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91531



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Mana Tohu Mātauranga o Aotearoa  
New Zealand Qualifications Authority

## Level 3 Agricultural and Horticultural Science 2023

### 91531 Demonstrate understanding of how the production process meets market requirements for a New Zealand primary product(s)

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of how the production process meets market requirements for a New Zealand primary product(s).	Demonstrate in-depth understanding of how the production process meets market requirements for a New Zealand primary product(s).	Demonstrate comprehensive understanding of how the production process meets market requirements for a New Zealand primary product(s).

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL parts of the task in this booklet.**

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (DO NOT WRITE). This area will be cut off when the booklet is marked.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

Excellence

TOTAL 08

## Page 1

### INSTRUCTIONS

Carefully read ALL the instructions and parts before answering.

You must answer the different parts using TWO different primary products – Primary product (1) and Primary product (2).

Different primary products are required for parts (a) and (b). Part (c) will be answered using either the primary product used in part (a) or part (b).

In addition, you must use different market requirements from the list below for parts (a) and (b).

#### Market requirements

- Quality (consistency, attributes, uniformity, presentation)
- Quantity
- Timing
- Price

### STIMULUS MATERIAL

Primary producers need to have a clear understanding of the requirements their customers or overseas markets have. This will allow them to make informed decisions on the farm to be able to satisfy those requirements.

Primary producers may get feedback from customers directly, from their importers overseas, from government industry bodies, or from their primary producers' organisations.

The better the feedback and understanding between the market and the primary producers, the better the alignment between production and market.

## PLANNING

### attributes kiwifruit:

ovoid shape and large  
29.3 average fruit per tray  
70% of fruit must be over 16% dry matter  
11-13% brix levels  
blemishes less than 1cm<sup>2</sup>

### artificial pollination:

6000 pollen grains are needed to get 400-600 seeds  
600-1000 seeds is top quality gold KF - 6 visits per flower from bees  
needs at least 100 seeds to be export quality  
all pollinated at the same time  
kiwifruit has low numbers of flowers, so needs 80% of flowers to turn into fruit  
97% chance of fruit set compared to 3.1% for insects  
can be planned in time for golden week  
science learn - 'bees aren't doing as good of a job as they used to'

\$6 global market, \$3 domestic market

### supavine:

decrease in labour - 12 people down to 4/ha  
6500 trays/ha without supavine  
9000 trays with supavine  
improves dry matter by 19.8%  
increases brix levels to 6.2  
decrease in reject rates from 28.1 down to 12.5  
increase in weight from 90g to 110g

### girdling:

increases dry matter by 2.1%  
improves brix levels  
cost \$240-\$340/ha

### cherries:

TSS - 23% (total dissolved solids)  
15mil exported to china  
79% of nz cherry exports go to china

### UFO:

yield 12t/ha compared to 8t/ha conventionally  
harvest takes 1/2 the time of a conventional orchard  
grown 2-3m in height

## TASK: How management practices meet market requirements

Name a primary product and a specific market. Choose a market requirement from the [list](#) above.

Primary product (1):

Specific market:

Market requirement (1):

(a) (i) Explain a market requirement for your named primary product (1). Use data to support your answer.

**B** *I* U

Every year, Japanese citizens celebrate golden week, a week long holiday in which kiwifruit are often exchanged as gifts. New Zealand Kiwifruit exports are worth \$2.7 billion, and a significant percentage of these are exports to Japan and surrounding areas. There are certain requirements which kiwifruit must meet to be able to be exported, one of these being quality. High quality kiwifruit fetches high prices in global markets. Kiwifruit must be ovoid shape and large, and cannot have blemishes greater than 1 square cm in size. This is because during golden week, kiwifruit are often displayed in store windows and given as gifts. Consumers will not pay good prices for kiwifruit if they are defected or small and misshapen. 70% of the fruit must be over 16% dry matter, and have brix levels of 11-13%. Brix levels are an indication of the sweetness, and dry matter is the amount of solids in the fruit. These two together are the ultimate combination of what makes up the best flavour and sweetness profile.

(ii) Explain two management practices that are carried out to meet the market requirement of your chosen primary product (1).

You must clearly link the management practices to the market requirement and use data to support your answer.

Management practice (1):

**B** *I* U

Supavine is an establishment-phase management practice, where kiwifruit vines are trained up a tent shaped trellis to maximise available sunlight. The use of supavine and its effects on kiwifruit meet the market requirement of quality in several different ways. Because the vines are in a tent shape, instead of on the traditional horizontal pergola system, there is a bigger proportion of the canopy and vine available to sunlight. As there is more light energy hitting the plant, this increases photosynthesis. (Photosynthesis - light energy + water + CO<sub>2</sub> = glucose + oxygen). As photosynthesis increases, there are more sugars produced which go into the fruit and increase kiwifruit sweetness. Studies have shown that supavine increases brix levels by 6.2% - contributing to the requirement that is brix levels of 11-13%. It also improves dry matter by 19.8%, this contributes significantly to the requirement that 70% of fruit must be over 16% dry matter.

Vines being trained on a tent shaped trellis promotes bigger, stronger canes which support larger fruit. This helps meet the requirement that fruit are ovoid shape and large. Supavine increases average fruit weight from 90g to 110g.

Supavine also helps meet the requirement of quality, with one of the requirements within that, being no blemishes larger than 1cm square. As vines are trained along a large trellis, there is more room for the fruit, so there is less bumping and bruising from fruit being close together. As well as this, the additional space around the vine increases air circulation, which helps with respiration of the plant as well as decreasing the chance of fungi or disease. This ensures that all fruit are high quality, without getting diseased either on the plant or post harvest.

All of these features combined help to meet the market requirement of quality.

Management practice (2): Artificial pollination

**B** *I* U    

Artificial pollination is a management practice used in kiwifruit orchards in which pollen is gathered from male flowers and spread over female flowers. A quad duster is used to spread pollen over the orchard - distributing 1.28kg per hectare. Artificial pollination is used to achieve uniformity, consistency, and reliability of fruit set, in order to grow high quality kiwifruit. Artificial pollination makes for a 97% chance of fruit set, compared to 3.1% for insects. 6000 pollen grains per kiwifruit are needed to get 400-600 seeds. 100 seeds is top quality gold KF. 600-1000 seeds is top quality gold kiwifruit, which would normally require 6 visits per flower from bees. This is basically unachievable, with Science Learn stating that 'bees aren't doing as good of a job as they used to'. However, artificial pollination can achieve this, creating top quality kiwifruit, with the right amount of seeds to gain high prices on overseas markets, along with uniformity and consistency. When artificial pollination is used, fruit can all be pollinated at the same time, so they grow at a consistent rate. This means energy from photosynthesis and nutrients travelling through the plant are spread evenly within all the fruit, not just directed at, say, the first ones to be pollinated. This means that all the fruit will grow to a high quality, and there won't be deficiencies in some fruit and not in others. It also means that the fruit will all be ready to harvest at the same time, which means they can be exported at a similar time, so there aren't kiwifruit sitting and degrading waiting for the harvest of others; they will all arrive in Japan of a high quality.

Name a second primary product and specific market. Choose a **different** market requirement from the [list](#) above.

Primary product (2): Cherries

Specific market: Chinese New Year

Market requirement (2): Quantity

(b) (i) Explain a **different** market requirement for your named primary product (2). Use data to support your answer.

**B** *I* U    

Every year, Chinese citizens celebrate the Chinese New Year. Everything 'red' is used for decor, as well as consumption. This makes cherries the fruit of choice for this time of year. New Zealand is a large producer of cherries, and exports \$15 million worth of cherries to China each year. 79% of our cherry exports go to china, mostly during their 'new year' time. This means NZ cherry producers must be able to grow significant quantities of cherries, as they are used for everything from consumption to decor and gifts. Cherries must be at least 26mm in size, with a long pedicle stem.

- (ii) Explain two management practices that are carried out to meet the market requirement of your chosen primary product (2).

You must clearly link the management practices to the market requirement and use data to support your answer.

Management practice (1): UFO

**B** *I* U    

UFO is a training system used for cherries, where the cherry trees are trained along a trellis, creating a 'wall' of cherries. This wall can be grown to 2-3m in height. This system of growing cherries increases the proportion of sunlight available to fruit. As more sunlight hits the plant, photosynthesis increases. This increases glucose production (see photosynthesis formula earlier), which means there is more going into the fruit, making sweeter cherries. This also increases the size of cherries, which contributes to the quantity requirement of them being at least 26mm in size. The main effect on quantity that the UFO system has, is that yield is significantly increased. With UFO, there is 12t/ha, compared to 8t/ha conventionally. One of the reasons why this is is that with a wall of cherries, there is more room for more fruit, than if all the cherries were clustered like in a 'tree'. As well as this, air circulation around the plant is increased. This increases respiration, which increases fruit growth, because more sugars are being produced. Another reason why yield is significantly increased, is that harvest takes 'half the time of a conventional orchard', because all the fruit is so easy to reach. This means there is less chance of cherries becoming overripe on the trees, waiting to be picked, and then being rejected because they didn't meet requirements. The post harvest life of cherries is maximised, and as a result a greater quantity can be sent overseas.

Management practice (2): Frost protection

**B** *I* U    

Frost is a real threat to the growth of cherry trees. From first white to full bloom and after, it only takes temperatures of -3 to -4 to wipe out 90% of fruit. This can majorly damage the yield of a cherry crop for growers, and significantly reduce the amount available to send overseas. Especially since around 80% of cherries are grown in central otago, a frost is likely to hit all of that area, and render most of the season's cherries unmarketable. Because of this, it is imperative that frost protection as a management practice is effectively put in place. One of the ways growers protect against frost is sprinklers. Water is sprayed onto the cherries before/during a frost, and the water freezes around the outside of the fruit. As it freezes, it releases the warmer air onto the fruit, and creates a protective inversion layer just around the outside of the cherries, protecting them from frost damage. This way of frost protection, while it does use a lot of water, is significantly cheaper than using helicopters, and more effective than frost cloths. Sprinkler systems for frost protection are effective down to -5degC. By using these as frost protection, growers can ensure their crops aren't damaged by frost, and so they have large quantities of good sized cherries to send away to China.

Answer this part using either primary product (1) or primary product (2).

Primary product:

(c) Justify the management practice that is the most significant for maximising profit or maximising volumes for your chosen primary product. Use data to support your answer.

**B I U** [List icons] [Undo] [Redo]

Supavine:

I believe that supavine has the most significant impact on maximising profit, through volume and quality of fruit for the kiwifruit industry. With supavine, the kiwifruit vines are trained up a tent shaped trellis, instead of the traditional pergola system. This way of growing kiwifruit decreases the need for labour, from 12 people per hectare down to 4, because the fruit and vines are much easier to access for maintenance and harvest. This is a significant decrease in people that need to be paid, so costs would decrease for the producer. As a result of the cost decrease, profits would increase. In this way supavine is helping maximise profits.

By improving dry matter by 19,8%, and increasing brix levels to 6.2, supavine contributes to an average increase in weight of kiwifruit, from 90g to 110g. This makes for a significant increase in yield, and as a result profit.

This leads on to a significant impact supavine has on both volume and indirectly profit: the increase in fruit grown per hectare. Growers would conventionally get 6500 trays/ha, but get 9000 trays/ha with supavine. This is because the tent shaped trellis promotes bigger, stronger canes, which can support more fruit. As mentioned earlier, the average weight of kiwifruit increases from 90g to 110 with supavine. This may explain the increase in number of trays per hectare. While the number of kiwifruit may not increase, the tonnage of yield/number of trays increases because the fruit are larger (slightly less fruit in a tray). This is a significantly larger quantity of fruit per hectare, and as a result profits for the producer would increase, as he is exporting a larger quantity of fruit.

Another way that supavine has a big impact on volume and profit is the decrease in reject rates. There is a decrease in reject rates when using supavine, from 28.1% down to 12.5%, a decrease of 15.6%. This is because there is more room on the vine, so there is less bruising and bumping. As well as this, all the fruit receive adequate and equal amounts of sunlight, due to the shape of the trellis. This means there is less fruit with sugar/dry matter deficiencies or defects which can't be exported. This means there is a much greater quantity of fruit available to be exported to Japan for golden week, at a higher quality, with larger fruit, so producers will receive premium prices for their fruit. NZ kiwifruit exports get a price of \$6 on the global market, compared to \$3 domestically. So, the higher quantity of fruit they send over for golden week, the higher their profits will be, compared to just selling kiwifruit domestically.

## Excellence

**Subject:** Agricultural and Horticultural Science

**Standard:** 91531

**Total score:** 08

Q	Grade score	Marker commentary
One	E8	<p>This is a well-structured and referenced response. In parts (a) and (b) the candidate has referenced specific quality features of kiwifruit and cherries as primary products to explain the specific market requirements during Japanese Golden week and Chinese New Year respectively. In both parts, the candidate used relevant data to support their explanation of how the management practice affects the ability to meet the market requirement. The management practices selected were linked to the chosen primary product through scientific explanation of the practices.</p> <p>In Part (c), the candidate focused on maximising profit to provide a rationale for choosing supavine as the preferred management practice. They supplemented it with data to indicate what improvement there was in quality and reduction in reject rates.</p>