as the leaves release moisture into the air. They can also be helpful, especially in marginal areas, in filtering the hot winds through windbreaks. Soil in such a microclimate does not dry out so quickly and crops grown in such an area therefore benefit significantly.



The REAP farm in Kisumu showing trees and vetiver hedges protecting the land

Having productive trees such as those for fruit and vegetable production as mentioned above contributes to this microclimate, as do those planted for timber. Productive hedges are a significant way of increasing the number of trees on a farm. Leguminous trees are a very helpful way of incorporating trees into the farm in a practical way, especially the smaller farms.

There are three species of leguminous trees that do well in tropical conditions that have been widely introduced. These are Sesbania, Leucaena and Calliandra. Sesbania is indigenous but the other two are exotic introduced species. All three help to add nutrients to the soil, provide good fodder for livestock and are a good source of fuel wood. Calliandra is particularly valuable as a fodder and the flowers attract bees which help pollinate crops and produce honey. Leucaena can also be used for charcoal. Sesbania is particularly fast growing.

Calliandra wildlings in a Vetiver Grass hedge, left to grow until they become a nuisance



All three of these leguminous trees produce prolific seeds so that they tend to propagate many wildlings. These wildlings may be perceived as a problem but can easily be converted into a great resource on the farm if properly managed. If some of the seedlings that regenerate are left in the farm they will grow fast and add fertility to the soil, increase penetration and can be left until they become a nuisance at which time they can be cut for fuel. A relevant strategy for sustainable land use on small farms is to leave these self-seeded trees for as long as they are not a nuisance. When small and in the drier times of the year they are no problem, but when they become too large they can be cut, having already contributed significantly to soil quality. The principle here is to work with the trees for a sustainable system, and one which is relevant for the challenges of climate change.

Cutting back an overgrown Sesbania and using it to mulch beds ready for planting



On many farms there are roots of trees that have been cut down. Many sprouts come out of these roots. This resource can be managed by a system called Farmer Managed Natural Regeneration (FMNR). One or two of the sprouts are chosen and the others cut back, and these can grow up to become a new tree. They can be pruned and managed like a planted tree and because of the mature roots grow much more quickly than planted trees.

Larger trees growing on the farm can also be managed by pruning so that they become a resource and contribute to the local climate. By cutting branches from larger trees it is possible to make sustainable charcoal on the farm. The system of pollarding which is to cut the branches

at a height of 3-4 metres above the ground and then let them regrow is particularly valuable. The leaves and smaller branches can also contribute to covering the soil in mulch.

Spreading pruned fig branches on land for mulch

In summary, past agricultural practices introduced from temperate regions of Europe and North America have led to a view that a farm should be an open space without trees. This is not appropriate in tropical conditions and especially



considering the growing challenges of climate change. A strategy that incorporates trees in the agricultural environment is now needed. These include trees as crops, as well as trees grown for their value in contributing to soil fertility and for use as timber and fuel. Trees on the farm are very important for developing a sustainable agricultural system and must be considered as a significant contributor to mitigating the effects of climate change at the farm level. Climate change needs a strategy where farmers are working with the trees rather than against them.