



Western Australian Certificate of Education ATAR course examination, 2016

Question/Answer booklet

PLANT PRODUCTION SYSTEMS

Please place your student identification label in this box

Student number: In figures

--	--	--	--	--	--	--	--

In words

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet
Multiple-choice answer sheet

Number of additional
answer booklets used
(if applicable):

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in this examination

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	20	20	30	20	20
Section Two Short answer	7	7	90	94	50
Section Three Extended answer	3	2	60	40	30
				Total	100

Instructions to candidates

- The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 12 Information Handbook 2016*. Sitting this examination implies that you agree to abide by these rules.

- Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write your answers in this Question/Answer booklet.

- You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
- Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

Section One: Multiple-choice**20% (20 Marks)**

This section has **20** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 30 minutes.

1. Training farm staff in the safe operation of machinery is considered
 - (a) good practice.
 - (b) a duty of care.
 - (c) an ethical requirement.
 - (d) quality assurance.

2. Carbohydrates produced during photosynthesis are utilised by plants for
 - (a) nutrient uptake.
 - (b) nodulation.
 - (c) transpiration.
 - (d) respiration.

3. Which one of the following is a by-product of photosynthesis in a plant production system?
 - (a) oxygen
 - (b) sugar
 - (c) water
 - (d) carbon dioxide

4. Which one of the following factors would increase the rate of photosynthesis in a plant?
 - (a) a high concentration of carbon dioxide
 - (b) high water loss in the plant
 - (c) very high temperatures
 - (d) high wind conditions

5. Keeping records of pesticides that have been sprayed on crops is a requirement of
 - (a) planning next year's crop rotation.
 - (b) financial management.
 - (c) quality assurance.
 - (d) intergenerational equity.

See next page

6. A number of management strategies are recommended for weed control because
- (a) a single control method will eradicate the weed.
 - (b) weeds exist as populations of species.
 - (c) this allows integration of strategic controls that are very effective.
 - (d) grazing management of weeds is not always practical.
7. Synthetic auxins are used in plant production to improve
- (a) selective weed control.
 - (b) water use efficiency.
 - (c) fruit colour.
 - (d) net photosynthesis.
8. A herbicide's 'mode of action' is determined **most** easily by knowing the
- (a) group name.
 - (b) active ingredient.
 - (c) crop to which it is applied.
 - (d) method of application.
9. A farmer finds weeds emerging following crop germination. Which type of herbicide should be used?
- (a) broad-spectrum herbicide
 - (b) grass weed herbicide
 - (c) broad-leaf herbicide
 - (d) selective herbicide
10. Fertiliser applications on a crop need to match soil types, rainfall and
- (a) weed populations/burden.
 - (b) expected yield.
 - (c) types of pesticide used.
 - (d) location of farm.
11. What does risk mitigation involve?
- (a) identifying potential risks
 - (b) finding solutions to reduce risk
 - (c) identifying consequences of risk
 - (d) assessing risk probability

Questions 12, 13 and 14 relate to the table below.

Water-holding capacity of soil (mm of water per metre of soil depth)

	Soil type X	Soil type Y	Soil type Z
Field capacity of the soil	140	350	400
Permanent wilting point	80	150	250

12. The amount of water available (mm of water per metre of soil depth) for the soil types is

- (a) X = -60, Y = -200, Z = -150
- (b) X = 60, Y = 200, Z = 150
- (c) X = -220, Y = -500, Z = -650
- (d) X = 220, Y = 500, Z = 650

13. Select the **best** explanation as to why there are differences in water availabilities in each of the soil types. Each soil has a different

- (a) fertility.
- (b) pH.
- (c) texture.
- (d) microbial population.

14. Predict the soil types used in the table.

- | | Soil type X | Soil type Y | Soil type Z |
|-----|-------------|-------------|-------------|
| (a) | sand | clay | loam |
| (b) | clay | loam | sand |
| (c) | sand | loam | clay |
| (d) | loam | clay | sand |

15. Which statement indicates how energy from sunlight can flow between natural and agricultural ecosystems and assist in farm production?

- (a) Energy from the sun can be absorbed and warms the soil, assisting micro-organism activity.
- (b) Energy from the sun is absorbed by annual grasses that die out quickly during dry seasons.
- (c) Energy from the sun can warm the water in lakes and rivers and assist in the growth of algae.
- (d) Energy from the sun is absorbed by pasture plants for photosynthesis and consumed by animals for feed.

16. Rehabilitating a waterlogged paddock with plants is an example of a
- (a) duty of care to reduce intergenerational equity.
 - (b) short-term approach to reducing waterlogging.
 - (c) long-term strategy toward sustainability by reducing waterlogging.
 - (d) legal requirement to reduce the impact of climate change.

Questions 17, 18 and 19 relate to the table below.

**Total soil nitrogen at the end of the growing season
(mg N/kg soil)**

Enterprise	Site 1	Site 2	Site 3	Site 4	Mean	Standard deviation
Lupin crop	25	28	30	27	27.5	1.80
Oat crop	10	11	9	12	10.5	1.12

17. What does the standard deviation indicate for the lupin and oat enterprises?
- (a) the lupin crop data are clustered closer around the mean, indicating less variation
 - (b) the oat crop data are clustered closer around the mean, indicating less variation
 - (c) the lupin crop data are clustered closer around the mean, indicating more variation
 - (d) the oat crop data are clustered closer around the mean, indicating more variation
18. How could plant producers use the above data to save on fertiliser expenditure?
- (a) sow a cereal crop followed by a lupin crop
 - (b) sow a lupin crop followed by a cereal crop
 - (c) sow a lupin crop followed by a lupin crop
 - (d) sow a cereal crop followed by a cereal crop
19. In which one of the following cropping situations would a farmer consider applying extra nitrogen fertiliser?
- (a) A lower than average rainfall has occurred during the growing season.
 - (b) The cropping paddock has a heavy soil type.
 - (c) Continuous cereal cropping has occurred on a paddock.
 - (d) A lupin crop has followed a cereal crop.
20. The purpose of randomisation in experimental design is to
- (a) control experimental variables.
 - (b) test the effects of different variables.
 - (c) act as a control.
 - (d) reduce experimental bias.

End of Section One

See next page

This page has been left blank intentionally

See next page

Section Two: Short answer

50% (94 Marks)

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

Suggested working time: 90 minutes.

Question 21

(18 marks)

Barley growers in Western Australia conducted an investigation into the effect of nitrogen application rates on grain yield.

The investigation was done as a field trial and used two different varieties of barley. The results are outlined in the table below.

Grain yield for two varieties of barley at different rates of nitrogen applied

Rate of nitrogen applied (kg/ha)	Barley	
	Variety X Grain yield (t/ha)	Variety Y Grain yield (t/ha)
0	2.5	2.5
10	3.5	3.5
30	5.0	4.5
40	5.5	4.0
50	5.0	3.5

- (a) Write an hypothesis for the investigation. (2 marks)

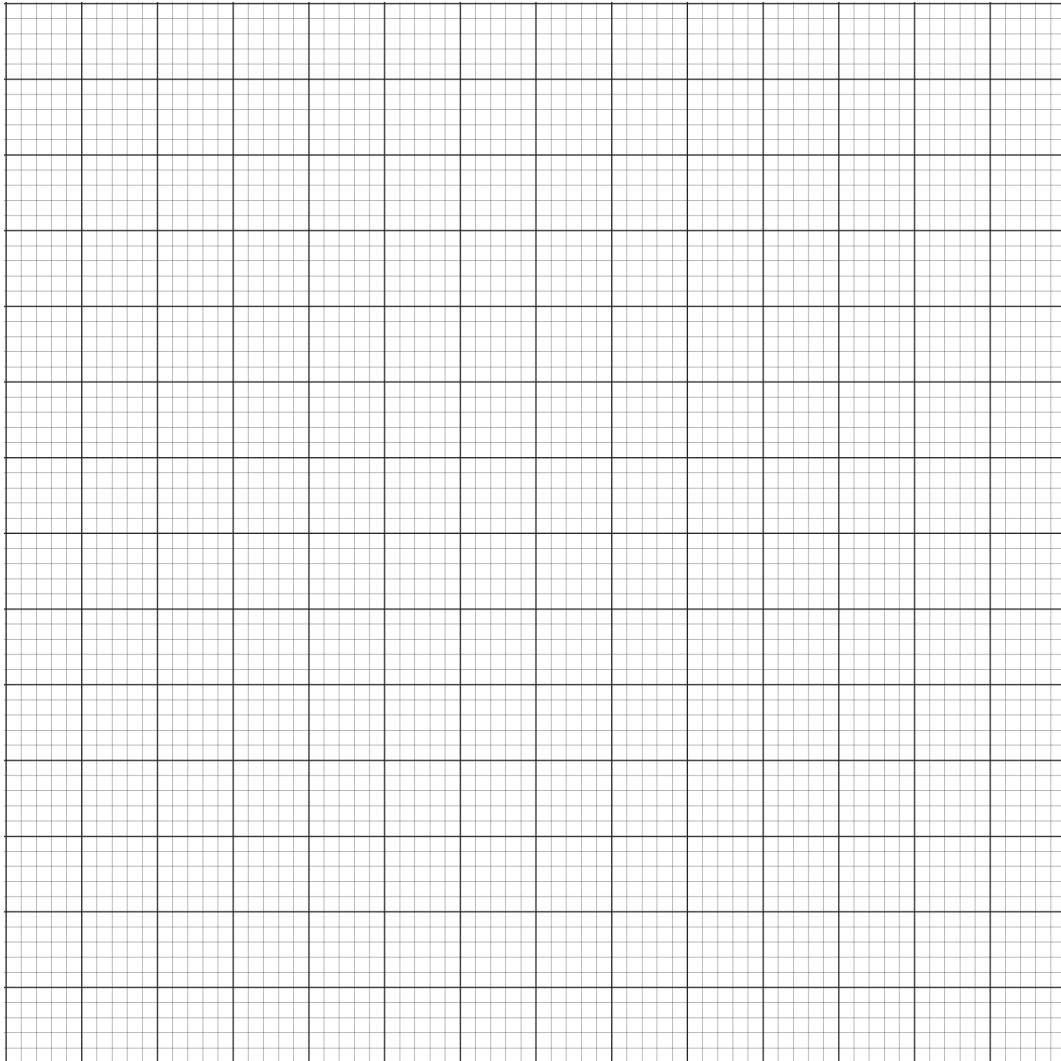
- (b) Name the independent variable and the dependent variable for the investigation. (2 marks)

Independent variable: _____

Dependent variable: _____

- (c) Graph the grain yield for the **two** varieties of barley at different rates of nitrogen applied. (5 marks)

A spare grid is provided at the end of the Question/Answer booklet. If you need to use it, cross out this attempt.



- (d) Outline the grain yield trend shown on the graph as the rate of nitrogen applied is increased. Also state which rate of nitrogen applied gives the highest yield for **each** variety. (3 marks)

Question 21 (continued)

- (e) Explain how the barley growers conducting this investigation could use randomisation, replication and controls to produce more reliable results. (6 marks)

Randomisation: _____

Replication: _____

Controls: _____

This page has been left blank intentionally

See next page

Question 22

(11 marks)

A producer has extra land to grow produce and needs to decide what crop would be most cost-effective. The table below shows a budget for **two** possible cropping enterprises.

	Crop	
	Wheat	Canola
Performance data		
Average yield (t/ha)	2.2	1.50
Average price (\$/tonne)	200	520
Income (\$/ha)	A	D
Variable costs (\$/ha)		
Seeding costs	46	34
Seed	24	44
Fertiliser	38	141
Herbicide	22	38
Harvest costs	37	54
Levies	4	10
Crop insurance	10	30
Windrowing	0	50
Insecticide	0	13
Total variable cost (\$/ha)	B	E
Gross margin (\$/ha)	C	F

(a) For **each** crop, calculate the income, total variable cost and gross margin. (6 marks)

Wheat:

Canola:

Income: **A** _____ Income: **D** _____

Total variable costs: **B** _____ Total variable costs: **E** _____

Gross margin: **C** _____ Gross margin: **F** _____

- (b) List **two** factors in the budget that account for the differences in gross margins between enterprises. (2 marks)

One: _____

Two: _____

- (c) By comparing wheat and canola yields, calculate what wheat yield the farmer would need to achieve to be comparable with the canola gross margin. Show **all** workings. (3 marks)

Question 23

(15 marks)

Most Australian plant products are sold overseas into a very competitive market. A comparative advantage is important to plant producers.

- (a) (i) Define the term 'comparative advantage'. (2 marks)

- (ii) Explain **one** example of how Australian producers have a comparative advantage compared to producers in other countries. (3 marks)

- (b) Using **one** example, describe how Australian quarantine laws help plant producers maintain their global competitiveness. (4 marks)

- (c) Countries that produce similar primary products to Australia often pay their farmers subsidies. Explain how the Australian Government can use tariffs to overcome the problems of competing with countries that pay their producers subsidies. (3 marks)

- (d) Identify a change in consumer trends relevant to a plant enterprise you have studied. Explain **one** way in which you could modify your production system in response to the change in the consumer trends. (3 marks)

Question 24

(13 marks)

There are many environmental issues that farmers must manage if they are to continue operating profitably.

- (a) Name an environmental issue that could affect a plant production enterprise and explain how each of the **three** parts of the triple bottom line could impact a farmer's ability to deal with it. (6 marks)

Environmental issue: _____ (0 marks)

Economic: _____

Social: _____

Environmental: _____

- (b) Using land clearing as an example, justify how you would balance short-term profitability with the long-term sustainability of a plant production enterprise. (3 marks)

- (c) Define the term 'intergenerational equity'. Explain how intergenerational equity is affected by environmental problems. (4 marks)

Question 25

(8 marks)

Plant hormones have a role in plant physiology.

(a) Give the role of each of the plant hormones listed below.

(4 marks)

Hormone	Role in plant physiology
Gibberellins	<hr/> <hr/>
Ethylene	<hr/> <hr/>
Cytokinins	<hr/> <hr/>
Auxins	<hr/> <hr/>

(b) Select **two** of the above plant hormones and describe how each can be used to manipulate plant production.

(4 marks)

One: _____

Two: _____

Question 26**(12 marks)**

Transpiration plays a vital role in maintaining a healthy plant.

- (a) Explain the process of transpiration. Include **two** of the plant structures involved.

(4 marks)

- (b) Explain **two** environmental conditions that can affect transpiration.

(4 marks)

One: _____

Two: _____

- (c) Explain how the absorption and translocation of nutrients in the plant occurs. (4 marks)

See next page

Question 27

(17 marks)

- (a) For a plant enterprise of your choice, outline how the following factors affect decision-making involved in fertiliser selection. (6 marks)

Plant enterprise: _____ (0 marks)

Soil type:

Crop type:

Stage of growth:

Cost of fertiliser:

Availability of fertiliser:

Application method:

- (b) For your chosen plant enterprise use the following table to outline a fertiliser program that you would recommended for **three** plant growth stages. Give a reason for each choice. (6 marks)

Plant growth stage	Fertiliser	Reason for fertiliser
Early growth stage	<hr/> <hr/>	<hr/> <hr/>
Mid growth stage	<hr/> <hr/>	<hr/> <hr/>
Final stage of growth	<hr/> <hr/>	<hr/> <hr/>

- (c) (i) List **two** strategies you could use to monitor your enterprise to ensure plants are receiving the correct amount of fertiliser. (2 marks)

One: _____

Two: _____

- (ii) Describe the impact of excess fertiliser on the environment and identify a strategy to lessen the impact. (3 marks)

Section Three: Extended answer

30% (40 Marks)

This section contains **three (3)** questions. You **must** answer **two (2)** questions: the compulsory question (Question 28) and **one (1)** of the other questions (Question 29 **or** Question 30). For Question 28 write your answer in the spaces provided. For Question 29 **or** Question 30 write your answers on the lined pages following Question 30.

Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

Suggested working time: 60 minutes.

Question 28

(20 marks)

This compulsory question must refer to **one** plant enterprise and marketable product you studied during the year.

Plant enterprise: _____ (0 marks)

(a) (i) Marketable product: _____ (1 mark)

(ii) Outline how the following factors affect quality and quantity of your selected marketable product. (8 marks)

Plant variety

- quality: _____

- quantity: _____

Weather conditions

- quality: _____

- quantity: _____

See next page

Nutrition

- quality: _____

- quantity: _____

Handling and transport

- quality: _____

- quantity: _____

- (b) (i) Name a quality assurance program relevant to your production enterprise. (1 mark)

- (ii) Outline how this program assists in meeting market expectation. (2 marks)

Question 28 (continued)

- (c) (i) Outline a new technology relevant to your enterprise to make your plant production system more efficient. (2 marks)

- (ii) Evaluate the risk of using this new technology to improve production by completing the risk assessment table below. (6 marks)

Describe a risk related to the introduction of this new technology.	Risk
If the farmer continues to use the new technology what could be the long-term effects?	Long-term effects
What strategy could the farmer use to decrease the risk effect?	Management strategy

This page has been left blank intentionally

See next page

Question 29**(20 marks)**

Conservation of biodiversity and natural ecosystems is considered important to the management of plant production systems.

- (a) Describe the structure of a natural ecosystem and use examples to explain why it is important for plant producers to protect natural ecosystems to maintain productivity. (11 marks)
- (b) Describe **three** impacts climate change has on the natural ecosystem and explain how plant producers could reduce each impact. (9 marks)

or

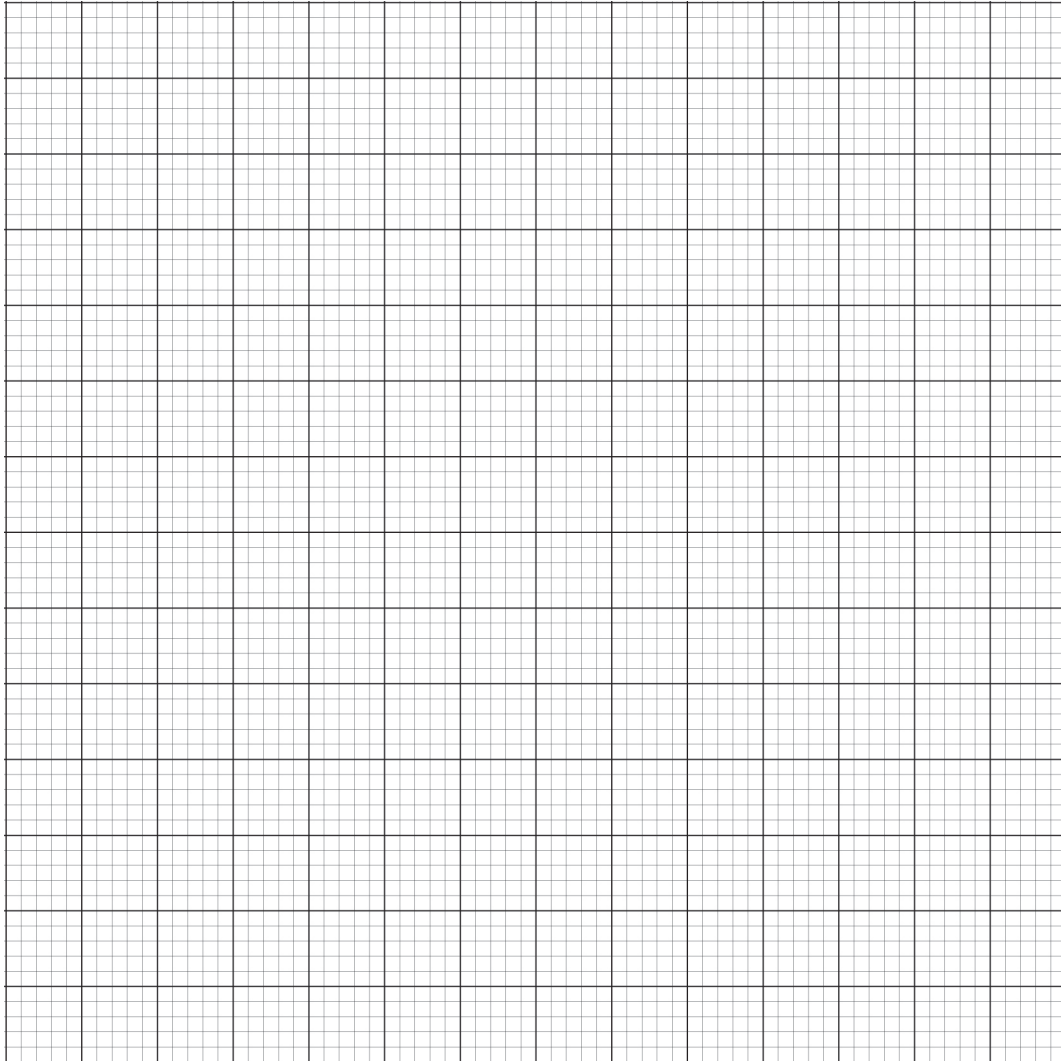
Question 30**(20 marks)**

Plant producers are looking at ways to enhance production, while consumers of plant products are becoming increasingly selective about their food purchases.

- (a) Explain how plants can be improved through the use of seed banks and genetically modified organisms (GMOs). Use examples for each in your answer. (12 marks)
- (b) Discuss why consumers have become more selective on the grounds of ethical concerns about GMOs used in plant breeding. Use examples in your answer. (8 marks)

End of questions

Question 21(c)



ACKNOWLEDGEMENTS

Question 21

Data source: Malik, R., & Paynter, B. (2015). *Nitrogen rates and timing for new malting barley varieties*. Retrieved June, 2016, from www.giwa.org.au/pdfs/CR_2015/Not%20presented/W23_MalikRaj_Nitrogen%20rates%20and%20timing%20for%20new%20malting%20barley%20varieties_Paper_CU15_final%20submitted_.pdf

This document – apart from any third party copyright material contained in it – may be freely copied, or communicated on an intranet, for non-commercial purposes in educational institutions, provided that it is not changed and that the School Curriculum and Standards Authority is acknowledged as the copyright owner, and that the Authority's moral rights are not infringed.

Copying or communication for any other purpose can be done only within the terms of the *Copyright Act 1968* or with prior written permission of the School Curriculum and Standards Authority. Copying or communication of any third party copyright material can be done only within the terms of the *Copyright Act 1968* or with permission of the copyright owners.

Any content in this document that has been derived from the Australian Curriculum may be used under the terms of the Creative Commons Attribution-NonCommercial 3.0 Australia licence.