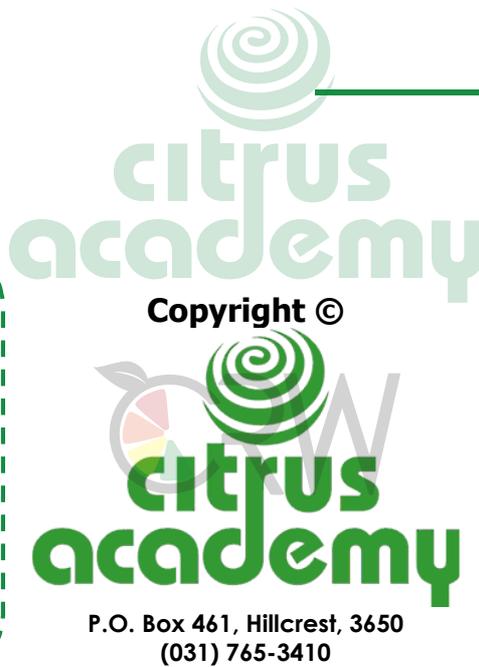

Citrus Planting Management

3 Orchard Layout and Planning

Learner Guide



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1st edition 2017

The content of this module is based on audio-visual material produced by the Citrus Academy.

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Audio-visual production:
Media World

Additional information sources:
Citrus Production Guidelines: Volume I – Citriculture: Establishment, *Citrus Research International*
Cultivar Fact Sheet, *Citrus Research International*
Citrus Academy production learning material:
Enterprise Selection and Establishment
Orchard Establishment
Propagation

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Contents

Introduction	4
Map	4
Natural Resources and Characteristics	4
Soil	5
Water Sources	5
Climate	6
Topography	6
Erosion	7
Infrastructure	7
Orchard Layout and Orientation	8
Conclusion	9



Introduction

By the time you start planning the layout of a new orchard, you will already know what you will be planting in the orchard, and you will have an approximate idea of where on the farm the orchards are going to be. But what exactly will it look like? What factors must I think about when I decide on this? The two major factors which we will look at now are firstly, the natural resources and characteristics of the area where you want to plant, and secondly, the role that infrastructure plays.

Map

Before you start, however, you need a map of the farm that you can use to make notes on. A high-quality aerial photo works very well for this purpose, but a topographical map will also work, as long as it is large enough. As you gather the information we will be discussing, note it on the map, in as much detail as possible. This will help you understand what you have to work with when you come to the final planning.

information

Map of the Farm

Aerial maps can be obtained from your local survey office, or from National Geo-spatial Information (NGI), a component of Department of Rural Development and Land Reform (DRDLR). More information is available at www.ngi.gov.za. Topographical maps can be obtained from reputable suppliers such as MapStudio (www.mapstudio.com.za) or MapQuest (www.mapquest.com).

Natural Resources and Characteristics



The natural resources that are important for citrus production are soil, water, and natural vegetation. By natural characteristics we mean climatic conditions and topography. All forms of farming have an impact on the natural environment. Into an area where there is a huge diversity of plant and animal species, farming introduces one species – in our case citrus trees – that from then on dominate all other species. The available water and soil is also from then on used mainly to cultivate the species that is being farmed.

In order to maintain and protect the natural environment as far as possible, it is important to understand exactly what natural resources are needed for cultivation of citrus trees, how much of it is needed, and how we can use them in the best possible way. We also need to understand how to limit the impact of farming activities on the water, soil and natural vegetation. And we need to understand this before we start planning the layout of an orchard, along with understanding how certain characteristics of the natural environment impacts on layout planning.

Soil



Before we can start planning our new orchard, we need to know if the soil is suitable for growing citrus. Citrus can be grown in different soils, as long as the soil is prepared correctly, is deep enough, is within an acceptable acidity range, does not have layers of vastly different kinds of soil, and has reasonable drainage, which depends on the texture of the soil.

While planning a new orchard we will dig profile pits in the area where the orchards will be so that we can investigate exactly what the soil there is like. Soil samples are also taken at the pits for analysis. Profile pits are dug at least 1.2 m deep. We dig at least five profile pits per hectare if the soil is more or less the same, or homogenous. If there are different soil types in the same area it is better to dig more than five profile pits per hectare. Soil samples are marked clearly so that we know exactly at which pit the sample was taken, and sent to a laboratory for analysis. Mark the position of your profile pits on your map of the farm, and cross-reference them with the soil samples.

information

Accredited Laboratories

For a list of accredited laboratories in South Africa, you can contact Citrus Research International (CRI) at www.cri.co.za or visit the website of the South African National Accreditation System (www.sanas.co.za).

Once we have the result of the soil analyses, we add to that the observations made in the profile pits. Note these findings on your map. It is a good idea to consult an expert soil scientist to advise on soil preparation for the new orchard, and even on how to best manage the soil once the orchard has been planted.

Water Sources

Outside of rain, the main sources of water on most farms are rivers, canals, dams and boreholes. Make sure that your water sources are all marked on your map. We need to be sure that there is enough water available throughout the year from one of the above sources or a combination of them to sustain our new citrus plantings.



Mature citrus trees need between seven and 10,000 l³ of water per hectare per year. When during the year the water is required depends on the rainy season of that area, but generally more water is required during the summer months than in winter. The water sources must be able to supply this water when it is needed. It is good policy to develop a farm to within the capacity of available water and to build in a safety factor for water supply.

Where the water sources are in relation to where you are planning to establish a new orchard is important, because you need to factor in the cost of getting the water to the orchard.

Water quality is generally not critical when it comes to citrus production, because citrus trees are reasonably tolerant. As long as the water is not polluted or extremely acidic or alkaline, the trees will be able to grow well. It is still advisable, though, to take water samples before planting a new orchard and to have them analysed by a laboratory so that you know what the water is like. Add this information on your map, along with data on the volume of water available from each source.

Climate

Worldwide, citrus is produced almost exclusively in the band between twenty and forty degrees north and south of the equator, better known as subtropical regions. Summers must be hot enough for fruit to grow sweet, and winters must be cold enough for fruit to develop colour. In South Africa, commercial citrus production is confined to areas with hot, reasonably humid summers, mild and almost frost-free winters where temperatures seldom drop below -2°C, and with high enough rainfall, and not too much hail and wind.

Hail and wind cause external damage to the fruit, which makes them less marketable. Hail can in fact damage and destroy small fruit, while it will cause marks on more mature fruit. Wind makes fruit rub against twigs and branches which cause blemishes on the fruit. To limit wind damage, orchards are laid out so that the wind move between the rows of trees. To plan this, we need to know the direction and strength of the prevailing wind.

Windbreaks also assist in limiting wind damage. A windbreak is usually one or more rows of trees or shrubs planted around an orchard. If the orchard is large or the prevailing winds are particularly strong, a row of windbreak trees may even be planted in the orchard. Mark the position of windbreaks on your map, indicating what trees or shrubs you need to plant.

Gather as much historical weather data as possible, measured and recorded as close as possible to the site where we will be planting. Enter this information on your map, indicating especially the direction and strength of the prevailing wind, along with the historical seasonal temperatures and rainfall, and data on the prevalence of hail and frost.

Topography

In simple terms topography means the lay of the land. This is the characteristics of the natural environment that plays the biggest role when planning orchard layout.

Topography determines the placement of the orchard and row direction. On sloping land, rows of trees are planted on the contour lines, for the sake of limiting irrigation run-off and better storm water management and also because they will be easier to access by tractor.

Draw contour lines on you farm map if they are not there already, so that it will help you to form a picture of the lay of the land where your orchard will be.

Erosion

Erosion is one of the biggest dangers when the cultivation of a single crop is introduced in an area. Where in the past the natural vegetation and natural barriers might have protected the soil against erosion, these will be removed and replaced with – in our case – an orchard of trees neatly planted in rows. Over-cultivation can also destroy the topsoil structure, which will affect the movement of air, water and roots in the soil.

When you plan the layout of an orchard, look to limit the eroding effects of water and wind on the soil as much as possible. Where gullies are already forming, mark them on your map, and take steps to improve the situation even before the orchard is planted.

Infrastructure

Now that we have looked at the natural environment, let's take a look at the man-made environment. Infrastructure is put in place to make economic activity possible.

External Infrastructure



External infrastructure is developed and built by government, its agencies and private companies to bring services to businesses. This includes the road system, the electricity generation and supply system, the water supply system, telecommunication infrastructure, logistics infrastructure (like the ports), and even towns and local businesses.

In rural areas this sort of infrastructure is sometimes lacking, but most of the time it is good enough to make it possible to farm profitably with citrus. Make notes on your map of where access points are to external infrastructure, and where the closest town and human settlement is. Also make a note of the distance to the nearest port, market, packhouse and processing facility.

Internal Infrastructure

Internal, or on-farm infrastructure, is developed to make the economic activity of the farm possible. In our case, infrastructure is developed to make the citrus farming operation as efficient as possible, while at the same time minimising impact on the natural environment. On a citrus farm, we need the following sort of infrastructure: fencing, farm roads, irrigation system, electricity supply, and farm buildings. We might also need structures for erosion control.



If you are planning a new planting on an existing farm, you will work with the internal infrastructure that is already on the farm. Mark it on your map, also recording the

supply capacity where relevant. If it is a large new planting, it may be necessary to develop more infrastructure, but if it just a replanting or small expansion, you could just make use of what is already in place. If you are planning a whole new farm, you have the opportunity to plan and plot out the infrastructure optimally, which you will do as part of the land utilisation plan.

When you do need to development and build infrastructure, your thinking should be around the capital cost of equipment versus the ongoing cost of maintenance, not forgetting the cost of failure if the infrastructure is not of good quality. For specific kinds of infrastructure, also think about the following:

- ❖ Fencing around a farm is put up to mark the boundary line of the property, to keep unwanted visitors out, and to secure your crop, your equipment, and the people on the farm. Additional high-security fencing is often put up around farm buildings, especially around staff housing. If there is already fencing on the farm, mark it on the map, indicating the type of fencing, its height, and its condition.
- ❖ Farm roads are built to give delivery vehicles access to the farm, and to give tractors, spray equipment, bakkies and so on access to orchards. Access for heavy vehicles that come to the farm to deliver supplies or transport fruit should be as close to the main road as possible, and should preferably not run through the orchards. In fact, traffic through the orchards must be minimised and controlled. Mark existing and new roads on your map, indicating the condition of the roads and how much traffic each road should carry.
- ❖ The irrigation system brings water from whatever water source to the orchards. In some cases the system will include holding dams, while in other cases it may merely consist of pipelines leading from the main water source. Make sure that you mark clearly on your map where the water will be coming from, and in what volumes.
- ❖ The electricity system needs to bring power to the farm buildings and to pump houses. Electricity connections must be installed by a qualified electrician and must comply with regulatory standards. Notes on your map about where the transformer is from where electricity will have to be taken, will help with your planning.
- ❖ Farm buildings is a substantial investment so think carefully about what you need, what the requirements are, and where you place it. Health and safety legislation and codes of labour practices have very clear prescriptions for buildings in which people work and live. Make sure that you know these regulations, know how it applies to your situation, and know how to comply with them. Fixing bad buildings afterwards is very pricey and can be avoided with a little planning. Mark existing buildings clearly on your map

Orchard Layout and Orientation

Now that we have a good picture of the area where the new planting will be, we can plan the layout and orientation of the orchard. The orientation of a new orchard depends on a few factors. Erosion and wind direction are important, as is light interception. Ideally, citrus is planted in rectangular blocks on a 10° to 30° south-east facing slope, with rows running north-south for



maximum light interception, or otherwise on contour lines on sloping ground to minimise erosion.

But local conditions ultimately determine the layout. For instance, in the Western and Eastern Cape, fruit in orchards on east-facing slopes will be ready for harvest earlier than on west-facing slopes. In windy areas, an orchard at the top of a hill facing the prevailing winds will suffer much more wind damage than one on the lee side of the hill. The layout of each orchard block will differ slightly because of topography factors.

Tree spacing between rows and between trees within rows is determined by numerous factors including climate, variety and soil type. A typical tree spacing is 6m between rows by 3m between trees, meaning that 555 trees per hectare are planted.

Remember that rows must be far enough apart to allow access for spray equipment without damaging the trees even once the trees are mature, and to allow enough light interception. Trees in rows have to be far enough apart to allow for cultural practices and limit tree damage.

A lot of research is being done on tree spacing, which boils down to a simple principle – the more trees you can plant per hectare, the more fruit will be produced early in the orchard's lifespan, meaning the orchard will become profitable much sooner. But the production per hectare will eventually level out at the same volumes it would have been at a lower tree density, because the growth of densely planted trees is limited. Planting at a higher density does mean a higher capital outlay – you will have to buy more trees – but the cost of the trees is the smallest portion of the capital outlay per hectare of planting a new orchard.

Conclusion

We now know all the factors that must be considered when planning the layout of our farm and the layout of our orchards. The layout of each block will determine the ultimate success of the orchard. Keeping environmental factors such as erosion and natural vegetation in mind when planting a new citrus block will lessen the impact of your new planting on the environment and it will ensure a more sustainable and profitable operation.

