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91290



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Mana Tohu Mātauranga o Aotearoa  
New Zealand Qualifications Authority

## Level 2 Agricultural and Horticultural Science 2025

### 91290 Demonstrate understanding of techniques used to modify physical factors of the environment for NZ plant production

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of techniques used to modify physical factors of the environment for commercial plant production in New Zealand.	Demonstrate in-depth understanding of techniques used to modify physical factors of the environment for commercial plant production in New Zealand.	Demonstrate comprehensive understanding of techniques used to modify physical factors of the environment for commercial plant production in New Zealand.

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 the questions 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 2–8 in the correct order and that none of these pages is blank.

Do not write in the margins (//////). 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.**

Merit

TOTAL 15

# Page 1

## QUESTION ONE: Light

Identify a plant production type and management practice of modifying light.

Plant production type:

Light modification management practice:

(a) Describe how your chosen management practice modifies the physical factor of light, and explain how this affects plant growth.

B I U     

By pruning tomato plants, farmers are allowing for more light to access the plant. With light being necessary for photosynthesis, it is very crucial that plants receive enough light to produce quality crops. By influencing photosynthesis, the likelihood of producing more yield and products is increased. This increase in yield and quality of the crops results in more profit for the growers, as they are able to sell more products as a result of increased growth. Pruning is a very good option as it is very cheap and economical. It is very important that the plants are maintained and that pruning is done regularly in order for the growers to maximise growth and production year-round.

(b) Compare the use of your chosen management practice over not using it. Consider this in terms of improvement in both **quality** and **crop yield**.

B I U     

Light plays a huge role in the quality and amount of yield in a crop. Photosynthesis needs light in order to occur, which means that an increase in light will mean an increase in photosynthesis. This increase in photosynthesis allows for higher quality and more products to be made, resulting in more profit for the growers.

By choosing not to prune your plants, you run the risk of not getting enough light to them. With this decrease in light, the quality and amount of product are going to be much less than what they would be when optimal light is available. In seasons where light is lost earlier, i.e, (winter months), it is very important that crops receive as much light as they can before it is lost. If the plants aren't pruned, then the overall amount of light that reaches them during the day is going to be far less than what it would be if they were. With less light, the total amount of yield will decrease. The overall profit is going to be far less than what it would be when the crops are pruned.

Overall, by pruning your plants, you are able to maintain steady growth year-round, resulting in more yield and higher-quality crops. These will help the growers make more profit as a result. Compared to not pruning, although the growers save time not pruning their crops, they run the risk of undernourishing their plants of light, resulting in less yield and poorer quality products, making them less profitable.

## Page 2

### QUESTION TWO: Irrigation

Choose a method of irrigation.

Irrigation method:

(a) Explain how this method modifies physical factors of the environment and impacts pasture production.

B I U   ↶ ↷ ?

In order for pasture to grow, it needs access to water in the soil. Without water available in the soil, the plants will eventually die, resulting in poor pasture for cattle to eat. Centre Pivot irrigation is great for irrigating large areas in one sitting. It works by moving through paddocks while spraying water onto the land. By allowing the soil to have the correct amount of moisture for the plants to grow off it allows for optimal growing conditions, resulting in better quality pasture and higher yields. In summer seasons where the soil gets very dry, it's quite important that there is enough moisture in the ground to support the correct needs of the plants growing on it. By maintaining a moist area for pasture to grow all year round, you are able to maximise profit through increased yields. Even though this is a great way of irrigating paddocks, farmers need to be careful that they don't over-irrigate, which would result in waterlogging. If waterlogging occurs, they run the risk of root rot and insufficient nutrient intake, resulting in poorer pasture growth or death.

(b) Justify a farmer's decision to irrigate their farm using your chosen method, taking into account the **environmental** and **economic** impacts of this practice.

B I U   ↶ ↷ ?

Centre Pivot irrigation is great for covering large areas. It is very efficient and allows for even coverage across a whole paddock. Knowing the importance of maintaining moisture in the soil for optimal plant growth, this is a great way of ensuring that you are supplying the correct needs for the plants feeding off the soil.

Even though it's great at supplying needs, it can be quite expensive to set up and maintain. With high water needs and running costs, farmers need to know when to use it. In summer conditions where the ground is dry, there is a higher demand for water in the soil. Compared to the winter and spring seasons, where the moisture in the ground is already high enough for optimal growth, farmers need to know when to irrigate so that they don't run the risk of over-application and waterlogging. Waterlogging is very harmful to the pasture as it doesn't allow the vital nutrients for growth to reach the roots, which results in less growth and production. By losing nutrients through over-applied water, you are losing money as a result of wasted product. With this increase in wasted product, you are decreasing the overall efficiency and profit of your farming system.

Overall, if done right and managed well, Centre Pivot irrigation is great at maintaining moisture and growth on your farm. It supplies and promotes positive growth among your crops and pasture, and is very efficient when not overused. It is great at covering large areas and helps boost the growth of your desired choice.

## Page 3



### QUESTION THREE: Temperature

Identify a production type and a management practice that could be used to modify temperature in horticultural production.

Horticultural production type:

Temperature management practice:

(a) (i) Describe how the use of your chosen management practice modifies the temperature of the physical environment for your chosen horticultural production type.

B I U     

Plants need optimal temperatures in order to produce high-quality products. Without their optimal temperature, the enzymes denature and the plants die. This results in less yield, therefore meaning less profit for the growers. Temperatures can be managed in greenhouses by using heaters. By using heaters, you are able to change the temperature inside the greenhouse. Unlike ventilation, which can only make it cooler, with heaters, you are able to increase the temperature if it is too cold. With heaters often being accompanied by thermostats, growers are able to change the temperature to the needs of the plants. By ensuring that the plants are receiving their optimal temperature all year round, you are boosting your total yield and production rates. This increase results in higher profit for the growers, making them make more money.

(ii) Explain how modifying the temperature improves plant growth.

B I U     

Plants need optimal temperatures in order to grow sufficiently. By modifying the temperature to the desired needs of the plants, you are allowing for year-round growth. If the temperature is too cold or too hot, the enzymes in the plants denature, causing the plant to wilt and die. So by supplying the optimal temperature for growth all year round, you boost the total amount of yield and increase the quality of your crop. This ultimately results in more profit for the growers as they are able to almost double their total yield.

(b) Justify how the use of this management practice impacts the **timing** of harvest and the **economic** returns for the grower.

B I U     

Greenhouses are known for trapping heat. That means that in hot summer conditions, farmers aren't going to need to use heaters as much. By not using them when not needed, they are able to save money as a result. Unlike winter months, where it is a lot colder, farmers will need to use heaters more in order to ensure that they are supplying their plants with the optimal temperatures to grow sufficiently. By ensuring that year-round growth can occur, this means that the harvesting times will be the same all year round. By having a higher rate of growth, you are able to make more money due to more products being sold. By managing when to heat the greenhouses and when not to, you can become more efficient, saving more money as a result. With an increase in yield and profit and a more efficient system, profitability can be maximised, and the growers can make more money. This means that the economic returns will be increased if the management of maintaining heat in the greenhouse is done correctly throughout the year.

## Merit

**Subject:** Agricultural and Horticultural Science

**Standard:** 91290

**Total score:** 15

Q	Grade score	Marker commentary
One	M6	The candidate has described how removing leaves from tomato plants modifies the physical factor of light and linked this to the impact on photosynthesis and growth. For a higher grade, the candidate should have named an aspect of tomato quality or explained how more light increases plant yield.
Two	A4	The candidate's response includes a description of how centre-pivot irrigation is carried out and modifies physical factors. Some links to plant growth are included but lacks explanation and clear links to plant growing processes.
Three	M5	The candidate has explained how the use of heaters increases the temperature in greenhouses. For a higher mark they needed to name a specific crop and explain how it impacts plant growing processes.