NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2021

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.

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

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~~

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

1.4	1.4.1	Parturition
	1.4.2	Heterozygote
	1.4.3	Production
	1.4.4	Horizons
	1.4.5	Budding/grafting
	1.4.6	Cross breeding

1.5	1.5.1	Vegetative/asexual
	1.5.2	Antibiotics
	1.5.3	Inbreeding
	1.5.4	Mechanical
	1.5.5	Third
	1.5.6	Optimistic

1.6	1.6.1	H
	1.6.2	L
	1.6.3	E
	1.6.4	B
	1.6.5	F
	1.6.6	G

SECTION B

QUESTION 2 PIG PRODUCTION QUESTION

2.1 **Number of pigs sold**

= pig sales/(carcass mass × price/kg)
= R 2 500 000/(75 kg × R26,00/kg) or 2 500 000/1 950
= 1 282 pigs

2.2 **Other income options**

- Sell manure as fertiliser for more income.
- Grow vegetables fertilised with pig manure.
- Install bulk feed silos to get cheaper feed.
- Increase the automation on the farm to decrease the labour costs.
- Possibly produce maize to offset the feed price at the mill.

(Any 3)

2.3 **Symptoms of ill health**

- Raised temperature
- Listlessness
- Loss of appetite
- Swelling
- Redness
- Sores or lesions

(Any 4)

2.4 **Vaccination**

Yes. Vaccination develops the immune system of the pig and the immune system helps to fight and prevent disease.

2.5 **Tapeworms**

- Decrease feed efficiency in pigs.
- Can cause blockages in the digestive tract.
- Major cause of piglet mortality if not controlled.
- Can be passed on to humans.
- Causes measles in the carcass.

(Any 3)

2.6 **Advantages of AI**

- Cheaper than boars.
- Quicker genetic progress.
- Easier management.
- Decrease in production costs by not having to look after boars.

2.7 **Timing of AI**

- Sperm needs to meet the receptive egg.
- Too late and sperm will die before meeting the egg or egg will have missed the sperm by the time it reaches the point where fertilisation takes place.
- Too early and the sperm will swim past the egg./Ovulation has not taken place.
- Because of size of litter and number of eggs slight miss will result in smaller litters.

(Any 6)

2.8 **Topsoil horizon**

- Usually high in organic matter.
- High biological activity.
- Referred to as biomantle or a horizon.
- Usually darker in colour than deeper soils.

(Any 4)

2.9 **Controlling environmental impact**

- Controlling the slurry on the farm – preventing it from running into natural water ways.
- Disposing of dead pigs safely – preventing smells and scavenging animals.
- Controlling flies and rats – preventing the spread of disease and irritation.
- Controlling water runoff from the roofs – could cause soil erosion.

(Any 2)

2.10 **Methods of soil conservation**

- Reduce tillage – maintain soil structure.
- Plant a cover crop – prevent losses of topsoil.
- Crop rotation – prevent removal of the same nutrients.

(Any 2)

2.11 2.11.1 **Water-holding capacity**

The finer the soil, the more water it will hold due to larger surface and smaller particles.

2.11.2 **Crop selection**

Crops requiring more water to grow would need finer soils that hold more water. If the soil is too course and doesn't hold the water the irrigation frequency would be too high.
(Any 2)

2.12 2.12.1 **Business principle**

Diversification

2.12.2 **Benefits of diversification**

- Spreading of risk.
- Utilisation of waste products that would otherwise be a problem.
- Decreasing the feed costs of the herd by providing the maize for the feed mill from the farm's own harvest.
- Ensuring the quality of the maize going into the feed.
- Possible extra income should the maize harvest be more than is required on the farm.

(Any 3)

QUESTION 3 BRANGUS QUESTION

3.1 **Bull jumping the fence**
No. Black is dominant over red so both cow and bull, although black in colour, were carrying the red gene.

3.2 **Test cross**
Test cross, because the bull can only contribute the red genes, it will test if the black animal is carrying the red gene since you need 2 red genes for a red coat.

3.3 **Number of expected red calves**
Number of carriers = 250 × 30% = 75 carriers

	B	b
b	Bb	b
b	Bb	b

X

So, 50% would be red and 50% would be black.

Therefore: 75 × 50% = 37,5 or 38 calves would be red.

3.4 3.4.1 **Synchronisation**
Insert progesterone sponge into cow's vagina.
Pull sponge 3 days before desired AI.
Inject with massive dose of oestrogen.
Inseminate at first sign of heat, usually after 3 days.

3.4.2 **How synchronisation works**
Arrests and takes control of the reproductive cycle of the animal using hormones injected or added to the body of the female. Usually begins with larger amounts of progesterone to arrest the cycle until corpus luteum degenerates followed later by large amounts of oestrogen to kickstart the process again.
(Any 4)

3.5 **Advantages and disadvantages of synchronisation**
Advantages:
- Shorter breeding season.
- Calf management easier.
- Better selection on heifers.
- Faster improvement in genetics through AI.

Disadvantages:
- Management intensive.
- Very little margin for error.
- Calf management more intensive.

(Any 2 of each)

3.6 3.6.1 **Selection pressure**
How strictly a farmer culls or selects his or her replacement stock.

3.6.2 **Reasons for higher selection pressure**
Faster genetic progress or improvement only keeping the very best of the best. This should lead to better animals being produced each season. The higher the selection pressure, the smaller the number of replacements the farmer will keep.

3.7 **Factors influencing bull fertility**
- Age
- Illness
- Stress
- Heat/temperature of environment
- Heat/temperature of testes
- Damage or injury to testes
- Hormonal imbalance

(Any 4)

3.8 **Age of first fertility test**
18 months to 2 years

3.9 3.9.1 **How to change species composition**
Oversow with seeds of the desired species after either grazing or mowing the pasture short. This could either be through seed drill or broadcasting.
(Any 2)

3.9.2 **Constant weeding**
Caused through seed dormancy. Weed seeds lie dormant and sprout long after parent plants are removed. Seeds referred to as a seed bank. Problem will only end after all seeds in the seed bank have sprouted. To prevent the problem getting worse, the weeds must be removed before they set seed.

3.10 3.10.1 **Genomics**
Determining which genes the animal has through DNA testing done as early as birth.

3.10.2 **Five benefits of genomics**
- Higher success rate with selection.
- Selection done very early so money not wasted raising inferior animals.
- Extremely accurate for selection.
- Uses the latest technology.
- Bad or detrimental recessive genes can be selected against.
- Keeps up with global trends.
- Totally removed the environmental effects that influence the phenotype.

(Any 5)

QUESTION 4 PEA/KOO QUESTION

4.1 **Genetic principle**
Hybrid vigour

4.2 **Maintaining hybrid vigour**
Keep parent lines pure maximum hybrid vigour occurs when you breed individuals as genetically different as possible. The farmer could also use asexual reproduction to produce more of the same type of plant.

4.3 **Genetic interaction in flower colour**
Incomplete or no dominance – offspring is a mixture of the 2 parents that is midway between the 2 parents.

4.4 **Methods of pollination**
- Wind
- Insects

4.5 **Labelled longitudinal section of a flower**
Picture should contain the following labels:
- Filament
- Anther
- Petal
- Stigma
- Style
- Ovary
- Sepal

4.6 **Punnet square**

	R	r
R	RR	Rr
r	Rr	rr

1 RR : 2 Rr : 1 rr
1 Red : 2 Pink : 1 White

4.7 **Colour variation**
Genetic explanation. More than one allele coding for the trait. Not seen in the F1 because it was a full heterozygote.

4.8 4.8.1 **Blanket fertilising**
Precision farming – do a soil survey to determine the exact needs of the soil at specific points.

4.8.2 **Soil survey**
Drawing should show a grid-like pattern where the samples are taken at regular intervals. Drawing should also show that each sample is numbered, each field is numbered and a GPS position of each sample is taken.

4.9 **Responsible farming**
Farming that is sustainable, profitable, ethical and not harmful to the environment.

4.10 4.10.1 **4 marketing principles**
- Transport
- Packaging
- Storage
- Processing

4.10.2 **Marketing concept**
Value adding

4.10.3 **Free market system**
Free market system
- Farmer can sell to anyone, anywhere.
- Price can change to suit the needs of the farmer – not controlled by a national body.

4.10.4 **Entrepreneur**
Yes
Reasons:
- Willing to take risks
- Hard working
- Has self-belief
- Adaptable and flexible
- Has good product and market knowledge
- Effective planning

(Any 2 reasons)

QUESTION 5

5.1 5.1.1 **Soil survey**
Take soil samples throughout the farm.
Dig soil pits wherever noticeable variation in the soil occurs.

5.1.2 **Labour required**
Unskilled/casual to pick up potatoes
Skilled – to grade the potatoes
Drivers – to drive the tractors

5.1.3 **More productive labour**
- Set achievable tasks.
- Production bonuses paid.
- Give product to staff if targets reached.
- Work staff in shifts.
- Take care of staff health.

(Any 3)

5.1.4 **Labour issues**

Ill health – if a person with a skillset is not at work then production will drop.
Unhappiness over mistreatment – staff will not work to their full potential and not keep production up.
Theft – if staff feel they are being underpaid then they may be tempted to steel to make up for low salary.
(Any 2 properly explained)

5.2 5.2.1 **Implication of driver policy**

Vehicle running costs could increase – if the driver is away and the vehicle stands, the vehicle costs the farmer money.

5.2.2 **Agricultural pollution**

- Plastic sacks blown in the wind.
- Oil or diesel from the tractor.
- Emissions from the tractor.

5.2.3 **Forces acting on potato business**

External forces:

- Market
- Weather
- Political environment
- Environment

(Any 2)

Internal forces:

- Labour
- Management
- Machinery

(Any 2)

5.3 5.3.1 **Cultivation of potatoes**

Vegetative/asexual propagation – Tubers/portions of tubers are planted.

5.3.2 **Bulb, tuber and root**

Root vegetable is the entire root of the plant, e.g. carrot, turnip and beetroot.
Tuber is a swelling or thickening of a section of the root, e.g. potato.
Bulb is the base of the stem of the plant, e.g. onion.

5.3.3 **GMO benefits**

- Higher yields
- Heavier or larger potatoes
- Disease resistant
- Pest resistant
- Drought tolerant

(Any 4)

5.3.4 **GMO legislation**

GMO legislation ensures that the GMO is produced in such a way as to prevent the modification becoming infective. If the crop is not grown according to legislation, then pests could adapt to the change and diseases could become resistant to change and hence become an even bigger problem than they already are. Legislation also protects the rights to the genetic material to ensure that the company that produced the GMO seed can keep the rights to the seed and maintain their competitive edge.

5.4 5.4.1 **Genetic hybrid**

Makes use of hybrid vigour through crossing two unrelated strains. Helps the farmer produce better through the extra vigour.

5.4.2 **Asexual and sexual reproduction in potatoes**

Plant breeders need the plant to set seed to select for specific traits from two different lines or cultivars. Farmer then uses asexual reproduction when planting tubers or seed potatoes to develop into plants that produce the potatoes. ✓

SECTION C

QUESTION 6

	1–0 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.	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**
	1–0 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 well structured in terms of sentence construction, use of paragraphs, introduction and conclusion.	**4 marks**

Total: 300 marks