NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2019

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

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	Income statement
1.4.2	Quarantine
1.4.3	Gene mutation
1.4.4	Epididymis
1.4.5	Occupational Health and Safety Act
1.4.6	Biotechnology/Genetic Engineering

1.5

1.5.1	Surplus
1.5.2	Assets
1.5.3	Ablactation
1.5.4	Pollination
1.5.5	Fixed
1.5.6	Upgrading

1.6

1.6.1	L
1.6.2	K
1.6.3	B
1.6.4	E
1.6.5	I
1.6.6	J

SECTION B

QUESTION 2

2.1 Soil erosion and land degradation: the global risks

2.1.1 Aims of soil surveys

- To determine suitability of soil for agricultural purpose.
- Data obtained on soil, climate and topography is used to determine the type of crop or animal to farm with.
- Soil mapping is used to get reliable data on soils.
- Optimal utilisation of land available.

(Any 2)

2.1.2 Explanation of the soil survey process in agriculture with steps that need to be followed during soil surveying

- Aerial photographs of the region are taken and studied (gives preliminary layout, topography, drainage and soil differences).
- Visit of the area for further details such as arable land, boundaries, fences, roads and buildings (so that these can be indicated on the aerial map).
- Development of the preliminary mapping of the land and veld types within the region (land divided into homogenous land and veld types).
- Soil profiles are used for soil classification (soil profiles are studied to distinguish the horizons and identify soil form).
- Morphological properties of each soil horizon are indicated on a soil chart (properties such as soil depth, colour, mottling, structure and consistency).
- Interpretation of all the collected data, so that each hectare of soil is utilised according to its potential.

(Any 3 × 2)

2.2 Soil classification using soil profiles

2.2.1 Identification of soil horizons from the soil profile

- **1:** O
- **2:** A
- **3:** B
- **4:** C

2.2.2 Characteristics of each soil horizon identified in Question 2.2.1

- **1**: Loose and partly decayed organic matter
- **2**: Mineral matter mixed with some humus
- **3**: Accumulation of clay transported from horizons above
- **4**: Partially altered unconsolidated parent material

2.3 **The diagrams below represent sexual reproduction**

2.3.1 **Identification of the process illustrated in Diagrams 1 and 3**
Pollination

2.3.2 **Naming the different types of processes illustrated by Diagrams 1 and 3**
(a) **DIAGRAM 1**: Self-pollination
(b) **DIAGRAM 3**: Cross pollination

2.3.3 **Letter and name of the part of flower in Diagram 2**
(a) E: Pistil
(b) B: Ovary
(c) D: Stigma
(d) G: Stamen
(e) C: Style

2.3.4 **THREE agents of the process identified in Question 2.3.1**
- Wind
- Water
- Insects
- Animals

(Any 3)

2.4 **The table showing production factors, characteristics, examples and rewards**

2.4.1 **Identification of the production factors A, B and C**
- **A:** Labour
- **B:** Land
- **C:** Capital

2.4.2 **The production factor rewards labelled D and C**
- **D:** Wages/Salaries
- **E:** Profit

2.4.3 **Indication of the functions of land in economic terms**
- Land is an asset that can be used as a collateral when applying for a loan
- Provides space for agricultural activities
- Provides space for human settlement
- Provides food for people and animals
- It is a source of minerals

(Any 1)

2.4.4 **Differentiation between an enterprise budget and a whole-farm budget**
Enterprise budget:
This is a budget for one particular enterprise on the farm

Whole-farm budget
This is a budget that combines all the farm enterprises to show the net returns to the business

QUESTION 3

3.1 **Case study**

3.1.1 **SWOT analysis**

(a) **Identification of FOUR components of the SWOT analysis**

- Strengths
- Weaknesses
- Opportunities
- Threats

(b) **Examples of SWOT analysis component from the case study**

Strengths:

- Owns 2017 Farmer's Weekly/ARC national best elite Sussex cow
- Qualified chartered accountant
- The farm owner is a Sussex stud breeder
- Long-held deep love for beef farming
- Being able to make decisions – Linden took a bold business decision not to leave the country
- Risk-taking – A lot of money invested/Left the job of being a chartered accountant
- Commitment – Linden persevered during bad times of theft and stock loss
- Problem-solving – Employed a security company to control stock theft
- Passion – Love of farming is driving him to do more on the farm
- Determination – To continue improving his stud
- Use of AI to ensure genetic progression
- Use of high-quality semen for artificially inseminating his cows

(Any 2)

Weaknesses:

- Kraaling of animals resulted in great additional costs
- Veld infested with micro-organisms causing heartwater, redwater and gall sickness
- Artificial Insemination is very expensive

(Any 2)

Opportunities:

- Being a stud breeder means he can further expand the business by breeding for other farmers
- Being a chartered accountant gives him an opportunity to expand the business by assisting other businesses with his expertise in exchange of money

(Any 2)

Threats:

- Stock theft
- Loses a lot of money investing in the security of his farm
- In the long run there may be a challenge of resistance to drugs used to vaccinate and control diseases

(Any 2)

3.1.2 **THREE identification methods that can be used in beef breeds**

- Hot iron marking
- Branding
- Ear tags
- Implants

(Any 3)

3.1.3 **Diseases:**

(a) **Main micro-organism causing heartwater, redwater and gall sickness**
Protozoan

(b) **The other name for gall sickness**
Anaplasmosis

3.1.4 **Table**

Disease	Mode of transmission	Symptoms
Gallsickness	Insect vectors or ticks and biting flies	• High fever • Lack of appetite leading to weight loss • Weakness and depression • Constipation • Dehydration (Any 1)
Redwater	Blue ticks or Boophilus microplus/ Boophilus decoloratus	• Dark red or brown urine • Acute abdominal pain • High temperature/ fever/pulse rate • Abortion • Anaemia • Jaundice • Muscle cramps (Any 1)
Heartwater	Bont ticks	• Nervousness • Breathing difficulty • Uncoordinated movements • Frothy drivel from the mouth • Watery diarrhoea (Any 1)

3.1.5 (a) **Tabulation of TWO advantages and disadvantages of AI**

TWO advantages of AI	TWO disadvantages of AI
• Disease control by preventing skin contact in natural service. • Decreases chances of injury. • Semen can be collected from bulls with problems. • Semen is evaluated each time it is collected. • Prevents bull overuse. • Allows more cows to be bred. • Permits breeding of cows with problems. • Permits use of older valuable bulls. • Allows cows to be bred at the best time for conception. • Quick and economical. (Any 2)	• Specialised equipment is needed. • Technical expertise is needed. • Incorrectly practiced AI can cause problems. • As is evident in this article, the advantages to artificial insemination far outweigh the associated risks. (Any 2)

(b) **TWO basic requirements for semen storage**

- After collection semen is placed in a water bath at 32–35 °C
- Antibiotics are added together with the dilutant for freezing
- For short period semen can be stored at 5 °C
- For longer time semen is placed in straws and frozen with liquid nitrogen at –196 °C

(Any 2)

(c) **TWO characteristics of good-quality semen**

- Must be viable and healthy/must be alive and motile
- Thick whitish to yellow fluid
- Good morphology structure
- The ejaculate must be concentrated with viable sperm cells
- Semen should have no bad odour, except for its characteristic smell
- pH of between 6,4 to 6,9
- Must show lots of waves/motility

(Any 2)

3.2 **Asexual methods of reproduction**

3.2.1 Bulbs: 5

3.2.2 Runners: 3

3.2.3 Rhizomes: 1

3.2.4 Sucker: 6

3.3 Grafting and budding

3.3.1 Identification of the parts

M: Stock
N: Scion

3.3.2 Definitions

(a) **Grafting**: involves transferring a part of one plant to another plant of the same species with barks attached
(b) **Budding** involves transferring a bud from a budding stem

3.3.3 Grafting techniques that can be applied by the horticulturist

(a) **ONE technique**

- Tongue graft
- Machine graft
- Split graft

(Any 1)

(b) **Description for the technique in Question 3.3.3 (a)**

- Tongue graft: Just before grafting small single bud slips are cut 10–50 mm above bud
- Machine graft: Aim is for stock and scion to make contact
- Split graft: The rootstock is cut 50 mm above a bud and a split is made in the middle of rootstock

(Any 1)

3.3.4 The person who is highly trained to use the technique

Horticulturist

3.3.5 TWO advantages and disadvantages of using asexual reproduction methods to propagate plants

Advantages	Disadvantages
It allows for rapid populating	It hinders diversity
It does not require mobility, it is done in a single area	It poses some inheritance issues because genetic defects and mutations are transferred to the offspring
It does not require mates	It can lead organisms to being prone to extinction
It is friendly to the environment	Less variation can cause organisms to not be able to adapt
Reproducing identical plants	Little or no control over productivity of offspring
Desirable traits are known	Increased likelihood for mutations since all offspring are clones
Hardier root stock results in better growth	

(Any 2 × 2)

QUESTION 4

4.1 Case study

4.1.1 Explanation of the process of plant tissue culture

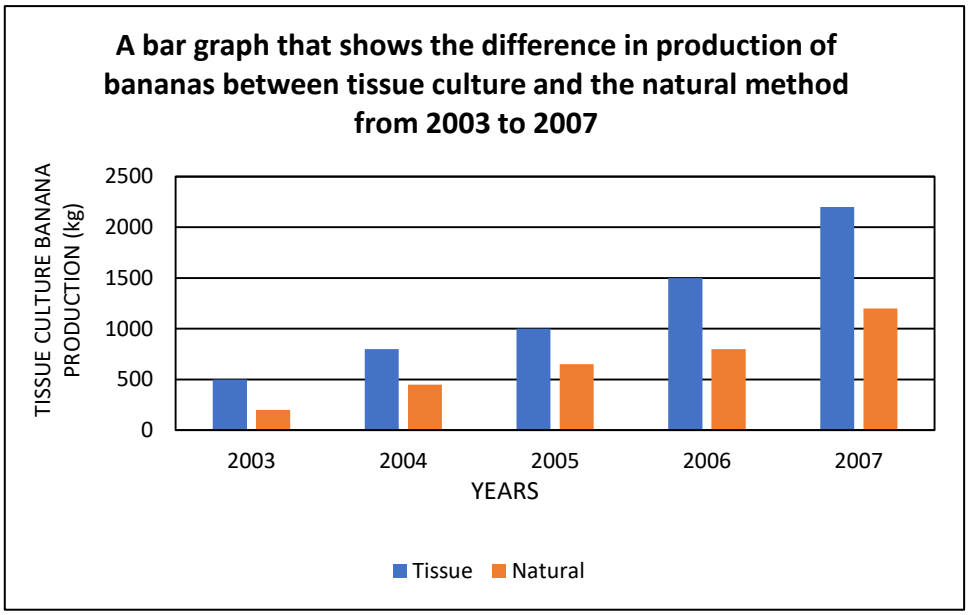
Plant tissue culture is a technique with which plant cells, tissues or organs are grown on artificial nutrient medium, either static or liquid, under aseptic and controlled conditions.

4.1.2 Importance of plant tissue culture applications for genetic engineering in crop production

- Produce exact copies of plants required that have desirable traits.
- Produce mature plants quickly.
- Multiple plants are produced in the absence of seeds or necessary pollinators to produce seeds.
- Whole plants are produced, regenerated from plant cells that are genetically modified.
- Many plants that are clones of each other can be produced.
- Disease resistant plants are produced by micro propagation.
- High rate of fecundity is obtained.
- This is the only method that is a viable method of regenerating genetically modified cells, even after protoplast fusion.
- This method is useful when insufficient amounts of seeds are produced, or when plants are sterile and they do not produce viable seeds or when the seeds cannot be stored.
- Some plants like orchids have very small seeds and the seeds are more reliably grown from seed in sterile culture.
- A larger number of plants can be produced and propagule can be stored for longer in a smaller area.

(Any 2)

4.1.3



Criteria/rubric/marking guidelines

- Correct heading
- X-axis: Correctly calibrated
- X-axis: Correct label (Years)
- Y-axis: Correctly calibrated
- Y-axis: Correct label *(Tissue culture banana (tcb) production)*
- Correct unit (kg)
- Correct type of graph (Bar graph)
- Correct plotting

4.1.4 **The trend in terms of production between the two methods**

In plant tissue culture the production is increasing at an increasing rate, but in the natural one it is increasing slowly.

4.1.5 **Total banana production in tons over the five years for**

(a) **Tissue culture**

- Total production: 500 kg + 800 kg + 1 000 kg + 1 500 kg + 2 200 kg = 6 000 kg

$$\frac{6\,000\ \text{kg}}{1000}$$

= 6 tons

(b) **Natural**

- Total production: 200 kg + 450 kg + 650 kg + 800 kg + 1 200 kg = 3 300 kg

$$\frac{3\,300\ \text{kg}}{1000}$$

= 3,3 tons

4.2 Genetics

4.2.1 The F_1 genotype

All offspring will be WwDd

4.2.2 The F_1 gametes on a Punnett Square

	WD	Wd	wD	wd
WD	WWDD	WWDd	WwDD	WwDd
Wd	WWDd	WWdd	WwDd	Wwdd
wD	WwDD	WwDd	wwDD	wwDd
wd	WwDd	Wwdd	wwDd	Wwdd

1 mark for male gametes
1 mark for female gametes
1 mark for the Punnet Square

4.2.3 The phenotypic ratio for the F_2 generation

This is a 9:3:3:1 phenotypic ratio.

9/16 will have white, disk-shaped fruit
3/16 will have white, sphere-shaped fruit
3/16 will have yellow, disk-shaped fruit
1/16 will have yellow, sphere-shaped fruit

4.3 A reproductive process

4.3.1 Identification of the reproductive process

Cloning/nuclear transfer

4.3.2 Labelling for parts A, B and C

A: Enucleation
B: Fusion
C: Somatic cell

4.3.3 TWO types of the reproductive process

- Reproductive cloning
- Therapeutic cloning

4.3.4 The difference between TWO types of reproductive processes

Reproductive cloning

A reproductive process that produces an identical copy of biological material

Therapeutic cloning

A reproduction process where tissue is cloned from the patient and then later returned after it has been cloned and grown in the laboratory

QUESTION 5

5.1 Case study

5.1.1 **Marketing system represented by the farmers**
Cooperative marketing system

5.1.2 **TWO types of the marketing system mentioned in Question 5.1.1**
- Production cooperatives
- Marketing cooperatives

5.1.3 **Brief explanation of TWO benefits of the marketing system in Question 5.1.1**
- Consistent supply of the product/Meet market demand for volume because farmers work together
- Potential for growth by involving more producers
- Economies of scale due to pooling of products or services
- Bargaining power of the group rather than individual farmers
- Access to professional expertise
- Access to better infrastructure that individuals cannot afford
- Eliminating the middleman and perform the functions themselves
- Bulk purchasing through negotiated prices
- Branding their product is easy for more visibility to potential buyers
- Access to funding because a number of government funding programmes encourage cooperatives

(Any 2 × 2)

5.1.4 **FOUR components of the Marketing Mix**
- Product
- Price
- Place
- Promotion

5.1.5 **Calculation of the percentage of the ground beef cut from a side of beef of about 300 kg of saleable product**

$$\frac{133,7}{300} \times 100$$

= 44,57% / 44,6% / 45%

5.1.6 **Description of TWO factors that can have a negative influence on the marketing chain**

- Labour challenges: Strict labour laws and the high cost of labour in South Africa can increase the cost of production.
- Infrastructure: Insufficient storage facilities for agricultural products, especially during peak harvesting periods, can lead to a drop in quality or product losses.
- Transport: The high cost of transport, limited availability of transport by road and the lack of proper rail transport slows down the movement of goods along the value chain.
- Accidents, theft and spoilage along the marketing chain can affect the marketing chain negatively.
- Handling facilities at ports: Insufficient handling operations for export products can lead to unloading taking too long, increasing the costs of exporting and slowing down the distribution process.
- Export regulations: Strict regulations in export markets can reduce the amount and quality of products that can be exported.
- Health, safety and traceability issues: Regulations that control the health, safety and traceability issues can be unnecessarily strict and can slow down the production.
- Product lifespan: Agricultural products are perishable and has a limited lifespan, which limits the time for marketing.
- Standardisation: Agricultural products are of biological origin with big variation, then standardisation has to be introduced to grade products. Standardisation increases marketing costs.

(Any 2)

5.1.7 **Remedial action related to the challenges in Question 5.1.6**

- Slaughter at a correct time and age to avoid incurring extra costs.
- Improve infrastructure of farm and public roads.
- Have cooling facilities on the farm to store the meat during periods of over supply to market out of season.
- Qualified packers and packagers with knowledge of how to handle meat should be used in the grading process.
- Sophisticated grading machines of a high standard prevent damage to meat.
- High-quality packing material prevents further damage and improves marketing price.
- Transport produce in cooler containers to prevent spoilage.
- Make use of internet and cellphone connections as a marketing strategy.
- Reduce transport cost by combining loads to meet market demand.
- Use transport companies with reliable drivers to prevent loss of produce as a result of accidents and theft.

(Any 2)

5.2 Different types of fruit

5.2.1 Identification of the types of fruit labelled A, B, C and D

- **A:** Simple fruit
- **B:** Compound/ Aggregate fruit
- **C:** Multiple fruit
- **D:** Accessory fruit

5.2.2 Classification of the examples of fruit listed in the box

Simple fruit	Compound/ Aggregate fruit	Multiple fruit	Accessory fruit
Grapes	Figs	Strawberries	Pears

5.3 Cashflow budget for the farmers

5.3.1

FARMER A				FARMER B			
INCOME (R)		EXPENSES (R)		INCOME (R)		EXPENSES (R)	
Manure sales	19 000	Chicks (2 000)	5 000	Manure sales	29 000	Chicks (2 000)	4 000
Meat sales	39 000	Labour	58 000	Meat sales	122 000	Labour	28 000
		Feeders	10 000			Feeders	20 000
		Water	4 000			Water	2 000
		Vaccines	500			Vaccines	15 000
TOTAL	**58 000**	**TOTAL**	**77 500**	**TOTAL**	**151 000**	**TOTAL**	**69 000**

Criteria/rubric/marking guidelines

FARMER A		FARMER B	
Correctly placed income items		Correctly placed income items	
Correctly placed expenses items		Correctly placed expenses items	
Correct total income		Correct total income	
Correct total expenses		Correct total expenses	

5.3.2 Viability of the TWO farmers

Farmer A: Not viable and healthy because of more expenses than income (Loss)

Farmer B: Viable and healthy because expenses are less than income (Profit)

5.3.3 Poultry product to be included by farmers to increase earnings

Poultry feathers/heads and Feet/Alimentary canal
(Any 1)

5.4 The reproductive system of a cow

5.4.1 Identification of parts

- **G:** Infundibulum
- **F:** Oviduct**/**Fallopian tubes
- **B:** Vulva

5.4.2 Matching functions with the letter

(a) E
(b) C/B
(c) D

SECTION C

QUESTION 6

Topic: The detrimental effects of internal parasites in livestock industry and its impact on food security

	Allocation of Marks	Poor	Fair	Good	Excellent
Definition of the parasites	**2**	**0**	**1**		**2**
		No definition provided at all in the discussions	Partial definition mentioning only one element between location and impact		Full definition with all the necessary elements such as location and impact
Differentiation between ectoparasites and endoparasites	**3**	**0**	**1**	**2**	**3**
		No differentiation between the ectoparasites and endoparasites in the discussions	Differentiation includes only one of the two types of parasites (external and internal)	Differentiation includes both external and internal parasites without mentioning anything about impact on the animal	Differentiation includes both external and internal parasites and how each impacts on the animal
Different types of the most important internal parasites	**3**	**0**	**1**	**2**	**3**
		No mention of the most important internal parasites in the discussions	Mentions only one example of the three most important internal parasites	Mentions only two examples of the three most important internal parasites	Mentions all three examples of the most important internal parasites
Financial and detrimental effects of internal parasites and its impact on food security	**9**	**0**	**3**	**6**	**9**
		Nothing addresses financial and detrimental effects of internal parasites and its impact on food security	Mentions only financial or detrimental effects of internal parasites on food security	Mentions both financial and detrimental effects of internal parasites on food security	Mentions both financial and detrimental effects of internal parasites and its impact on food security
Preventative measures of internal parasites	**3**	**0**	**1**	**2**	**3**
		No mention of the prevention measures of internal parasites in the discussions	Mentions only one form of preventative measure for internal parasites, e.g. chemical	Mentions only two forms of preventative measures for internal parasites, e.g. chemical and biological	Mentions all three forms of preventative measures for internal parasites, e.g. chemical, biological and pasture management
TOTAL	**20**				

The detrimental effects of internal parasites in livestock industry and its impact on food security

A parasite is an organism that lives in or on another and takes its nourishment from that other organism called the host. Parasites can be broadly classified as external (ectoparasites) or internal (endoparasites), depending on where they live on their host. External parasites often annoy their hosts by biting, embedding, or otherwise irritating the skin. They can cause serious diseases, such as mange and scabies, which affects the animal's health and growth. Internal parasites live in the blood or tissues inside an animal's body. Some organisms enter an animal when it swallows contaminated food or water. Others burrow through the skin, reach the blood stream and settle in a preferred location to mature and reproduce. Both external and internal parasites may weaken an animal's immune system and create conditions favourable to bacterial disease. In severe cases, these diseases can also be deadly.

Parasites of animals come in many forms, including helminthes [e.g. roundworms (nematodes), tapeworms (cestodes) and flukes (Trematodes)]. According to Nighbert (1927) there are over 1 000 species of parasites affecting domesticated animals throughout the world. Internal parasites often interfere with digestion and assimilation of food, causing poor growth, temporary or permanent injuries, or death. Parasites have been responsible for economic losses ever since humans first undertook the domestication of animals.

Roundworms usually live in the abomasum of ruminants, or the small and large intestine. Roundworms have a negative effect on the hosts if present in large numbers, as they live on blood and nutrients that the animals need for growth and production. The life-cycle of the different species differs considerably. Some roundworm species need an intermediate host that must be swallowed by the real or end host. Some intermediate hosts pick up the parasite while sucking the end host. Most species do not need an intermediate host to complete their life cycle.

The liver fluke is a flat, leaf-like parasite, occurring in the bile ducts of the liver of the host. Adults are 1,25 cm wide and 2,5 cm long and grey-brown in colour. It is mainly a parasite of cattle, sheep and goats but also occurs in pigs, rabbits, horses and even humans. Eggs of the worm are carried via the bile to the intestine and excreted with the faeces. They are dependent on humidity and under favourable conditions will hatch after 9 days in warm weather but will take longer in cold weather. The liver fluke feeds on the villi of the bile ducts and sucks blood. As a result, anaemia develops in the host.

A tapeworm does not have a mouth or intestinal tract. It lives in the intestinal tract of the host and takes, throughout its entire body, food already fully digested by its host for its own use. It deprives its host of its food. The excretions of the worm end in its host's intestinal tract and can be detrimental. Tapeworm is not a bloodsucker and does not cause anaemia, but they weaken their host and this results in poor condition. Tapeworms need an intermediate host for further development. Eggs do not hatch before the right intermediate host digests them. The egg will then develop in the intermediate host into a so-called bladder worm.

Financial implications and detrimental effects of internal parasites

Farmers and ranchers whose herds are infected with parasites pay higher costs to raise sick animals and earn less because of lower production. Economic losses occur not only when animals die, but also when they are unable to perform their regular work, or when they produce inferior meat, milk, wool, hides, or eggs. The World Food Summit of 1996 defined food security as existing "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."

Internal parasites destroy the host's tissue during feeding, which ultimately leads to poor feed conversion. This is economically important, especially in an intensive production system with high feeding costs. Many aspects of animal production improve in response to good parasite control (e.g. live mass gain, wool and milk production, calving or lambing percentage and weaning mass).

Parasitism is an erosive disease, it does not cause high mortality, but simply

- erodes the livestock farmer's profit
- the price of good dewormers is high
- labour costs will increase at times of livestock treatment
- livestock losses reduce the income of the farmer
- stock losses also affect the economy of the country
- animal carcasses that are infested with internal parasites are degraded
- the consumption of carcasses infested with parasites that are harmful to human life, such as meat infested with measles, can cause serious illnesses and even death
- to prevent infested animal products from entering the human food chain, daily inspections are performed at abattoirs, which is a huge financial cost for the country
- the cost of treatment for internal parasites is very high

Loss of production includes a decrease in the quantity and quality of animal products such as meat, milk and wool; consequently food security is affected. As the population grows so does the demand for more food, therefore internal parasites are a threat to food security, especially in Africa. Food insecurity and malnutrition give rise to many consequences for health and development, with mothers and children most vulnerable to the devastating effects. Malnourished mothers are at a greater risk of dying in childbirth and of delivering low-birth-weight babies who fail to survive infancy. Undernourished babies who make it through infancy often suffer stunting that cripples and shortens their lives. Subsequently, they transfer the broad economic disadvantages of malnutrition in their own lives to the next generation thereby perpetuating the vicious cycle of low human development and destitution. A household is said to be food secured "if it can reliably gain access to food in sufficient quantity and quality for all household members to enjoy a healthy and active life."

Malnutrition is a direct consequence of food insecurity; however, even if a person consumes enough calories, this does not guarantee adequate intake of essential micronutrients – vitamins, minerals and trace elements. Insufficient calorie consumption often goes hand-in-hand with micronutrient malnutrition and can have grave public health consequences.

Preventative and control measures

Biological measures

- Dung beetles are helpful in removing manure from pasture but in large herds of cattle it is impossible to remove all the dung.
- Introduce natural enemies to control the internal parasites.
- The use of micro fungi is still just experimental.
- Housing should be kept clean.

Pasture management measure

- Apply rotational grazing.
- Control of intermediate hosts.
- Good nutrition.
- Use of feeders to prevent feed from being contaminated by faeces.
- Providing clean drinking water.
- Prevention of overstocking of pastures or housing.
- Separating young animals from adults and letting the young ones graze first on fresh pastures.
- Resting of infested pastures.
- Allowing other species that are resistant to the specific internal parasite to graze on the pasture (they act as 'vacuum cleaners').
- Avoiding wet areas to prevent fluke infestations using zero grazing, where sheep and lambs do not have access to any vegetation to prevent infection by parasite.

Chemical measures

- Chemical medicines and remedies, such as anthelmintic, must be used to control and prevent infestations by parasites.
- Infestation of animals by liver fluke can be prevented by destroying the intermediate hosts (snails and slugs) by using flukicides.
- Chemicals for liver fluke include Rafoxanide, Closantel and Oxyclosanide.
- Worming products include injections, drenches, pour-on or boluses.
- Narrow-spectrum wormers target flukes and bloodsucking.
- Drugs can be administered in the form of drenches, tablets or injections.
- To prevent infestation, dose animals with the appropriate treatments, especially young ones or pregnant cows.

References

1. Parasites, Diseases, and Control Measures "A proper knowledge of animal parasites…and vigorous application of this knowledge will help to protect the nation's livestock industry and save it millions of dollars annually." E. M. Nighbert, Associate Veterinarian, Zoological Division, Bureau of Animal Industry, USDA, 1927

2. Food insecurity and malnutrition in Africa: Current trends, causes and consequences, 19 September 2012 by: In On Africa IOA

3. Contact Temitope Folaranmi through Consultancy Africa Intelligence's Public Health Unit (public.health@consultancyafrica.com)

4. Sanchez, P., et al., 2005. Halving hunger: It can be done. UN Millennium Project, Task Force on Hunger. Earthscan Publications, London.

Total: 300 marks