**NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Year 12 Plant and Horticultural science

**91290**

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

PRACTICAL WORKBOOK

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**MONITORING THE CLIMATIC FACTORS OF A RANGE OF ENVIRONMENTS**

**Introduction:**

Different environments are characterised by ***physical factors*** such as ***prevailing wind*** and ***wind*** ***speed***, ***light intensity***, ***air*** and ***soil temperature***. These physical factors determine ***what plants*** can be grown in the environments and in what ***seasons***.

**Equipment:**

Anemometer

Digital thermometer

Lux meter

**Method**

Use your Anemometer, digital thermometer and Lux meter to collect field data on physical conditions of a range of microclimates in the morning and afternoon:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Environment*** | ***Light intensity*** | ***Air temperature*** | ***Soil temperature*** | ***Wind speed*** |
| ***Time of day*** | M | A | M | A | M | A | M | A |
| Gardens (open ground) |  |  |  |  |  |  |  |  |
| Classroom – growing area  |  |  |  |  |  |  |  |  |
| Shade house |  |  |  |  |  |  |  |  |
| Glasshouse |  |  |  |  |  |  |  |  |
| Propagator on a hot pad |  |  |  |  |  |  |  |  |

Describe the effect ONE of these modified environments (other than the glasshouse) had on the FOUR physical conditions when compared to open ground (use your measurements in your answer)

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Explain what effect this would have on plant growth in the chosen environment

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A grower decides to grow a crop of tomatoes in winter in a glasshouse. Justify their choice of environment.

In your justification you should:

* Describe the physical environments of the glasshouse and plastic house
* Explain why plant growth will be different in the two environments
* Analyse why the glasshouse is a good choice in winter for growing tomatoes. (you may find a double bubble helps you answer this)

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**COMPARING THE GROWTH OF PLANTS IN DIFFERENT ENVIRONMENTS**

**Introduction:**

A commercial grower needs to choose the environment which will provide optimum growth conditions for their plants. Plants need to grow quickly and have a high quality to meet market demand and provide good grower returns.

**Equipment:**

*Seeds:*

Dwarf beans

Lettuce

Punnets

Seed raising mix

Larger pots for growing on

**Method:**

1. Sow **four** punnets of dwarf beans and **four** punnets of lettuce seed
2. Place one punnet of each in the following environments:
* Shadehouse
* Glasshouse
* Propagator on a hot pad
* Outside in the school garden
1. Monitor, measure and record the following growth indicators
* **Time** taken for the first seedlings to **germinate**
* **Percentage germination** after 2 weeks
* **Height** at 3 weeks
* **Number of leaves** at 4 weeks
1. Record and average the following environmental factors for each environment over the investigation period:
* Light intensity
* Air temperature
* Soil temperature

**Results:**

**A. Plant growth**

|  |  |  |
| --- | --- | --- |
| **Growth** | **BEANS** | **LETTUCE** |
|  | **Garden** | **Shade-house** | **Glass house** | **Propagator – hot pad** | **Garden** | **Shade-house** | **Glass house** | **Propagator – hot pad** |
| **Time for germin-ation** |  |  |  |  |  |  |  |  |
| **% germ-****ination** |  |  |  |  |  |  |  |  |
| **Height after 3 weeks** |  |  |  |  |  |  |  |  |
| **Number of leaves at 4 weeks** |  |  |  |  |  |  |  |  |

**B. Physical Environmental factors**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Garden** | **Shade-house** | **Glass house** | **Propagator – hot pad** |
|  | **Light (lux)** | **Air****Temp****o C** | **Soil temp****o C** | **Light (lux)** | **Air****Temp****o C** | **Soil temp****o C** | **Light (lux)** | **Air****Temp****o C** | **Soil temp****o C** | **Light (lux)** | **Air****Temp****o C** | **Soil temp****o C** |
| **Week 1** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Week 2** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Week 3** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Week 4** |  |  |  |  |  |  |  |  |  |  |  |  |

**Interpretations:**

1. Describe and compare the trends shown in the growth of beans and lettuce in the four different environments.

**Beans:**

Garden/Plots \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Shade house \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Glasshouse \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Propagator/hotpad\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Lettuces:**

Garden/Plot \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Shade house \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Glasshouse \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Hot bed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. ***Explain*** the difference in plant growth in each of the environments, using the environmental data you collected to ***justify*** your explanation.

Garden \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Shade house \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Glasshouse \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Propagator /hot pad \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Choose ONE of the environments which you think would be the most ***economically*** viable for a commercial grower of beans ***and*** lettuce seedlings.

**Justify** your choice of this environment over the other environments.

Environment \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In your justification you should:

* Describe the optimum conditions for bean and lettuce growth
* Explain the environmental conditions provided by the chosen environment
* Analyse why the chosen environment would be the most economically suitable for raising bean and lettuce seedlings

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**COMPARING THE GROWTH OF PLANTS IN DIFFERENT LIGHT INTENSITIES**

**Introduction:**

Plants need light for photosynthesis and growth. They adapt their growth patterns to different light intensities available to maximise the use of the light available.

**Equipment:**

# Ruler

Range of one variety of plant some grown in full light and others in shade

**Method:**

***Measure:***

1. Ten internodes of the plants grown in the shade and repeat with plants grown in full light.
2. The length of ten leaves of the plants grown in the shade and repeat with plants grown in full light.

***Observe*** the colour of the leaves in each area and rate them on a scale of 1-5 (1=pale 5 =dark).

***Average*** the results for both sets of measurements.

**Results:**

|  |  |  |
| --- | --- | --- |
| **Measurement** | **Full sunlight** | **Shade** |
| Average internode length |  |  |
| Average leaf length |  |  |
| Colour |  |  |

**Interpretations:**

1. Describe the difference in:

Internode length \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Leaf length \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Leaf colour \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Explain how the differences show how the plants have adapted to the different light intensities of their environments.

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1. Select the best environment for growing seedlings before they are pricked out and justify your choice by explaining why this environment is more suitable than the other.

Selected environment \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In your justification you should:

* Describe the best seedling structure for pricking out
* Explain how light quality affects seedling growth
* Analyse why the environment you have chosen is more suitable for growing seedlings which need to be pricked out.

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**COMPARING LEAF TYPE AND FROST DAMAGE**

**Introduction:**

Different types of leaves are affected by frost. Hardy plants survive quite deep frost, while tender plants can be badly burnt and eventually killed.

**Equipment:**

Petri dishes

Tomato plant leaves

Camellia leaves

Any other leaves of a range of plant types

Masking tape.

**Method:**

1. Place the different leaves in the Petri dishes and seal.
2. Store the Petri dishes in the fridge for 2 – 3 days
3. Inspect the leaves for frost damage.

**Results:**

|  |  |  |
| --- | --- | --- |
| **Name of plant** | **Type of leaf** | **Description of damage** |
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**Interpretations:**

1. Describe the characteristics of leaves prone to frost damage

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1. Explain why these leaves should be damaged in this way and how it will affect crop growth in the winter.

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1. A commercial grower wished to grow these plants in winter.
* Select a suitable environment for these plants
* Explain why this environment is suitable
* Justify your selection over others which may be available.

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**COMPARING SOIL TEMPERATURES UNDER A RANGE OF MULCHES**

**Introduction:**

Mulches are materials which are used to cover the soil around plants. These may be natural or artificial.

**Equipment:**

Punnets

Potting mix

A range of mulch material

Digital thermometer

**Method:**

1. fill the punnets with potting mix
2. Cover each with a different mulch
3. Place all the punnets in the same environment e.g. shade or plastic house.
4. Monitor the temperatures of the potting mix for a week

**Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mulch** | **Day 1** | **Day 2** | **Day 3** | **Day 4** |
|  |  |  |  |  |
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**Interpretations:**

1. Describe the effect each mulch had on soil temperatures

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1. Explain the effect each mulch had on the soil temperatures and how this would effect plants grown in each type of soil covering.

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1. Select the mulch you think would be the most effective when growing early strawberries and justify your selection.

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| **Industry leaders call for support** |
| **By Roger Bourne**As orchards and vineyards across the country slowly recover from frost damage, industry leaders are calling for growing communities to support each other through what will be a difficult and stressful time for many members.Kiwifruit Growers chairman Grant Eynon wants people to be aware of the social impact destructive frosts can leave behind well after the temperature returns to normal.“It is far bigger than just a single grower or family, there is a whole community which is going to knocked around.“There are potentially millions of dollars that aren’t going to come into the local economy and it is really going to demand some understanding from infrastructure and support  | services that growers use, such as banks and accountants”.Mr Eynon says KGNZI will be examining ways to support growers and hopes the wider community will do the same. “This is a big issue; real economic hardship,” he says.Zespri chairman Doug Voss agrees growers need to help each other.“The psychological impact is very signigicant and we have to make sure we can give growers all the support we can. We need a pan-industry strategy to see how we can help people deal with this.”KGNZI and Zespri have formed a joint-industry working group to provide support and practical advice to growers.Mr Voss says it is important growers understand the orchard and financial management needed to cope with a frost, as  | well as the emotional impact it can have.“It is a matter of letting growers know that they are not alone,” he says.Waikato-based farm finance specialist Don Fraser agrees. He also wants growers to make a realistic assessment of their situation and not jump to “panic” decisions which could make the situation worse.“When a farmer gets into financial trouble, stress levels tend to go through the roof and he doesn’t think straight. that is what is going to happen to some growers. Logic will go out the window.“What has happened is terrible and the financial implications may be huge, but affected growers should stand back and take a reality check. What may seem the end of the world today will be survivable tomorrow,” he says |

Read the two articles from the same paper and justify the social and economic impact of frost on a community.

In your justification you should :

* Describe the effect of frost on kiwifruit production
* Explain how this affects the local economy
* Link this effect with the influence it has on the people in the local community and their response.

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