LEARNER GUIDE

Production Management

Level 3

P.O. Box 461, Hillcrest, 3650
(031) 313-3364

Title:		**Explain the Planning and Scheduling of Tasks in a Production Environment**					
Applied Title:		**Explain the Planning and Scheduling of Tasks in a Citrus Production Environment**					
Field:		Agriculture and Nature Conservation					
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Skills Area:		Production Management					
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Author:		L. von Broembsen					

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Unit standard alignment and assessment tool development:
Cabeton Training and Development

Project coordinator:
Jacomien de Klerk

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Directions

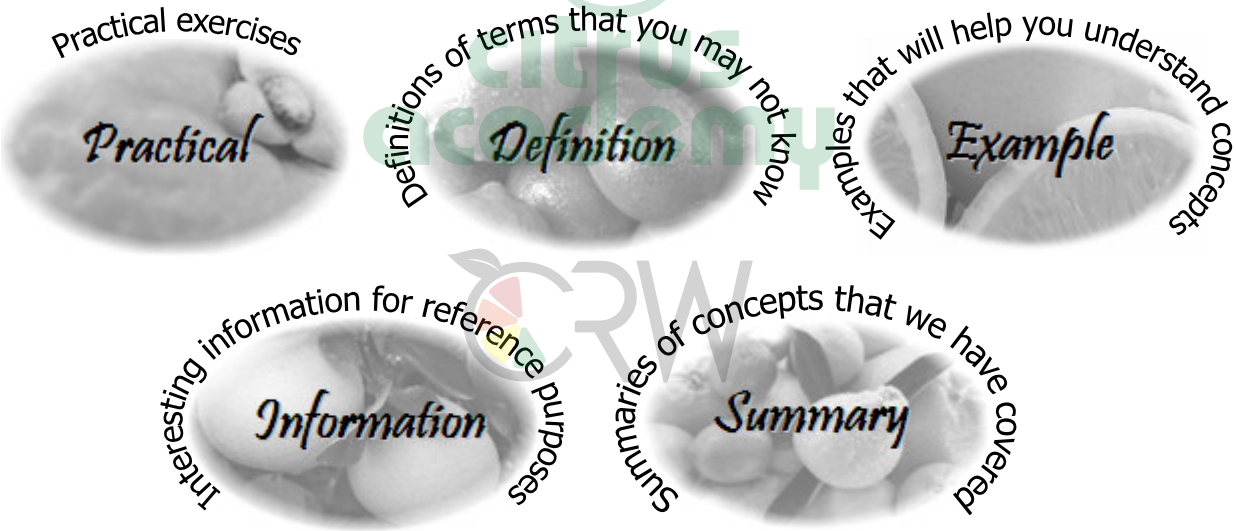
This learning material has been developed to assist the learner wishing to complete this unit standard. The guide contains all necessary learning to ensure that the learner will attain the competencies required by the unit standard.

The learner guide is accompanied by a Learner Assessment Guide. Please ensure that you have access to this guide as well.

The learner guide was designed to be used by a learner during the presentation of a skills program based on the unit standard, and to be kept afterwards by the learner for reference purposes. The learner assessment guide was designed to be completed during and after the presentation of the skills program, and forms part of the assessment process.

Although this learner guide contains all the information required for attaining competency in this unit standard, references to additional resources, both printed and electronic, are provided for further study by the learner.

Information in boxes is indicated by tags that show:



Introduction

1. Purpose

The learner achieving this unit standard will be able to understand the use of day to day planning and scheduling for optimal production in the agricultural processing environment. The learner will also be able to make useful inputs in the planning and scheduling process. In addition, they will be well positioned to extend their learning and practice into other areas of agriculture and management, creating a valuable human resource within the agricultural sector.

Learners will understand the importance of the application of business principles in agricultural production with specific reference to production/conversion.

They will be able to operate farming practices as businesses and will gain the knowledge and skills to move from a subsistence orientation to an economic orientation in agriculture. Learners will gain the knowledge and skills to access mainstream agriculture through a business-orientated approach to agriculture.

2. Learning Assumed to Be in Place

It is assumed that the learner has successfully completed the unit standards listed below:

NQF Level	*Unit Standard Number*	*Unit Standard Description*
NQF2	Literacy and Numeracy	
2	116115	Define and understand production systems and production management

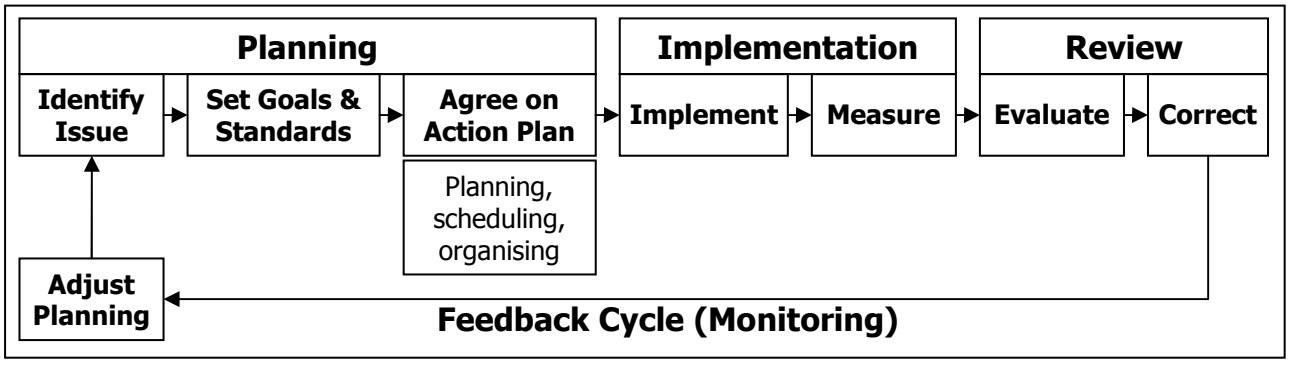
Revision of Level 2

1. Production Systems

- Production systems is about using production practices to convert resources to products that acceptable to the market, in other words to achieve production objectives.
- Production management is about coordinating production systems.
- Meeting market requirements consistently ultimately determines the success of the farming operation. The export market is the most important in citrus production.
- Resources are either fixed (natural) or mobile.
- Fixed resources are expensive and limited.
- Citrus farming implies being in competition with nature, and agricultural practices must always be such that it has a minimal impact on the environment, while still achieving the required yield and quality targets.
- Resources, especially limited natural resources must be employed optimally.

2. Basic Managerial Tasks

- The basic managerial tasks are setting objectives planning, scheduling, organising, implementation, coordination, and monitoring
- Setting objectives is about finding answers to the question "What do we want to achieve?"
- Planning is about working out how to achieve an objective.
- Scheduling is about working out how a plan can be implemented.
- Organising is about arranging the various actions that has been planned and scheduled so that they can be performed within the required timeframe.
- Implementation is about carrying out the agreed plan according to the agreed schedule.
- Coordination is about bringing in the various players at the appropriate times and in the most effective way in pursuit of the agreed objective.
- Monitoring involves control, feedback, adaptation and correction.



Management Process Chain

3. Additional Production Management Tasks

- Additional management tasks are decision-making, leadership, communication, motivation, delegation, discipline and human resource management.
- Decision-making is about weighing all the option and selecting the best course of action. There are various techniques to assist managers in this task.
- Leadership is about giving direction, aligning people, motivating and inspiring people, and introducing change.
- Good communication is about ensuring that everyone involved in a task or project knows what to do, why they are doing it, how to do it, how well to do it, and how well they are doing it.
- Motivation is about helping people to be passionate about their work.
- Delegation about entrusting authority for performing a task to a subordinate, while retaining responsibility for the outcome.
- Discipline is about doing what you are supposed to when you are supposed to and how you are supposed to do it.
- Disciplinary action is taken against an employee who does not do what is required of them.
- The functions of human resource management is staff selection and recruitment, succession planning and career path development, staff training, setting remuneration policy, setting and monitoring performance management policy, ethics and disciplinary procedures, and industrial relations.

4. Setting Goals and Objectives

- The different types of goals are long-range goals, shorter-term goals, business goals, outcome goals, performance goals, activity and personal goals.
- Goals set at various levels for various purposes must all be aligned towards meeting the overall goal, or vision, of the organisation.
- There are various mechanisms to assist with goal-setting, one of the most useful being a SWOT analysis, which analysis the strengths, weaknesses, opportunities and threats to the organisation.
- Goals in a citrus production environment can be overall goals, such as production targets, or specific goals relating to specific production practices.

Production Practices

Production practices are the actions and processes carried out to achieve production objectives, such as fertilisation, irrigation, pest and disease control, pruning, harvesting, etc.

Production Systems

Production systems are concerned with the production practices required to **convert resources** into a desired **product**, which in this case is a marketable citrus crop.

Production Management Production management is the management of production systems and production practices.
Production Objectives Production objectives are measured in terms of yield (quantity), export percentage, fruit size, and external and internal quality.
Export Pack-out Percentage Export pack-out percentage means the percentage of total fruit produced that can be exported. If a total of 1,000 tons are produced and 600 tons (40,000 15kg cartons) are exported, then a 60% export pack-out percentage is achieved.
Planning Planning means to formulate a scheme, program or method to accomplish a specific goal, within a specific timeframe, and with a specific purpose in mind.
Scheduling Scheduling is a management term that involves entering or drawing up a timetable for the completion of various stages of a complex project, or the co-ordination of multiple related actions or tasks into a single time sequence. Scheduling is most commonly used with regard to repetitive tasks, such as the application or irrigation water.
Organising Organising means to arrange tasks into an orderly functional, structured, coherent and systematic manner to bring about harmonious or united action.
Implementation Implementation is the act of carrying out the agreed plan according to an agreed schedule to achieve been agreed should be done.

Chapter 1

After completing this chapter, the learner will be able to:

Explain production planning and the different levels of planning that can be used in production planning activities

1. Different Levels of Planning

Planning can be defined as ***developing an approach to achieve goals set at various levels***. The level of planning can therefore be said to be determined by the level of goal-setting.

The executive boards of corporations, companies and institutions are responsible for setting the strategic goals for the institution. Strategic goals are concerned with achieving such parameters as growth, development and positive shareholder returns. By their very nature, such overarching goals are endorsed at the highest level and tend to span long time periods.

Attaining strategic goals depends on sound planning at the various levels in the organisation, starting with senior management.

Large multinational fruit producers and exporters, such as Del Monte, Unifrutti and Fyffes, plan new production, export and marketing ventures on a global level. This means that planning for these aspects are done across countries and continents. In each of the locations in which operations are set up, plans are made to meet the specific objectives set by their respective parent companies.

On a single citrus farm a similar process is followed, only at a different level. The production plan ranks alongside the financial plan and the marketing plan as an essential contributor to attaining the overall strategic plan for the farm.

The production plan comprises any number of component actions, each of which will have an objective, which can be measured, and a plan for carrying it out.

A typical production plan comprises, for example, the following:

- A pest and disease control plan
- A fertiliser and irrigation application plan
- An estate production expansion plan
- An orchard or tree replacement plan
- A new area extension plan
- A nursery tree order plan
- A fruit maturity indexing plan
- A harvesting plan

Each of these components is further broken down into actions and tasks, each to be completed within an allotted timeframe with accountabilities allocated to specific groups and their supervisors.

For example, the pest and disease control plan will typically list the following:

- Stated objectives, for example that the proportion of fruit rendered unmarketable due to pest and disease factors should not exceed 15%.

- The list of pests and diseases that have to be controlled and the advised control measures.

- The start date for pest and disease monitoring, the monitoring methods and threshold levels.
- The control actions that can be done in at the same time.
- The tasks which require completion before others can start.
- The personnel and other resources required and available to complete the control program.
- The calibration and testing of equipment.
- The ordering of required control chemicals.

Similarly, the estate production expansion plan would be based on the production goals as determined by the management team of the enterprise. Taking projected production levels of existing plantings into account, the expansion plan would indicate the number of hectares or trees required to be planted over a given time period to ensure that the production objectives can be achieved.

2. Enterprise and Product Options

The type and cultivar of citrus that a farm produces has a major influence on almost every component of the production plan. The question: "What crop type to produce?" is therefore fundamental for every citrus farm, and is best answered by analysing both marketing and production considerations.

Product is the first of one of the famous 4 Ps of Marketing (people, place, product, price). Working back from the market, the critical question for determining the appropriate enterprise or product to pursue is "What can I ***produce*** that the market will especially want?"

The first part of the question – "What can I produce…" – is concerned with the climatic and fixed resource capacity of the farm. The second part, being "…that the market will especially want", concerns market opportunity. The key to deciding what crop type and what products to grow lies in finding the best match between these two aspects.

Market Opportunity versus Production Potential

It has been established that there is a good export market opportunity for late-maturing seedless mandarins. An evaluation of the climatic conditions and the soil analyses and profiling show that the farm in question is suitable for the production of late mandarins. In this case, the choice of product to grow is pretty clear. If on the other hand the farm's location is such that good quality mandarins cannot be produced, but valencia oranges can, an analysis of the market opportunity for valencia oranges should be undertaken before a decision is taken.

There are a number of tools and methods available to assist decision-making, which are discussed in detail in unit standard 116115 – ***Define and Understand Production Systems and Production Management***. To make a decision on what enterprise or citrus variety to produce, one such method would be to use a simple comparison analysis as illustrated below.

Variety Options	***Key Considerations***		***Sum of Ratings***
	Market Opportunity	***Production Potential***	
Grapefruit	1	1	2
Seedy Mandarins	1	2	3

Navel Oranges	2	2	4
Valencia Oranges	1	4	5
Lemons	2	4	6
Clementines	4	3	7
Seedless Late Mandarins	4	4	8

The example shows that under these specific circumstances, grapefruit is the least attractive and seedless late clementines the most attractive of the available varieties to plant. The example however just illustrates the point and, in reality, much would depend on the criteria used for ranking the Market Opportunity and Production Potential factors. For example, there may be good reasons to include the planting a variety with a ranking of only 5, such as valencias oranges, to lengthen the overall harvest period and thus make more efficient use of labour and packhouse facilities.

3. Factors Influencing Planning

Plans are generally produced on the basis of current and expected circumstances, or assumptions. If these change, the plan has to be adapted accordingly. Plans and the process of planning therefore have to be flexible, allowing changing circumstances to guide their relevance and validity.

For example, the pest and disease control plan will have to be adapted if a ban is placed on the use of one of the key chemical products intended for use. Similarly, the plan would have to be changed if a new destructive pest or disease is discovered in the orchard.

Other factors which influence the planning process include:

- New legislation;
- Labour disputes;
- Resource availability;
- Market circumstances; and
- Financial viability

4. Income, Expenditure, Costing and Budgeting

Budgeting Budgeting is the process that provides a detailed breakdown of what is planned to be spent and earned for each item of income and expenditure by month for the financial year.
Income Income is money generated from the sale of the product and may include other minor sources, such as interest received.
Expenditure Expenditure is the cost associated with generating the income and supporting the business over the longer term.
Costing Costing is a process for determining the actual cost of producing a particular product or providing a particular service.

We have learned that sound planning is a prerequisite for a successful and sustainable citrus production enterprise. We have also seen that one of the key objectives of any business is for it to be financially viable. The company's financial plan brings these two concepts, namely planning and financial viability, together.

Financial viability simply means that the business must have sufficient cash in the bank to pay for the costs of running it and that the value of the business should increase over a period of time. For this to happen, the amount of money generated from the sale of the products must exceed the costs of production and part of this excess, or profit, must go towards maintaining, improving and expanding the business.

The enterprise's budget is the financial expression of the enterprise's strategic plan. Similarly, its production budget is the financial expression of the production plan.

There are many places in the citrus production and marketing process where the actual costs associated with a particular item or action cannot be easily quantified. This is because it is often convenient and cost-effective to simply use the average costs over a number of items or over an extended time period. However, if this inaccuracy leads to a situation where, for example, it is not possible to assess the relative profitability of one variety compared to another with sufficient accuracy, it would be necessary to resort to such methods as, for example:

- Intuition or educated guessing, with its obvious limitations.
- Traditional cost accounting, which in itself may prove insufficiently accurate.
- Activity-based cost accounting, where costs are allocated to specific activities.

Chapter 1

- The level of planning is determined by the level of goal-setting.
- Reaching strategic goals requires strategic planning, reaching production goals requires a production plan, and reaching pest and disease control goals requires a pest and disease control plan.
- Product selection depends mostly on environmental factors (climate, soil, water availability, etc.) and on market opportunities.
- Planning has to be flexible, allowing changing circumstances to guide their relevance and validity.
- A budget is a financial expression of a plan.
- Income is money generated from the sale of a product.
- Expenditure is the cost associated with generating income.
- Costing means determining the actual cost of producing a specific product or delivering a specific service.

Complete activity 1 in the **Learner Workbook**.

Chapter 2

After completing this chapter, the learner will be able to:

Demonstrate an understanding of scheduling

1. Explaining Scheduling

In simple terms, scheduling involves deciding in advance when work will be performed. Planning determines what needs to be done. Scheduling puts the planned actions to a timeframe, indicating when a task has to be performed or completed. It is an essential tool for managing and implementing processes and actions such as fertilisation, irrigation, and pest and disease control. It is also used to formalise the sequence of events that need to take place for the execution of a project or program.

However, the scheduling process is not only about what will be done when. It also involves aspects such as:

- Who will perform the work
- Where will the work be performed
- What resources are required
- How will progress be measured against the scheduled work
- How will progress be reported on

Scheduling can be used as the basis for both the management of a specific project, such as the establishment of a new citrus orchard, or to enable a repetitive action, such as irrigation, to be carried out effectively. In both cases the design and implementation of schedules may involve individuals from different parts of the operation.

Scheduling

On a large citrus estate deciding on the ideal irrigation schedule could require inputs from:

- The horticulturist, to indicate the water requirements of the specific planting.
- The soils and fertilisation expert, to indicate the physical and chemical features of the soil and thus the advisable range of water application rates.
- The irrigation engineer, to indicate the capability and capacity of the system to deliver the desired water application rates.

Similarly an effective pest and disease control program would require agreement from various specialists and managers regarding the operations required, by when and by whom. The output of such a schedule would be the required tasks listed in sequence and set to specific dates. Thus irrigation regimes, pest and disease control programs, and manufacturing projects all have one important thing in common: the need for scheduling.

The agreed schedule, including details of what, when, how and where, has to be communicated clearly and concisely to all those concerned in its management and implementation. This is formalised using an appropriate scheduling technique.

2. Different Scheduling Techniques

A scheduling technique is a tool used to facilitate the scheduling process. Most recognised and frequently used scheduling techniques have their origins in the manufacturing and logistics industries. Whenever projects are undertaken, for example to investigate and produce a report, install a system, manufacture or assemble products, or move them from one place to the next, a clear step-by-step process needs to be designed, communicated and executed.

Depending on specific needs and circumstances, the manager selects the most appropriate scheduling technique for a particular project. Before selecting the scheduling tool, the project's information must be assembled in a certain way. The required information includes:

- The project start date;
- The completion date;
- The scope of the project, meaning what it includes and excludes;
- The tasks, in the order in which they might be accomplished, by project phase;
- An estimate of the personnel required and available for the project;
- The interim milestones or interim deadline dates set for the project; and
- The project control or review points

The project manager would then decide which scheduling technique to use. There are a few to choose from, of which the most common are the following:

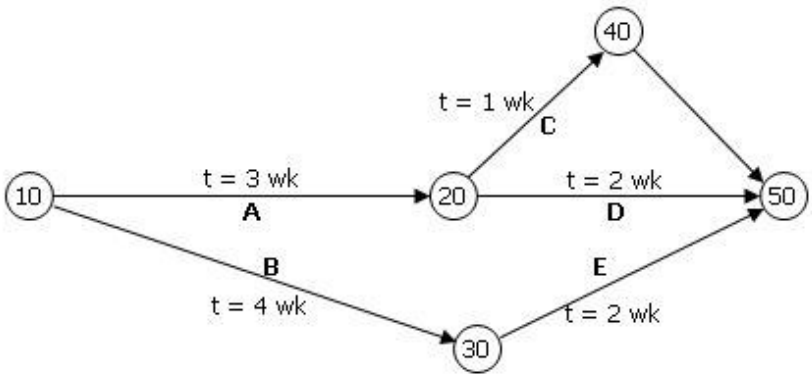
- **Flow charts** or **process charts** can be used, but do not normally include a timeframe and are thus not truly schedules

- **Milestone charts** are used to determine the overall status of each major project. It is however not a good schedule methodology for day-to-day monitoring of work effort at the detail level;

- On **Critical Path Method (CPM) charts** the critical path, representing the key activity, is drawn along a timeline with the tasks associated with it indicated alongside.

- **Programme Evaluation and Review Technique (PERT) charts** are used for complex projects requiring a series of activities, some of which must be performed in order and others at the saem time. PERT charts are normally drawn on ruled paper with the horizontal axis indicating time period divisions. Each arrow, or diagonal, represents an activity that has to take place, or links to another activity that has to take place, to accomplish the end goal.

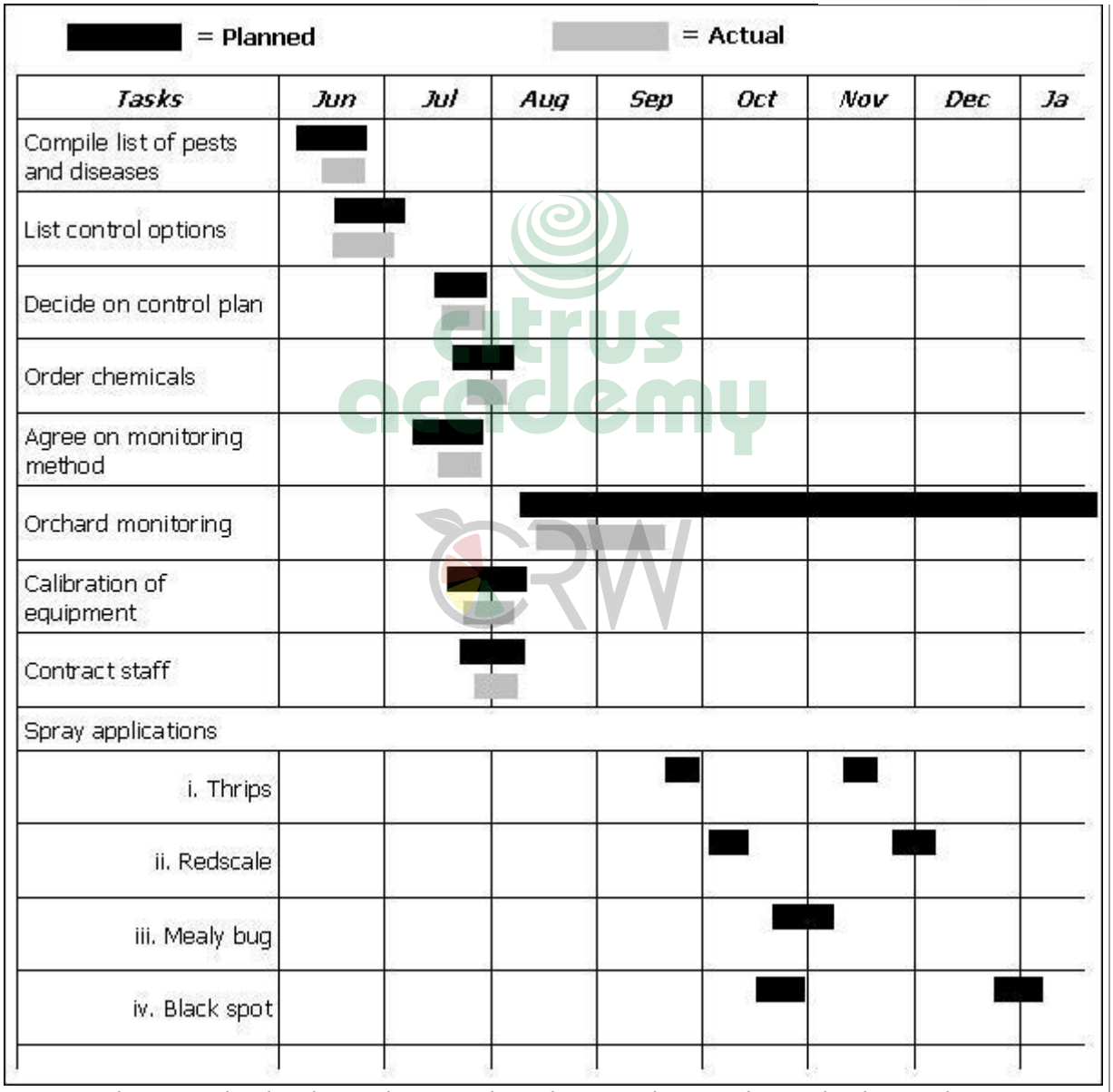
PERT Chart



- The milestones are numbered **10**, **20**, **30**, etc.
- **t** denotes time in weeks for each activity
- **A**, **B**, **C**, etc. denote activities

- **Gantt charts** are bar graphs that help plan and monitor project development and resource allocation on a horizontal time scale. An example of a simple Gantt chart for pest and disease control is shown in the example below. Gantt charts can also be used to indicate:
  - The relationship between tasks planned and actual completion dates
  - The cost of each task
  - The person(s) responsible for each task
  - The milestones in a projects development

Gantt Charts



Note: In this example, the chart is being evaluated near end September and indicates the progress that has been made with the various planned tasks.

The production manager's task is to consider the overall production plan and, where necessary through using such tools as Gantt charts, ensure that the allocation of resources and the implementation of the

plan occurs effectively (that the right things are done), efficiently (that the things are done right), and on time.

3. Forward and Backward Scheduling

Schedules can be created in two ways, being forward and backward scheduling.

Forward scheduling calculates schedules forward from today to project the completion date. For example, if a citrus packhouse is to be built during the off-season, it may be appropriate to start at today's date and plan each activity on a process chart. Having done this, and having put realistic deadline dates to each activity, it would then be possible to project the completion date.

Backward scheduling calculates job and event schedules back from the due date to project the start date. This is commonly used when the due date is critical, such as when a spray treatment has to be completed by a certain date to comply with harvest interval requirements. In this case the completion dates for the various actions required for the sprays to have been applied by the final date, will be scheduled accordingly.

4. Control Over Schedules

A schedule is a living document that belongs to all who participate in its compilation and its implementation. This means that it should be displayed in a prominent place, feature as an agenda point at operational meetings, and be referred to constantly.

On a regular basis the schedule must be reviewed and evaluated and if necessary adjusted to take account of changing circumstances. The various scheduling techniques provide for this process of review and adaptation.

Chapter 2

- Scheduling is about putting plans to a timeframe.
- Scheduling indicates who will perform the work, where will the work be performed, what resources are required, how progress will be measured against the scheduled work, and how progress will be reported on
- Scheduling techniques are tools used to facilitate the scheduling process.
- The most commonly used scheduling techniques are flow, milestone, CPM, PERT and Gantt charts.
- Schedules can be created forwards, meaning from a certain date onwards with an estimated completion date, or backwards, meaning from a predetermined completion date back to the date on which the task will begin.
- Schedules must be displayed prominently and communicated well.

Complete activity 2 in the **Learner Workbook**.

Chapter 3

After completing this chapter, the learner will be able to:

Demonstrate production optimisation techniques

1. Introduction

Left unattended, the growth and fruiting patterns of a citrus tree will be determined by its hereditary characteristics and how the natural environment in which it is being grown, act on these to trigger various responses. Environmental factors such as temperature, humidity, sunlight, day-length, and available soil moisture influence the rate and nature of various metabolic reactions in the plant tissue.

This in turn determines the nature and concentration of plant growth regulators located in various parts of the plant. These regulators switch reactions at cellular level on and off, which manifest in the timing and nature of flowering, fruit set, fruit growth, fruit colour development, fruit drop, leaf drop, vegetative growth flushes and other responses.

The citrus production manager must understand that tree response to environmental conditions is complex and often unpredictable. He or she must therefore use whatever tools are available to assess and measure the production status of trees at various critical times so that he or she can apply appropriate treatments timeously.

One of the primary goals of the citrus production manager is to produce high yields of marketable fruit. It is also important that he or she is able to predict the size of the crop, the likely fruit size range, and the maturity time of the fruit long before the fruit is harvested. This is required for effective planning of harvesting, packing, transportation and marketing operations.

These crop predictions, or estimates, are made at various times, and the earlier they are made, the less accurate they are likely to be. For this reason certain techniques are employed to improve the accuracy of early predictions.

Another reason why early crop predictions are important is to enable the production manager to plan and implement timeous actions, such as production treatments, that will result in the crop most closely meeting market specifications and requirements.

Production optimisation techniques therefore refer to the methods used to:

- Make early predictions relating to the crop; and
- Manipulate the tree, its crop and/or the environment in such a way that the resultant crop is best able to meet the requirements of the market in an economic and sustainable manner.

At all times, it must be remembered that the purpose of optimising production is to meet the overarching goals and objectives of the enterprise, namely to maximise profits in a socially and environmentally responsible and sustainable manner.

2. Recording and Measuring Inputs

Decisions on the nature and timing of citrus production treatments, or interventions, are based on information. Inaccurate or incomplete information can easily lead to poor decisions that can waste money and have serious short- and long-term consequences for the crop and environment.

The quality of the information is determined by the data gathered and the manner in which data is processed, presented and used.

As a first step it is therefore important to decide what data is important to collect and where and how it should be collected and processed, to turn the data into useful information. The following are examples of the kind of parameters for which appropriate data is required as a basis for making critical citrus production management decisions:

- Expected blossom time
- Expected fruit set time
- Growth flush status
- Daily temperature, humidity, evaporation and rainfall measurements
- Orchard counts for specific pests and diseases
- Fungal spore counts
- Fruit growth-rate measurements
- Tree yield measurements
- Soil water status measurements
- Soil and leaf analysis results

For each of these parameters a process for measuring and recording the most relevant data has to be developed and implemented. An example of a data record sheet for blossom stage and timing is given below.

Records

Record of Blossom Development Stage (% in each stage)					
Cultivar:	Valencia	**Orchard No.:**	10	**Date:**	
Data Tree No.	***Green Button***	***White Button***	***Balloon***	***Full Bloom***	***Petal Drop***
1	5	10	30	30	25
2	0	5	25	40	30
3	10	10	40	20	20
4	0	20	40	35	5
5	5	20	20	30	25
Average	**4**	**13**	**31**	**31**	**21**
Previous Years Averages					
2004	13	25	30	14	15
2003	0	20	35	25	20
2002	0	10	15	20	35
2001	20	35	40	5	0

The specific data provided by this record sheet is useful for estimating the ultimate fruit maturity date, as well as deciding the nature and timing of subsequent production actions, such as pest and disease control treatments. It also allows comparisons to be made with the situation at about the same date in past years. Note however that a data sheet of this kind is indicative only of the relative stage of maturity of the crop at a particular time. Such data are usually not suited for statistical analyses.

It is also necessary to keep track of the inputs made to the production process, and the input costs, during the course of the production cycle. The production planning and scheduling processes referred to in the previous chapters have shown how an action plan is developed for implementation. Once the plan is put into operation, it is necessary to track progress against the plan. The Gantt chart makes provision for this.

3. Measuring Production Output Data

If records are maintained properly and as a result of this accurate, useful information flows from the various operations during the production period, there should not be any major surprises for the production manager at the time of harvesting and packing the crop.

In practice, however, things do not always work out like this. Events in the period close to harvest, such as prolonged rainfall or drought, unusually high or low temperatures, labour disputes, or machinery failure, can have a sudden and disproportionate effect on the performance of a citrus production unit against expectations.

It is therefore important to track and measure final production performance (output) against targets set and to use this information to plan in future. This requires that appropriate output data is generated. For a citrus production unit, output refers to the quantity and quality of fruit produced which is suitable for the various market segments for which it was intended.

The following are examples of the output parameters for which appropriate data would be required for any single season:

- Yield and fruit size distribution by variety, rootstock, orchard and hectare;
- The percentage of fruit delivered to the various market segments (e.g. export, local fresh, processing);
- Cull factor analysis, being the proportion of fruit lost as a result of various pest, disease and environmental factors;
- Maturity indexing data, indicating the fruit maturity patterns culminating in when the fruit first reached harvest maturity;
- Actual versus budgeted income.

Such data has to be captured, processed and summarised in a user-friendly format to enable actual performance to be compared against predictions. The information arising from this would also be used to build historical records for tracking trends in annual performance.

4. Statistical Analysis

Statistical analysis is used to evaluate the validity or significance of the results from data collected. When we find differences between expected and actual results, it may not be possible to determine whether the difference is due to any identifiable factor, or whether it is simply due to chance variation.

It is commonly used to determine the validity of research results where different treatments are being compared. Such techniques are also sometimes used to assess the significance of observations made in the field.

For example, we may wish to know whether a particular chemical spray treatment should be used to increase the yield of clementines. As a result, we decide to spray half of the orchard leaving the rest unsprayed. At harvest we find that the average yield of all the sprayed trees is 5kg of fruit per tree more than that of unsprayed trees. Can we say that this difference is due to the spray treatment or due to sample variation, that is, due to chance? Statistical analysis provides the tools for being able to make valid conclusions in such comparisons and in much more complicated situations.

Statistical analysis is also most useful for determining the extent to which two variables are proportional or linearly related to each other. For example, to determine the relation between the seed content and the roughness (texture) of the fruit rind, data would be generated by taking a sample of fruit and recording rind texture ratings and the seed number for each fruit. The data would be statistically analysed to see if there is a correlation, or linear relationship, between rind texture and seed content. If the result showed a high correlation, we could conclude that if we wanted to know the seed content of a fruit of that particular cultivar we could do so by observing the rind texture without having to cut open the fruit.

There are many instances where statistical analysis is a valuable way of determining whether differences are real or perceived. Where costly decisions have to be made on future tree or fruit treatment options, statistical analysis is especially handy.

5. Adapting Inputs to Achieve Required Output

Maintaining flexibility in the management of any project, program or system is very important. Circumstances, especially in fruit production systems, change continuously. These changes are often related to climate or market demand factors, over which the producer has no control. The production manager therefore has to ensure that there is a continuous measurement and evaluation of production and market circumstances, thereby placing him or herself in a position to adjust inputs accordingly.

Earlier we have seen that the framework for managing a citrus production project or program comprises a sequence of steps. These can be summarised as a follows:

1. Decide the objective or goal
2. Set the required standards
3. Decide on the implementation plan
4. Schedule the activities
5. Allocate responsibilities and resources, or inputs
6. Measure progress and results
7. Evaluate by comparing the results with the goals and targets set
8. Adapt the goals and/or targets
9. Adapt the inputs, and go back to step 5

This sequence, and point 9 in particular, shows that the allocation of resources, or the application of inputs, is a dynamic process driven by changing circumstances and outcomes as the program progresses.

Chapter 3

- Production optimisation techniques are about making accurate, early prediction relating to the crop, and manipulating the tree and its environment to produce the best possible quality and quantity crop.
- Decisions on production interventions are made on the basis of accurate information, which is obtained from records.
- Records must be kept of inputs made and their costs.
- Output records that must be kept include yield and fruit size distribution, percentage to each market segment, cull factor analysis, maturity indexing data, and actual versus budgeted income.
- Statistical analysis is used to evaluate the validity or significance of the results from data collected, and to determine the extent to which two variables are proportional or linearly related to each other.
- The steps required to manage a citrus production unit are:

1. Decide the objective or goal
2. Set the required standards
3. Decide on the implementation plan
4. Schedule the activities
5. Allocate responsibilities and resources, or inputs
6. Measure progress and results
7. Evaluate by comparing the results with the goals and targets set
8. Adapt the goals and/or targets
9. Adapt the inputs, and go back to step 5

Complete activity 3 in the **Learner Workbook**.

Chapter 4

After completing this chapter, the learner will be able to:

Demonstrate the ability to make meaningful comments on the planning and scheduling process

1. Understanding Production Planning

In previous chapters we have seen that production activities:

- Are varied;
- Often overlap; and
- Should follow a logical sequence so that resources and inputs can be used effectively to achieve stated goals

A production plan is only compiled once the production objectives, or goals, have been set. The high level plan indicates the main activities that need to take place for the agreed goal to be met. Each of these activities also requires their own plan. The overarching plan and the various activity plans are developed using past experience, technical and management expertise, and in-season information.

The plans indicate what has to be done as well as how, where and by whom it has to be done. It may also indicate a completion date though the setting of the various activities to their specific deadline dates, which is achieved through scheduling.

Thus the production plan identifies the various steps and the required and available resources and inputs needed to achieve the objective.

2. Understanding Scheduling

Scheduling puts the agreed plan to a time frame. It is usually the step that follows planning and indicates the desired completion date, or deadline, for each activity within the overall plan. In practice, planning and scheduling are often done at the same time, when the activities required for the execution of a plan is identified and at the same time set to completion dates.

Various scheduling techniques can be used to facilitate the scheduling process. These include flow charts, milestone charts, critical pathway diagrams and Gantt charts. Of these, Gantt charts are the most useful for planning and scheduling citrus production projects, programs and activities.

A very important benefit of following a formal planning and scheduling process is that the documentation stipulating the actions and deadline dates serves as a means of ensuring that all participants have a single set of basic reference documentation. This facilitates communication and ensures that all role players are literally working off the same plan.

3. Linking Planning, Scheduling and Optimisation Techniques

The citrus production manager has the task of integrating the many different aspects of the production operation. The end result of all the activities of his staff and the mix of other inputs must measure up to and exceed the goals and targets set and the expectations created.

There are various tools available to assist the manager in achieving this. Planning and scheduling tools help to systematically develop the goals and the means of reaching those goals within required time frames. Production optimisation techniques focus on two main things, being the most accurate way of

predicting crop volumes and timing, and the production (orchard) practices required to manipulate the crop most effectively and efficiently to meet the production objectives.

Chapter 4

- Production activities are varied, often overlap, and should follow a logical sequence.
- Goal-setting is followed by planning, which is followed by scheduling, which is followed by implementation, of which records are kept, which are used to evaluate the implementation of the plan and the achievement of the goals, which allows for optimisation.

Complete activity 4 in the **Learner Workbook**.