

Year 10 agriculture notes - Farm business management and potato growing

Hurlstone Agricultural High School

October 19, 2013

Acknowledgements

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The authors would like to thank Kevin La (10O) for providing information for sections 2.8, 2.9 and 2.10, as well as Nelson Fu (10I) for providing information for sections 2.11, 2.12 and ??

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Chapter 1

Farm business management

1.1 Property

Property values can vary greatly. This can be because of:

- Climate/water availability
- Improvements
- Carrying capacity
- Proximity to markets

1.2 Farm management terms

Total income - The income received from the sale of all produce and saleable products.

Net farm income - Total income minus fixed costs minus variable costs. Kinda like your profit.

Total farm variable costs - The sum of the farm's variable costs. Variable costs change the size of production. ie. Fuel, seed/feed, labour, fertiliser, drenches, agent costs, stock, labour (casual) equipment replacement.

Total fixed costs - The sum of all fixed or overhead costs which are the same. For example, rates and taxes, insurance, administration, electricity, depreciation workers compensation.

Management - Administration of a business. A manager carries this out.

Operators allowance - The owner's or manager's salary.

Capital - Money and accumulated wealth.

1.3 Gross margin budget terms

Gross margin - Income minus variable costs

Fixed costs - What I can't control. eg. Body corporate fees, cost of the unit, furniture, appliances.

Variable costs - What I can control. It can change in a short amount of time. eg. Telephone and gas bills, food, water bills.

Income - How much money you earn.

Total income

Net income

Chapter 2

Potato growing

2.1 Potato tubers

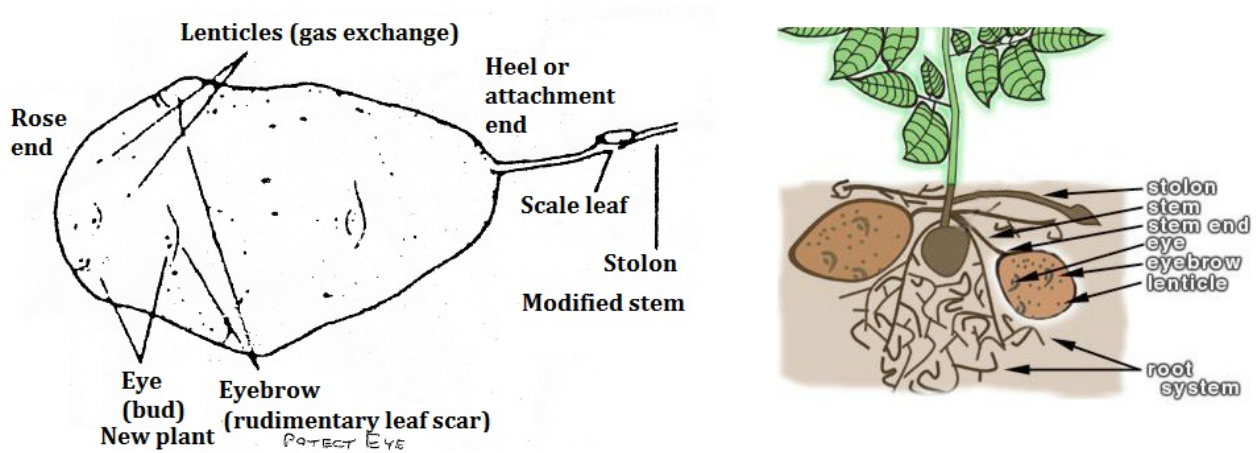


Figure 2.1: Typical potato tuber showing physical characteristics

You'll be required to draw and label the above diagram. Make sure you know about the below parts.

Rose end - The attachment point between the tuber and plant.

Eye - Eyes are buds from which the potato plants grow.

Eyebrow - A leaf scar.

Stolon - This is an underground STEM originating from the eye. It is NOT a root. Some other plants such as strawberries have this as well.

Lenticles - Holes in the potato where the gases go into and out of the potato. Potatoes are living and need to air. Gases in the potato go into the soil atmosphere and similarly, the gases in between the soil particles go into the lenticles into the potato.

Note that the stolon is an underground stem and NOT a root.

2.1.1 Composition

The composition of the potato tuber is:

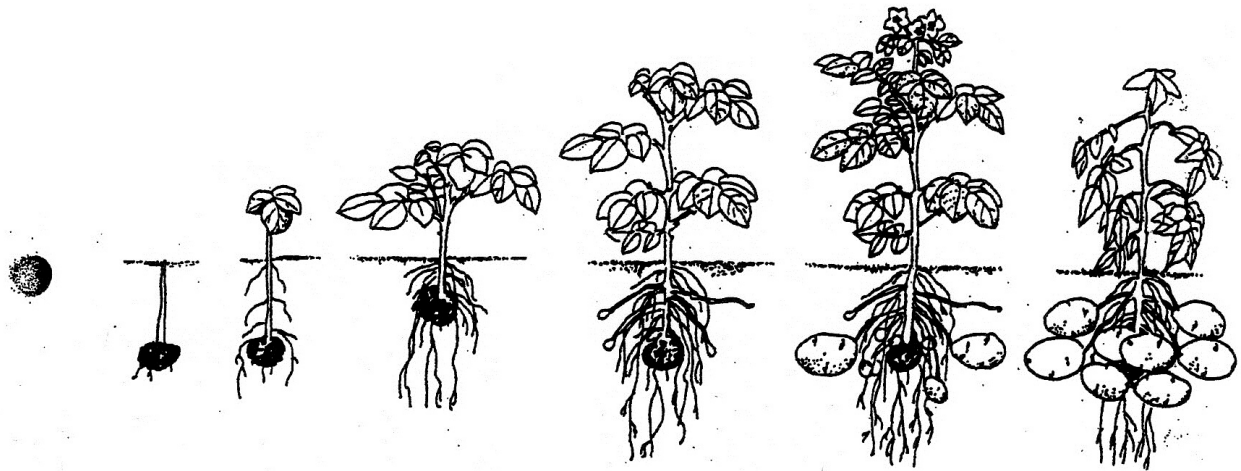
80% water

18% starch

2% proteins, vitamin B1, vitamin C, minerals

2.2 Development of the potato

STAGES OF GROWTH IN THE POTATO PLANT



The four stages of growth in the potato are:

- 1) Vegetative growth (first two diagrams)
- 2) Tuber initiation (diagrams 3-4)
- 3) Tuber growth (diagrams 4-5)
- 4) Maturation (diagram 6)

Vegetative growth

The first sprouts emerge from the eyes of the potato. Stems will grow from these sprouts. The stems may grow above or below the soil surface. An underground stem is called a "stolon".

Tuber initiation

Tubers (the potatoes) begin to form on the tips (ends) of the stolons. Tubers begin to grow just before the plant begins to flower.

Tuber growth

Any excess CHOs (carbohydrates) that the plant does not utilise is transported down to the tubers - the tubers become larger in size.

Maturation

The skin of the tuber hardens. The potato reaches its maximum size. The above ground part of the plant withers and dies off - the potatoes are ready to harvest.

2.3 Comparison of different potatoes and their uses

Potato variety	Skin col.	Flesh col.	Salads	Roasting	Boiling	Mashing	Frying
Bintje	Red	Yellow	x	x	x		
Desiree	Red	Yellow	x	x			
Patrones	Red	Yellow	x	x			
Pontiac	Red	White		x	x		
Tasmanian Pink Eye	Pale Red	White	x	x		x	
Toolangi Delight	Purple	Creamy	x	x	x	x	x
Sequoia	White	White	x		x		
Russet Burbank	Brown	White		x	x		
Exton	White	White		x		x	
Kennebec	White	White			x		x
Coliban	White	White			x	x	

Potatoes can be used for:

- Fresh whole - boil, mash, bake
- Processed - french fries, potato chips and crisps
- Seed potatoes



Figure 2.2: One of the end uses of potatoes - chips.

2.4 Where do potatoes come from

Potatoes are planted around Australia at different times of the year because the climate of each growing area is different. Because the potatoes are planted at different times of the year, they are ready to eat at different times. This gives consistency of supply into the market place.

People living in Sydney get their potatoes from a number of areas, depending on the season of the year.

Potatoes sold in Sydney are known as “fresh” potatoes as they have not been stored for a long period of time. Fresh potatoes into the Sydney market come from areas of NSW, Qld, Vic and SA.

Potato growing areas in Qld have been developed to take advantage of the lack of potatoes in the market during the winter months. Although these areas do not have ideal climates for potato growing, the increased monetary return due to poor supply from other areas makes potato growing a viable option. The main potato growing regions in New South Wales are indicated below.

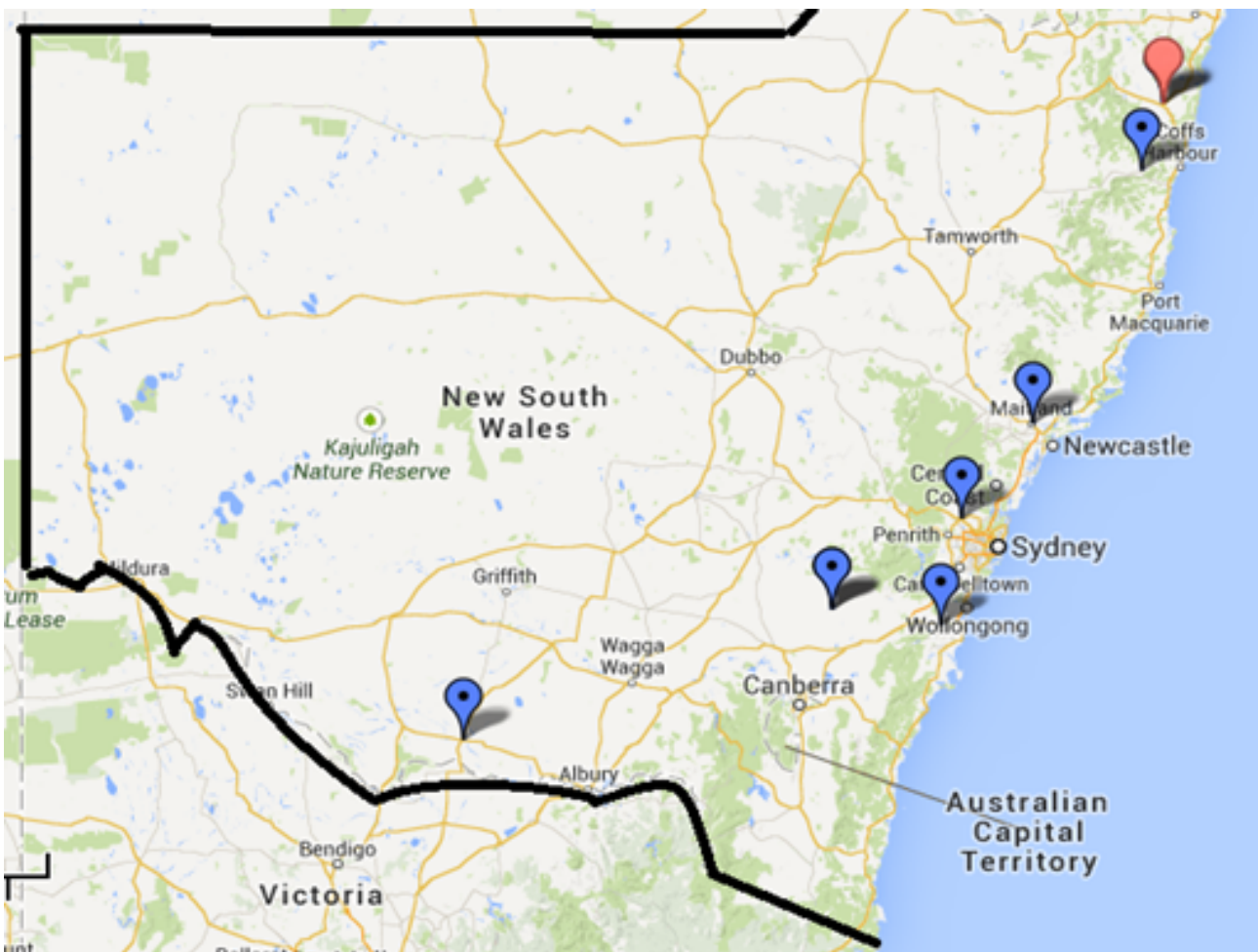


Figure 2.3: From left to right: Finley, Crookwell, Robertson, Windsor, Maitland, Dorrigo, Grafton

2.5 Calendar of operations

Month	Activity - HAHS- sebago potatoes
June	Initial soil preparation - ploughing
July	Fertiliser - NPK applied
August	Hill rows - add lime and gypsum
September	Plant - beginning of Sept
October	Water, weed, pest and disease control if necessary
November	Water, weed, pest and disease control if necessary
December	Harvest around mid December

Note: NPK is nitrogen, phosphorus, potassium

Soil preparation

Soil is ploughed to loosen soil aggregates and kill weeds.

Fertilise

N.P.K fertilise prior to sowing the potato crop or at planting time in bands about 5cm below and 5cm to the side of the tuber.

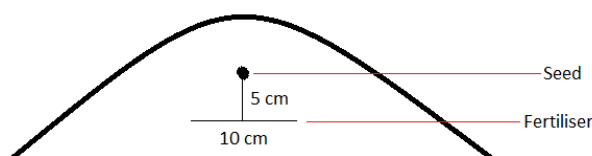


Figure 2.4: Remember that fertiliser is acidic so if the fertiliser is too close, the acid will kill the tuber or seed. Never EVER put the fertiliser next to the seed. Y'all got?

Fun fact: Fish bones are made of calcium carbonate (CaCO_3^-) which is a base. If you get bones stuck in your throat, drink some sulphuric acid¹ to dissolve it².

Initial hilling

Lime and gypsum are added.

Lime adjusts the pH. This makes the soil less acidic and lowers the pH. *Gypsum* is made up of 20.6% calcium and 15.4% sulphur and some other stuff. The *calcium* improves soil structure. It causes the particles to stick at the right amount. We don't want clay (too sticky) or fine dust (not sticky). *Sulfur* improves water penetration and aeration. That is, it helps water move down through the soil and get through the root zone. The improved aeration allows air to get through. Note that plants and roots do not "breathe". They do not have lungs!

Both calcium and sulphur enhance root development We want the roots to spread out as much as possible to pick up as much nutrients as possible.

Planting

6-8 weeks after soil preparation.

Harvest

Occurs approximately 16 weeks after planting.

¹Actually, that's quite strong. Drink coke or vinegar instead.

²See neutralisation reactions

2.6 Climatic and soil conditions

Potatoes do best in cold climates BUT are only slightly resistant to frost.

Maximum yields are obtained when their growing season temperature range is 15-18°C.

The yield of tubers is governed by the rate of photosynthesis and the rate of respiration of high temperatures 29°C+.

When photosynthesis and respiration are in balance there are no carbohydrates available for storage in the tubers. Mild days and cool nights result in surplus energy that can be stored in the tubers to form starch.

Potatoes have a limited root system and because of this, potatoes require a regular and ample supply of moisture. Potatoes have thin and small (fibrous) roots that spread around. This contrasts to a tap root. If we just rely on natural rain fall, it will sink below the root zone.

Potatoes require from 300-350mLs of rainfall during their growing period. The best soils for potatoes are those that are fairly deep, well drained, free of clods and stones and slightly acidic with a pH of 6. Stony and cloddy soils are unsuitable because they restrict tuber development. A high level of decomposed soil (organic matter) is desirable because it benefits soil structure and assists water penetration, drainage and air exchange.

2.7 Certified seed potatoes

Certified seed are grown for four years in controlled field conditions, and inspected rigorously to ensure the high standards of the certification scheme are met. Prior to this the seed is grown as virus free plant material in tissue culture.

Some of the key advantages of Certified Potato Seed are:

- True to type
- Free from disease
- Vigorous growth
- Greater yield

2.7.1 Reading labels

If anyone has information on this topic, please contact me so it can be added it. We would be very grateful for your help.

2.8 Potato moths

2.8.1 Life cycle

1. Adult - At night, the adult lays eggs on the plants or tubers.
2. Egg - Eggs are laid under the surface of leaves or on tubers around the eye.
3. Larvae - Once hatched, crawl to the surface of the leaf and eat it. The leaf becomes brittle and dies. The larvae infest the plant.
4. Pupa - Inside the cocoon the dark brown pupa develops into a moth in a week or two.
5. Resting Adult - lays more eggs on plants and the life cycle begins again.

2.8.2 Infestation and damage

Larval mining in leaflet causes brown blistering which can occur anywhere on the leaflet.

The larva also tunnel in leaves, leaf stalks, main stems and growing points of terminal shoots.

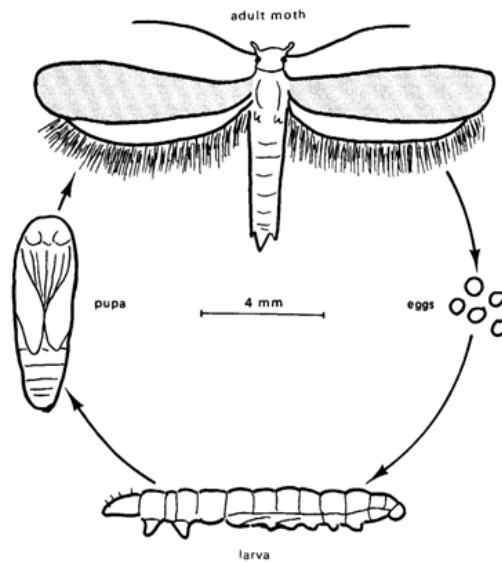


Figure 2.5: A diagram depicting the stages of the life cycle of the potato moth.

Heavily infested plants will die. Larval mining in tuber tunnel can be shallow or up to 8cm deep. Happens when plants die, and when tubers are developing closer to the surface, causing soil to crack. The larvae move down to infest tubers and moths lay eggs directly on or near the tubers. The tunnelling is then filled with excrement aka shit. Damn. What's going to happen to my chips now?

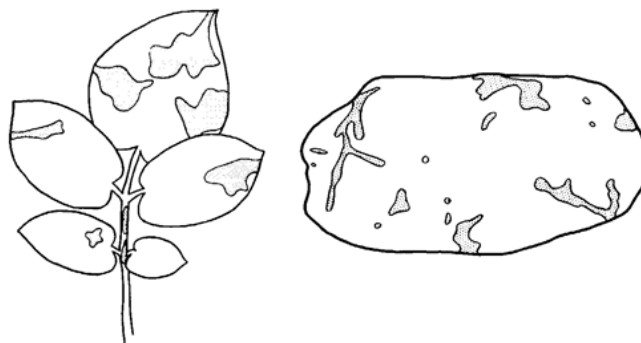


Figure 2.6: Leaf mining damage and tuber mining damage caused by larva penetration.

2.8.3 IPM program

IPM - Integrated pest management

IPM involves the use of more than one control method to maintain the lowest possible population of pests.

A farmer³ will only control a pest if it is cheaper to pay for the chemicals. For example, if there is insignificant damage, you're just wasting your money buying chemicals for no reason. You would only buy chemicals for IPM when it is more expensive to replace your potatoes.

Methods for IPM for potatoes:

- Hilling (protects new formed tubers)

³This does not apply to Hurlstone students however, as we are not farmers. We will spray whatever because we feel like it.

- Irrigating soil (stops moths digging into the soil)
- Crop Rotation (maintain soil quality and prevent soil cracking)
- Insecticide/Pesticide

2.9 Commercially harvesting potatoes

The most frequently utilised mechanical method for the commercial harvesting of potatoes is carried out by the potato harvester, which are implements attached to tractors. The machines work by lifting the potatoes from the bed using a share. Soil and crop are transferred onto a series of webs where the loose soil is sieved out. The potatoes are moved towards the back of the harvester on to a separation unit and then to a picking table where people pick out by hand the stones, clod, haulm and reject clod. The potatoes then go on to a side elevator and into a trailer or a potato box.

2.10 Storing potatoes

When storing potatoes in the home, they should be kept at the below temperatures depending on their type:

- Table potatoes: 3-7 °C
- Processing potatoes: 10-11 °C
- Seed potatoes 2-3 °C

2.11 Poisonous potatoes and green potato tubers

Leaves, leaf stalks, stems, green potato tubers are all poisonous. Green potato tubers which are photosynthesising (thus the greenness) produce glycoalkoids which are poisonous. Human consumption of these would cause sickness.

2.12 Genetic engineering

Scientists identified the genetic code for the production of an enzyme called PPO which causes fruits and vegetables to turn brown once flesh is exposed to air. Scientists have developed a gene which suppresses the action of PPO, so potatoes will not brown when exposed to air. Manufacturers of French fries can be assured that cut potatoes will not turn brown when processing. Genetic engineering improves both marketing *and* potato production.