NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2018

AGRICULTURAL SCIENCES

MARKING GUIDELINES

Time: 3 hours 300 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A

QUESTION 1

1.1

1.1.1	~~A~~	B	C	D
1.1.2	A	~~B~~	C	D
1.1.3	A	B	C	~~D~~
1.1.4	A	~~B~~	C	D
1.1.5	A	~~B~~	C	D
1.1.6	~~A~~	B	C	D
1.1.7	A	~~B~~	C	D
1.1.8	A	B	~~C~~	D
1.1.9	A	~~B~~	C	D
1.1.10	A	B	~~C~~	D

(10 × 2 = 20)

1.2

1.2.1	~~T~~	F
1.2.2	T	~~F~~
1.2.3	~~T~~	F
1.2.4	T	~~F~~
1.2.5	T	~~F~~
1.2.6	T	~~F~~

(6 × 2 = 12)

1.3

	A only	**B only**	**A and B**	**None**
1.3.1	A	B	~~C~~	D
1.3.2	A	~~B~~	C	D
1.3.3	A	B	C	~~D~~
1.3.4	~~A~~	B	C	D
1.3.5	~~A~~	B	C	D
1.3.6	A	~~B~~	C	D

(6 × 2 = 12)

1.4

1.4.1	Germination ✓✓
1.4.2	Quantitative trait ✓✓
1.4.3	Seed or fruit ✓✓
1.4.4	Clay ✓✓
1.4.5	Free market ✓✓
1.4.6	Asexual reproduction ✓✓

(6 × 2 = 12)

1.5

1.5.1	Incomplete dominance ✓✓
1.5.2	Demand ✓✓
1.5.3	Horizons ✓✓
1.5.4	Cuttings ✓✓
1.5.5	Uterus ✓✓
1.5.6	Style, Stigma ✓✓ (Gynoecium)/ Pistil

(6 × 2 = 12)

1.6

1.6.1	K	✓✓
1.6.2	F	✓✓
1.6.3	H	✓✓
1.6.4	B	✓✓
1.6.5	J	✓✓
1.6.6	E	✓✓

(6 × 2 = 12)

80 marks

SECTION B

QUESTION 2

2.1 **Determining soil types**
Digging soil profiles ✓ where ever the soil seems to change ✓
Soil sampling ✓ at regular intervals across the entire farm in a grid pattern ✓ (4)

2.2 **Impact of soil texture**

2.2.1 **Irrigation frequency**
Courser soils = less water holding capacity due to spaces between particles ✓ more frequent irrigation ✓ (2)

2.2.2 **Water holding capacity**
Finer soil = better water holding ✓ due to capillary action ✓ (2)

2.3 **Soil degradation**

2.3.1 **Physical degradation**
Run-off water/wind erosion ✓ – prevent too much surface water run-off / wind erosion ✓ Plant grass or mulch between the rows of peach trees ✓✓
Compaction – movement of heavy equipment over wet land (4)

2.3.2 **Chemical degradation**
Changing in the soil chemistry ✓– rather plant soil suited crops rather than try and change the soil ✓ – Ensure crop rotation to prevent leaching and check soil pH regularly ✓✓ (4)

2.3.3 **Biological degradation**
Depletion of nutrients ✓– prevent mono-cropping and fertilise the soil correctly ✓ – Rest lands between crops of trees or rotate land with other vegetable crops to prevent leaching of nutrients ✓✓ (4)

2.4 **Five negative impacts of soil degradation**
- Poorer soil fertility ✓
- Poor soil structure ✓
- Soil acidity ✓
- Lower water holding capacity ✓
- Loss of top soil ✓
- Decrease in soil biodiversity ✓

(any 5) (5)

2.5 2.5.1 **Grafted tree**
Tree made from a branch or eye of a desired variety ✓ placed or joined onto a hardier root stock of a similar variety ✓ (2)

2.5.2 **Why grafting**
- Ensures variety characteristics ✓
- Every plant will produce the same ✓
- Better growth through hardier root stock ✓ (3)

2.6 Advantages and disadvantages of sexual and asexual reproduction

2.6.1 Sexual reproduction

Advantages	*Disadvantages*
Genetic diversity ✓	No control over the productivity of offspring ✓
Less labour intensive ✓	Varied production ✓
Good for local bee population ✓	Potentially less hardy ✓
Makes cross pollination possible where it is required ✓	Susceptibility to disease ✓

(Any 2 of each) (4)

2.6.2 Asexual reproduction

Advantages	*Disadvantages*
Identical plants can be produced ✓	No control over the productivity of offspring ✓
Production characteristics are known ✓	Varied production ✓
Better growth through hardier root stock ✓	Potentially less hardy ✓

(Any 2 of each) (4)

2.7 Diversification

2.7.1 Diversification / Mixed farming✓ (1)

2.7.2 Risk ✓ (1)

2.7.3 Beef production ✓
- Animal not crop ✓✓
- Utilise the maize residues ✓ could graze between the trees ✓ (5)

2.8 2.8.1 Market being developed

Niche market ✓ (1)

2.8.2 Niche market risks

- Very small buyer pool ✓
- reliant on people having disposable income ✓
- Unreliable market ✓
- Peach trees are long-lived so won't be a regular purchase ✓
- Are the extra costs of production coverable if niche market crashes? ✓

(any 4) (4)

[50]

QUESTION 3

3.1 **Organ responsible for milk production**
Udder ✓ Mammary gland (1)

3.2 **Name and function of milk ejection hormones**
Oxytocin ✓ – contraction of cells to release milk ✓
Prolactin ✓– milk formation ✓
Insulin ✓– milk production ✓
Cortisol ✓ – milk production ✓
(any 2) (4)

3.3 3.3.1 **First milk**
Colostrum / Bies/ beesting ✓ (1)

3.3.2 **Unique property of colostrum**
Contains antibodies ✓/ Very nutritious/ high energy value (1)

3.3.3 **Importance of suckling with 24hrs**
Gut is porous to antibodies ✓antibodies not digested by rather enter the blood stream helping give the calf immunity to disease ✓ (2)

3.4 3.4.1 **Mastitis definition**
Infection of the mammary gland or udder ✓✓ (2)

3.4.2 **2 causes of mastitis**
- Bacteria ✓
- Dirt ✓
- Damage to the udder ✓

(any 2) (2)

3.4.3 **4 things to prevent mastitis**
- Milk cows with mastitis last ✓
- Keep udder clean ✓
- Dip the teats after milking ✓
- Do not over milk ✓
- Handle the udder carefully during milking ✓
- Rinse and disinfect the clusters between cows ✓

(any 4) (4)

3.5 3.5.1 **Grass reproduction**
- Seed ✓
- Rhizomes ✓ (2)

3.5.2 **Application of grass reproduction**

(a) Rhizomes ✓ – small area and requires land prep ✓ (2)

(b) Seeds ✓ – can be easily dispersed over the entire area ✓ (2)

3.6 **Sequence of AI**

D; ✓ F; ✓ A; ✓ H; ✓ B; ✓ E; ✓ C; ✓ G; ✓ (8)

3.7 **How genomics aids in bull selection**

- Only bulls that carry the correct ✓ genes are reared at the test station ✓ this then costs less for the test station ✓
- Specific traits either negative or positive can be selected ✓ for or against at a very young age ✓
- Reliability of the bull's proof is higher ✓
- Bulls then selected through the test are truly the best of the best ✓

(any 5) (5)

3.8 **Cloning in dairy cattle**

- All animals would be susceptible to the same diseases ✓
- Cells in the cloned animals would be as old as the high producing cow ✓
- Massive increase in inbreeding within the breed globally ✓
- Cloned animals exhibit old age characteristics (3)

3.9 **4 factors to be managed**

- dairy hygiene ✓
- labour ✓
- animals ✓
- water ✓
- equipment and or machinery ✓

(any 4) (4)

3.10 **3 strategies for more productive labour**

- pay the labour well ✓
- ensure a happy working environment ✓
- offer incentive bonuses ✓
- contribute towards medical aid and pension ✓
- set attainable or achievable daily tasks ✓

(any 3) (3)

3.11 **2 labour issues that could negatively impact the business**

Marketing strategy
Inputs / Labour
Financial viability / Funding
Selection of suitable breed / animals
Available Facilities

(4)

[50]

QUESTION 4

4.1 **Demand before Listeriosis**
Demand B ✓ – higher than A (after outbreak) ✓ (2)

4.2 4.2.1 **2 management strategies to deal with Listeriosis**
- Be proactive ✓
- Ensure herd / farm hygiene ✓
- Improve efficiencies where possible ✓
- Diversify ✓

(any 2) (2)

4.2.2 **Brief explanations of 4.2.1**
- Take positive steps before the crisis hits ✓
- Bacterial disease, therefore keep the farm biosecurity high to prevent the bacteria becoming a problem ✓
- Prices going to crash so focus on the highest possible production at the lowest possible cost ✓
- Too late to do after the fact, but best not have all your eggs in one basket ✓

(1 mark each for appropriate explanations of given points) (2)

4.3 **Calculate the missing values**
A = R652 800 + R26 000 ✓ = R678 800 ✓
B = R48 000 + R472 800 + R15 000 + R12 700 + R15 000 + R23 450 + R8 635 + R2 500 ✓ = R598 085 ✓
C = R678 800 – R598 085 = R80 715 ✓ (5)

4.4 **Average price per kg**
= R652 800 / (320 × 85 kg) ✓ = R24 ✓ / kg ✓ (3)

4.5 **Would there be profit at equilibrium B**
Equilibrium B = R21,50 / kg ✓
New income = (320 × 85 kg × R21,50 / kg) ✓ + R26 000 = R610 800 ✓
Profit/loss = R610 800 – R598 085 = R12 715 ✓
So yes a profit will still be made ✓ (5)

4.6 **Difference between stud and commercial**
Stud – pure bred ✓ offspring are registered ✓ and are sold to breed with ✓
Commercial – mixed breed ✓ all offspring sold for slaughter ✓
(any 4) (4)

4.7 4.7.1 **Definition of terminal sire**
Sire used to produce progeny that are all for slaughter ✓ and is usually a different breed to the dam line ✓ (2)

4.7.2 **Genetic principal being used in a terminal sire**
Hybrid vigour or heterosis ✓ (1)

4.8 4.8.1 **Selection index**
A selection is a calculation used to compare several animals ✓ over several traits with one figure ✓ (2)

4.8.2 **Calculate index**
A waiting is given to each trait that is to be selected for or against ✓ and this is then applied to several traits to calculate the index. ✓ Those traits to be selected against are given a negative weighting ✓ while the desired traits are given positive weightings ✓ (4)

4.8.3 **Reasons for indexes**
Compare several traits over several animals at once ✓and weightings can be customised to suit the individual farmer's needs ✓ (2)

4.9 **Reason for reading drug labels**
- Correct storage of the drug ✓
- Correct administration of the drug ✓
- Withdrawal period information ✓
- Precautions to be aware of ✓
- Side effects listed ✓
- Disposal of the drug once expired ✓

(any 4) (4)

4.10 4.10.1 **Withdrawal period**
Time after administration of the drug that the meat or milk is safe for human consumption ✓ (1)

4.10.2 **Importance of withdrawal period**
Drug remaining in the meat or milk can be harmful to the health of the person eating or drinking it ✓✓ (2)

4.11 **5 improvements to biosecurity**
- All visitors must shower before entering the farm ✓
- Farm must provide protective clothing ✓
- Fence the farm ✓
- Keep birds and rodents out of the houses ✓
- Vaccinate the animals against disease ✓
- Limit the number of visitors ✓
- Restrict vehicle access ✓
- Staff must not visit other farms or have the same production animals at home ✓

(any 5) (5)

4.12 **Internal and external parasites**

Internal parasites
- Tapeworms ✓
- Round worms ✓

(any 1)

Treatment
- Oral dosing ✓
- Injecting with anthelmintic ✓

(any 1)

External parasites
- Ticks ✓
- Mites
- Ringworm
- Lice ✓

(any 1)

Treatment
- Pour on dip ✓
- Injection with antiparasitic agent ✓

(any 1) (4)

[50]

QUESTION 5

Start this question on a NEW page.

5.1 **Locus**
Site on a chromosome ✓ where a single gene can be found ✓ (2)

5.2 **Qualitative or quantitative**
Quantitative ✓ it can be measured ✓ and the is variation from large to small ✓ (3)

5.3 **Punnet square**

	LS	Ls	lS	ls	✓
LS	LLSS	LLSs	LlSS	LlSs	✓✓
Ls	LLSs	LLss	LlSs	Llss	✓ 1 tick for format
lS	LlSS	LlSs	llSS	llSs	
ls	LlSs	Llss	llSs	llss	✓✓
	✓	✓✓	✓✓		

% Large = 1/16 ✓ × 100 ✓ = 6.25 % ✓ (16)

5.4 **Genetic interaction in flower colour**
Incomplete dominance ✓ heterozygous flower is midway between both homozygous parents ✓✓ (3)

5.5 **Phenotypic ratio**
1 red flowering plant : 2 pick flowering plants : 1 white flowering plant ✓✓ (2)

5.6 5.6.1 **3 methods of pollination**
- Insect ✓
- Wind ✓
- Self ✓ (3)

5.6.2 **Pollination methods to be avoided**
All of them ✓✓
The farm has no control over where the pollen came from in the wind or insect pollination ✓ and in self-pollination the flower is unable to pollinated by the farmer for selective breeding ✓ (4)

5.7 **Difficulty in breeding sizes of pink blooms**
Pink is heterozygous ✓ so most pink blooms produced in any cross is 50%. ✓ Only way is carefully cross the large white blooms with the large red blooms ✓ but only 50% will be pink ✓ (4)

5.8 **Difficulty in producing medium red blooms**
Easy ✓ Simply cross large red with small red ✓and all should then be medium ✓ (3)

5.9 **Lines to drop**

Small and medium red and pink. ✓ White are for weddings and funerals so there is always a market. ✓✓ The poorer market ✓ and lower prices ✓ for small and medium red and pink is another reason to stop them (5)

5.10 **5 qualities of an entrepreneur**

- Optimistic ✓
- Out of the box thinker ✓
- Passionate and motivated ✓
- Not afraid to take risks ✓
- Self-belief, hard worker ✓
- Adaptable and flexible ✓
- Strong financial management ✓
- Effective planner ✓

(any 5) (5)

[50]

200 marks

SECTION C

QUESTION 6

	0–1 mark	2 marks	3 marks	4 marks	Weighting
CONTENT and COMPLETION The candidate's ability to provide sufficient, appropriate and scientifically accurate facts that answer the question.	Response is incomplete. Many facts are not related to the question. Serious factual errors.	Significant important information is missing in one or more aspects required to answer the question. Many facts are not appropriate. Many scientific errors	A response that provides detail but some information is missing in one or more of the four aspects required to answer the question. Most facts are appropriate. Little or no scientific error	A thorough response that provides sufficient information across all four aspects required to answer the question. Facts are appropriate to the question. No scientific errors.	**4 × 2 = 8 marks**
	0–1 mark	**2 marks**	**3 marks**	**4 marks**	
WRITING SKILL The candidate's ability to select information and use it to synthesise a response.	Clearly missed the point of the question. Unfocussed response with no sign of linkage	Understands the question but thoughts are not organised coherently. Lots of irrelevant information and concepts poorly linked	Answers the question but there are some gaps in the logic or flow and some lack of relevance. Concepts not always well-linked.	Has a thorough control of the subject matter which is displayed in a cohesive written piece that answers the question. Sustained logical progression. Concepts well-linked.	**4 × 2 = 8 marks**
	1 mark	**2 marks**	**3 marks**	**4 marks**	
PRESENTATION The candidate's ability to set out the response properly and communicate ideas clearly.	Weakness in three or four of the four areas	Weakness in two of the four areas	Weakness in one of these four areas	The response is structured in terms of sentence construction, use of paragraphs, introduction and conclusion	**4 marks**

20 marks

Total: 300 marks

Conservation Agriculture (CA)

Conservation agriculture aims to conserve, improve and make efficient use of soil, water and biological resources.

The principals of conservation agriculture are:

- **Minimum soil disturbance**
  The soil is not ploughed and the seeds are planted directly into a mulch covered field using specialised no- till planters.
  This also has the implication of water conservation because tilling tends to dry out the soil. Furthermore, the mulch act as a barrier to reduce evaporation of moisture.
  Disturbing the soil as little as possible has the following additional benefits:
  It ensures minimum destruction of the soil structure,
  It does not expose soil to wind and water erosion
  It allows slower mineralisation of organic matter, hence organic matter build-up.
  It causes little disruption to the life of organisms that reside in the soil, which improve the soil structure
  It saves on time, energy and money as there is less ploughing and fertility amendments are placed only in the planting

- **Permanent organic soil cover**
  The soil needs to remain covered either with crop residues, other types of mulch or growing plants at all times. Generally in CA the crop residue is left on the field to cover the soil. Other types of mulch can also be placed between the rows and planting basins or planting holes. Mulch not only reduces soil erosion, it can reduce soil temperature by at least 4 °C, creating better conditions for soil organisms to thrive. When properly managed soil cover has the following benefits:
  It improves water infiltration resulting in a higher soil water content
  It helps in reducing direct raindrop impact and run-off in the field; thus reducing soil erosion
  It reduces evaporation and conserves soil moisture
  It keeps the soil temperature even and cool
  It helps to suppress weeds
  It provides for food and a conducive environment for soil organisms that are important for biological processes and soil fertility

- **Diversified cropping (including cover crops)**
  Mixed cropping involves planting various crops together in one plot. Plants can either be interplanted at the same time (inter-cropping) or crops can be rotated. This means that different crops are planted in the same place at different times. Using both inter-planting and crop rotation in your field is a good idea. In this system food crops are mixed with soil enriching crops that can fix nitrogen into the soil (legumes) and cycle plant nutrients , grow fast and provide a lot of above-ground (leaf) and below-ground (root) biomass and improve soil biology, soil fertility and soil structure both when they are growing and when they are decomposing in the soil.
  Other benefits if diversifies cropping includes:
  Soil fertility replenishment – N-fixing legumes add "top-dressing fertiliser" to the soil.
  Crops better use the nutrients in the soil. Different crops have different feeding zones and will therefore not compete for nutrients. The exploitation of different soil layers by different crops also helps prevent formation of a hard pan.
  It helps to control diseases and pests as the life cycles of these pests and diseases are broken by the introduction of a different crop.

The soil structure benefits when the soil is occupied by the roots of many different plants, because – – the roots move the soil; – the roots create a network of living matter which dies and rots to create humus; – when the roots die they leave tunnels which improve the porosity and drainage; – roots secrete weak acids to dissolve minerals in the soil then draw these back up in solutions; – roots also secrete a portion of their photosynthetic energy in the form of sugars that feed the microbes, which in turn provide soil mineral nutrients to the roots.

- **Integrated farming systems**
  The application of all these CA principles then makes it easy to follow other good agricultural practices, such as:
  Integrated soil fertility and acidity management: CA improves soil fertility and thereby reduces the amount of fertiliser required and saves time, money and energy. It is possible to have a sustainable biological system without the use of fertilisers.
  Integrated weed management: CA reduces the need for herbicides over time. It is possible to have complete weed control without using chemicals.
  Integrated pest and disease management: Management of pests and diseases includes crop diversification, timing of planting, promotion of natural balances between pests and predators in insects and naturally occurring microbes as well as physical control methods. This reduces the need for expensive pesticides and fungicides to a minimum.
  Integration of animals: Systems that include fodder production and management for livestock create an added benefit. This practice can include winter and summer forage crops, as well as longer term grass species. Besides improving the physical, chemical, biological and water holding properties of the soil, such species, including annual or perennial cover crops, can successfully be used as animal feed.

- **Precision farming**
  The use of precision farming leads to a reduced fertiliser usage, therefore having an advantages influence on soil health as well as the economics of such an enterprise. However, the use of a precision farming system, might have huge financial implications, especially with the initial financial set-up.

- **Economics**
  In a dryland system that Mrs Mahvethu intends the safest economic decision will be to apply the principals of conservation farming, rather than spend money on the set-up of an expensive precision farming system.

  All the above are interconnected and the learner should make the connection regarding the DRY-LAND situation and the feasibility of the chosen system.