

AGRICULTURAL SCIENCE

8222
Paper 1

GENERAL COMMENTS

The overall performance of candidates was satisfactory. Teachers are commended for their efforts in preparing candidates to take their first examination ever in Agricultural Science AS level. Although a number of items proved to be well known by many candidates, there were some aspects that proved to be more challenging e.g. some candidates could not cope with questions that required mathematical skills. Most candidates failed also to draw the correct graph for question 1 d (i) and some could not differentiate between the dependent and independent variable and as such failed to label the x-axis and the y-axis correctly. Candidates did not also pay attention to command words in questions. There was evidence that some centres did not cover the whole syllabus as candidates from those centres left some of the questions unanswered. Candidates need to be reminded of the importance of clear handwriting and how to delete incorrect answers.

COMMENTS ON INDIVIDUAL QUESTIONS

Section A

- 1 (a) Fairly answered, Although some candidates, referred to Agronomy as the production of staple food.

Answer

Agronomy focuses on study of crops and the soil and environment in which they grow;
Involves breeding plants through scientific processes;
Aspects of Soil Management; Soil classification, soil fertility, weed and pest control;

- (b) Well answered.

Answer

Less photosynthesis / crop productivity reduced / reduced yield
Produces poor quality products;
Less water and minerals absorbed;
Stunted/poor growth;
Plant dies / crop failure;
Plants wilt;
Delayed germination/ failure of seeds to germinate;

- (c) (i) Most candidates could not explain further as to why the yield doubled

Answer

Use of pesticides / herbicides / fungicides, which are more effective at controlling pests / weeds / fungi
Use of improved crop varieties that are resistant to pests
Application of inorganic fertilizers, to improve soil fertility faster
AVP;

- (ii) Majority of candidates scored one mark. Candidates referred to the disadvantages of conventional farming rather than the reason why organic farming is more sustainable. (Teachers should encourage candidates to always answer questions from a positive perspective).

Answer

Less damage to environment;
Improves soil structure / texture / less soil compaction / Result in better soil quality / soil gives higher productivity;
Less erosion;
Reduce water pollution from fertilizer or pesticides run off;
Maintain soil pH;
Preserve soil organisms / increase biodiversity
AVP;

- (iii) Fairly answered. Candidates however, focused more on negative impacts and should be reminded that impacts could be both positive and negative.

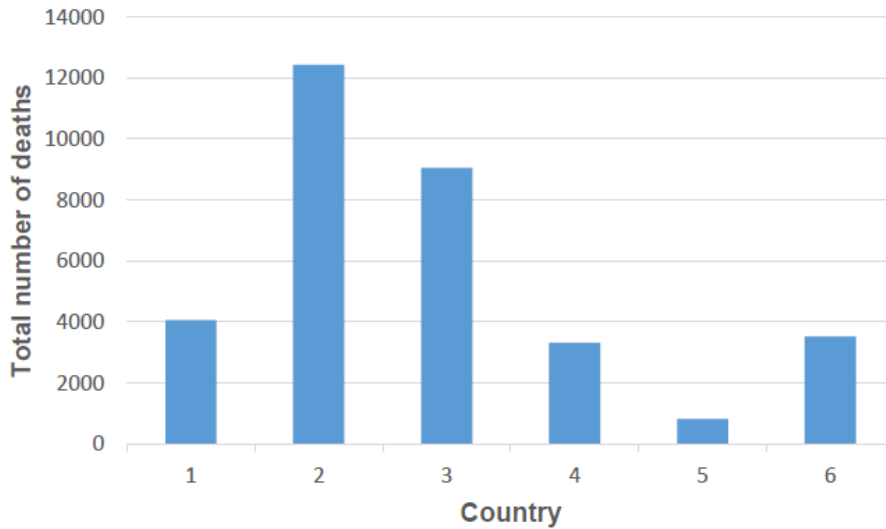
Answer

Results in high income/profit/returns/yield;
More money spent on fertilizers/expensive to buy fertilizers;

Expensive to buy pesticides/ fungicides/ herbicides/

- (d) (i) Poorly answered. Most candidates drew a line graph instead of a bar chart. Candidates could also not get the correct scale for the graph.

Answer



Axis labelling / correct labels and orientation;
Scale (linear scale and data plotted on at least half of the available grid);
Plotting (all points/ at least four plotted to \pm half a small square);
Bars (equal width of bars and space between bars)
If wrong graph, max 2 for plotting and labelling;

- (ii) Fairly answered

Answer

Absent from work due to illness / sickness / being isolated;
Absent from work taking care of the sick / isolated family members;
Workers who are sick are too weak to work;
Limited number of workers / reduced labour force to work per day / shift; not all important jobs are able to be completed on farm e.g. pest control, fertiliser application/ less land cultivated;
Loss of skilled workers / lack of skilled workers / skills lost through death of experienced workers
AVP.

- 2 (a) (i) Well answered. Some candidates however referred to narrow tubes instead of narrow pores in the soil.

Answer

Refers to the ability of water to rise up / move upwards; between the narrow pores in the soil; against the force of gravity / due to adhesion force;

- (ii) Well answered

Answer

B

- (iii) Fairly answered. Majority referred to this as gravitational force.

Answer

Adhesion / cohesion / surface tension

- (iv) Poorly answered. Many referred to pore spaces without specifying whether large or small.

Answer

Large air spaces/macro pores; large soil particles; open soil texture/sandy soil

- (v) Poorly answered. Candidates could not compare the movement of water in soil A and B.

Answer

Soil A has big pores between the particles, could not hold more water by capillarity; lose more water through drainage than B;

Has large particles and less cohesion compared to B;

ORA of B

Soil B is able to hold more water due to tiny pores; lose less water through drainage than A;
The smaller the pores, the greater the movement;

(b) Well answered.

Answer

Refers to the amount of soil moisture/water content held in the soil; after excess water/gravitational water has drained away, and the rate of downward movement has decreased;

(c) Poorly answered. Few candidates scored one mark for the first step of calculation, but could not get to the correct final answer.

Answer

Amount of phosphorus applied (kg/ha)

= amount of fertiliser (kg/ha) × %P

150 kg/10ha

15 kg/ha;

18/100 × 15kg;

= 2.7 kg/ha;

(d) Fairly answered. Majority of candidates referred to label as the ratio of fertiliser in the bag instead of ration of nutrients.

Answer

Represent the percentage/ratio of nutrients in the fertiliser; N: P: K: S;

3 (a) (i) Fairly answered.

Answer

Ability of the seed to resist external conditions; and stay in a state of not germinating;

Incapacity of a viable seed to germinate; even if conditions are favourable;

(ii) Well answered, some candidates however stated boiling seeds for 24 hours instead of soaking seeds.

Answer

Stratification / exposure to light / scarification / soaking;

(b) Well answered

Answer

Reduce competition for resources/nutrients/water/sunlight;

Reduce spread of diseases / allows air circulation

Improve plant growth / influence size of crop;

Influence the quality of product;

Increase crop yield;

Makes it easier to weed / machinery movement

(c) (i) Well answered

Answer

Meiosis;

(ii) Well answered

Answer

1 parent cell produced 4 daughter cells;

Daughter cells are genetically different;

Parent cell is diploid and daughter cells are haploid / chromosome number halved;

(d) (i) Fairly answered

Answer

Palisade cell 26;

Pollen grain 13;

(ii) Fairly answered. Some candidates however referred to the growth of cells instead of growth of plant, and replacement of tissues instead of repair of tissues / replacement of cells

Answer

Formation of new/more cells;

Formation of genetically identical cells/ duplication of cells;

Aid/for growth of plants;

Repair/ regeneration of tissues/ replacement of (old, worn out) cells;

A Allow asexual reproduction/ methods of asexual reproduction stated;

4 (a) (i) Fairly answered. Candidates should be careful with spelling of terms.

Answer

Gametogenesis;

(ii) Fairly answered. Some candidates did not however, specify whether primary or secondary, which was crucial for this question.

Answer

Haploid: secondary spermatocytes/secondary oocytes; mature oocytes; mature spermatids; polar bodies;

Diploid: primary spermatocytes/primary oocytes;

(b) (i) Fairly answered

Answer

Proper/Correct and regular feeding their cows (to avoid too thin or too fat cows)/production ration/right amount of nutrients/balanced diet;

Isolation;

Correct housing/ enough space/ shaded place;

Ensure availability of water;

Regular monitoring;

Maintain high disease and parasite control measures;

(ii) Poorly answered

Answer

Poor nutrition; results in too thin or too fat cows;

Metritis; infection of the uterus due to cows having given birth in contaminated environments previously;

Bacterial or viral infections/ reference to venereal diseases such as brucellosis or vibriosis;

Genetic defects;

Stress/ hormonal imbalance;

Cow age;

(c) (i) Well answered

Answer

Meet global demand for efficient food /increase meat/milk production;

It improves the quality of products/ high value products (named products);

Enhance disease/ parasite resistance in livestock;

Improves animal fertility;

Improves the growth rate of the animal;

Improves adaptation of animals to local climatic conditions;

(ii) Majority of candidates could suggest the positive effects of stimulating ovulations in cows

Answer

Positive: produce more egg cells that can be harvested for artificial insemination;

More predictability of production by the farmer;

Results in production of more offspring/multiple birth;

Negative: reduced growth rate of the progeny;

Possible increase in dystocia/increased risk of pregnancy loss;

Productive/reproductive life spans of cows is shortened;

(d) Well answered. Some candidates could not give the correct reason.

Answer

Fodder A;

It contains high percentage of protein;

It contains high percentage of calcium;

5 (a) Fairly answered

Answer

A - Lance/ spray gun;

B - Tank;

C - Trigger (on/off) valve;

- (b) Poorly answered. Most candidates scored one mark for the number of tanks, but failed to calculate the amount of product that should be added.

Answer

$10\ 000 \div 15 = 667$ (tanks)

2 kg = 2 000g;

$2\ 000 \div 667 = 3$ g;

- (c) (i) Well answered. Although some candidates referred to the maintenance of a tractor rather than a planter.

Answer

Empty/clean/wash all hoppers

Remove plant materials/remove soil/clods/use air hose to remove soil;

Check for worn or broken parts and replace them before the next season;

Cover all the furrow openers with protective covers;

Paint any exposed metal surfaces and lubricate/oil all moving parts;

Store inside a building with the wheels off the ground/store in a dry/dry and shaded place/away from moisture;

- (ii) Fairly answered. Some candidates referred to empowering instead of powering of other machines. Candidates should be specific on what implements are pulled by the tractor.

Answer

Can supply power directly to machines such as pumps, mowers, mills and threshers/power generator;

Lifting using front loaders; e.g. loading a trailer;

Moving materials/pulling a trailer;

Ploughing;

Personal transport around the farm;

A pulling specified implements

- (d) Fairly answered. Most candidates could not state the group the implement belongs to.

Answer

Implement: Cultivator

Group: secondary tillage implement;

- 6 (a) Poorly answered. Most candidates gave the reasons for regulating the price and not the effect it has on the Agricultural sector.

Answer

If the price ceiling is low, the price of the product will drop, the demand increases and suppliers will be unable to recover their production/lead to low supply;

Not making enough profit due to high cost input / government imposes high specification on products which means high production cost for farmers;

Taxes ensure that consumers buy locally produced products more than the imported products/ government not imposing tariffs on products leading to oversupply in the market/ allowing cheap imports, depressing the country's price on that product/ high competition between local and foreign, well established business enterprises;

Setting a price control keeps price for consumers low but decreases profitability for farmers / price ceiling ensures that farmers do not sell products at a price that is too high for consumers;

If the price floor is high, the price of the product will be high, the demand will drop and this will cause a surplus of the product in the market;

- (b) (i) Well answered

Answer

Agricultural bank;

Personal savings;

Credit services;

Commercial banks; R Banks

Cooperatives;

Entrepreneurial sponsors/dealerships;

NGOs;

(ii) Well answered

Answer

Not easily repayable if enterprises made a loss/ risk of repossession;
Bank charges;
Limited number of clients to be given financial assistance;
High interest rate;
Requires collateral;
Not easy to get because agricultural enterprises are risky/ lack of market trust;
Short repayment period/ regular repayment / cash flow not easy due to seasonality of crops;

SECTION B

7 (a) Most candidates could give examples but failed to explain the farming techniques further.

Answer

Use of herbicides/ use of pesticides/ use of fungicides, for control of weeds/ pests/ diseases;
Use of inorganic fertiliser: NPK / N-rich fertiliser e.g. urea / P-rich fertiliser e.g. superphosphate / K-rich fertiliser e.g. muriate of potash, to increase the soil fertility;
Use of hybrid seeds / use of certified seeds / use of genetically modified (GM) seeds / use of growth substances;
Irrigation system;
Vertical farming e.g. hydroponics
Use of remote sensors/ sensing/ drones; robots;
Use of machineries;

(b) Well answered.

Answer

Advantages of conventional farming:
High yield/ high production/ high profit
More food for high population/ food security;
Rapid technology innovation;
Fast control of pests/ diseases;
Fast control of weeds;
Inorganic fertiliser are fast in releasing plant nutrients;
Less labour cost/ use of fast machineries;

Disadvantages of conventional farming
High salinization;
Soil compaction/ reduced soil structure/ reduced soil quality
Increased erosion;
Loss of organic matter;
Desertification/ deforestation;
Pollution;
Disturbance of biological activities;
Loss of biodiversity;
Loss of employment;
Very expensive;
ORA

(c) Majority scored two marks.

Answer

Approach the Ministry of Agriculture, Water and Land Reform / the directorate of extension and advisory services / approach AMTA/ AGRIBUSDEV / NAB;
Store the maize grains in the silo;
This will maintain the quality of grains for longer until the market is found;
Reduce the price of the produce;
Attract the demand of maize/ improve marketing activities;
Add value to the maize/ create new products/ processing
Export the produce;
Find new market for maize grains;
Use part of maize crop for seed sowing next crop;

- (d) Fairly answered. Most candidates focused on the PPEs and could not get further marks since these were considered as alternative answers.

Answer

Wear the following PPE:

Overall / work wear; to avoid the spray solution from getting into contact with the skin;
Masks; to avoid inhaling the chemical;
Gloves; to avoid the spray solution getting into contact with hands;
Boots; to prevent any injuries to the foot;

Max 1 for PPE

Avoid eating/smoking (to prevent poisoning);
Avoid spraying on a rainy / wind day; reduce the effectiveness of the pesticide;
Avoid spraying on a windy day; to avoid spraying to other crop area;
Avoid spraying near open water;
Avoid spraying in dry conditions;
Select the correct chemical for the job/follows guidance on product label;
Correctly calibrates the sprayer according to the product label/ avoid over spraying;

- 8 (a) Fairly answered.

Answer

BNF accounts for most of the fixation of atmospheric nitrogen into ammonium;
This makes it the main process by which nitrogen is naturally added to the soil;
BNF provides the legumes with which they have a symbiotic relationship with ammonia, which the plants can use as a source of nitrogen;
Using legumes with BNF bacteria as a forage crop provides a rich source of nitrogen-rich fodder for livestock;
This reduces the need for supplementary feed;
BNF provides high-protein crops for human consumption;
Using legumes in crop rotation systems and ploughing the residues of the legume crop into the soil as a green manure adds nitrogen to the soil;
It does not harm the environment/ environmentally friendly;
BNF does not harm the soil/ prevents soil erosion;
Does not pollute water supplies or surrounding ecosystems;
Using BNF to fertilise the soil is cheaper than using inorganic nitrogen fertiliser;
Increases organic matter in soil/ improves soil structure;
Legumes are carbon sinks;
Opportunity for insect pollination;

- (b) Poorly answered. Some candidates failed to interpret the question.

Answer

Nitrogen availability: Less soil water decreases the rate at which soil organisms decompose soil organic matter to form ammonia;
Phosphorus availability: Less water in the soil can reduce the rate of the processes of decomposition and mineralization /
The processes by which organic phosphorus is converted to inorganic phosphorus;
Potassium availability; less water in the soil causes decreased movement of potassium to the plant roots;
When there is a lot of water in the soil, leaching of nutrients to the deeper layers take place, making nutrients less available to plants;
Salinization / reverse osmosis can lead to reduced nutrient uptake
This is a bigger problem in sand than in clay soil because of the large spaces in sand soil where water with dissolved nutrients drain through fast;
Sulfur/zinc/ iron become unavailable;

- (c) Fairly answered. Some candidates did not specify whether high or low pH and therefore lost marks.

Answer

For acid soils/to decrease soil acidity/to raise pH, add agricultural lime/limestone;
Add crushed shells//biological charcoal/ash;
Add mushroom compost;
For alkaline soil/to reduce pH/decrease soil alkalinity add farm manure;
Add aluminum sulfate/ ferrous sulfate;
Plough back crop residue into the soil;
Over/heavy irrigation;

(d) Well answered.

Answer

(i) Arenosol: Colour: brown/light red/reddish/yellowish red;
Productivity: poor/ low fertility;

(ii) Cambisol: Colour: blue grey/dusky red/very dark grey;
Productivity: good crop production/useful for crop due to high fertility;

(iii) Fluvisols: Colour: black/ brown to very dark grey/ very dark brown/ very dark reddish brown;
Productivity: useful for crop cultivation/good crop production due to high accumulation of organic matter;

9 (a) Fairly answered. Majority of candidates scored one mark for "inhibit root growth".

Answer

Causes cell elongation/ control the direction of root growth;
It increase root growth in low concentration;
Inhibit root growth;
Promotes rooting of cutting/promotes adventitious roots/ root branching;

(b) Poorly answered.

Answer

Less auxin/auxin production will stop;
Apical dominance will stop/removed;
Side shoots grow/lateral buds or auxiliary buds will develop/
Plant becomes bushy;

(c) Fairly answered.

Answer

Gibberellin: Increase fruit size;
End seed dormancy/ increase germination;
Promote the production seedless fruits;
Used for thinning of fruits/ flowers;
Flower formation / blossom;
Increase stem elongation;
Can be used as a pesticide;
Plant growth regulator;

Ethylene: Causes fruit to ripen;
Causes the crop to ripen at the same time;
Delaying food production;
Prevent wastage of fruits if ripen before use;
Used for thinning fruits/ flowers
Inhibit terminal bud growth/ make flower stems more compact/plant growth regulator;
Causes fruits to colour;

AVP

(d) Well answered. Majority of candidates scored full marks.

Answer

Large (bright) petals (to attract insect);
Petals are scented (to attract insect);
Stamen/anther inside of the flower;
Carpel/stigma inside of the flower;
Presence of nectary;
Sticky/rough pollen/ sticky stigma;
Small/ firm anthers;

(e) Fairly answered.

Answer

Pollen grain land on the stigma, the pollen tube is formed/pollen tube emerges from pollen grain and grows through stigma into the style and reaches the ovary;
The generative nucleus moves down the pollen tube and divides into two haploid generative nuclei/male gametes;
Pollen tube reaches the ovule and degenerate;
The two generative nuclei/male gametes enter the ovule;
One male gamete fuses with female gamete/egg cell/ovum to form diploid zygote;
The other male gamete fuses with polar nuclei to form the endosperm nucleus; which is triploid;
Endosperm stores nutrients of the seed;
After fertilization, petals, stamen, style and stigma will dry out and fall off;

10 (a) Candidates could describe the benefits of artificial insemination but not for embryo transfer.

Answer

Benefits of artificial insemination:

Semen from a donor bull can inseminate more cows;
Cheaper than maintenance of breeding bulls;
Semen used is tested, hence reduces the spread of venereal diseases;
Semen from exotic bulls can be use;
Can improve the quality of the herd quickly;
Semen can be stored and used even after the death of a donor bull;
Prevents big bulls from mating with small heifers/ decreases chances of injuries;

Benefits of embryo transfer:

Calves with superior genetics are produced;
Improves the genetic quality of the herd;
Progeny received in a given time as many cows can be impregnated/ more offspring produced
Cheaper to transport/ less transport of live animals thereby reducing the risk of disease transmission;
Easier and fast exchange of genetic materials between countries;

(b) Poorly answered. Some candidates referred to genetic modification in general instead of genetically modified animals.

Answer

Possible allergic reactions from modified animal products;
Animal welfare is not considered as animals may die earlier than expected/short lifespan;
GM species can have a negative impact on wild species/ reduce biodiversity;
Transferred genes may present unknown potential harm/danger to the health of people or the environment;
Lack of regulation;
Moral implications / unethical;
Causes genetic defects/ genetic mutation/ abnormalities;

(c) (i) Well answered.

Answer

Virus;

(ii) Well answered.

Answer

Vaccination;
Quarantine/ isolation;
Restricted movement;
Slaughtering infected animal/ burning/ incineration of infected animal
Sterilize equipment/boots/overall;

(iii) Poorly answered. Most candidates explained how the disease spreads instead of describing the life cycle of the agent that causes anthrax.

Answer

(Dormant) spore enters the body; and become active/ germinate;
(Active) spore engulfed by a white blood cell and multiplies in the white blood cells instead of dying; its coating resists antibodies;
It releases toxins as it multiplies which causes death of the animal;
Bacteria grow in decomposing animal and forms spores (dormant);

(d) Poorly answered.

Answer

Selection of animals with required/desired characteristics/Use genetically modified animals;

Separate the selected animals from the rest;

Use artificial insemination/ cross breed with more resistant breeds;

Practice MOET;

Use other animals (not selected for breeding) as surrogates;

Repeat over many generations;

POSITIVE SUGGESTIONS TO TEACHERS

- Teachers are advised to plan their time well to prepare candidates for the examination by doing more revision, making them aware of the command words and generally how to answer examination questions.
- Teachers should guide candidates on how to answer questions with action verbs that require a discussion or an explanation.
- Candidates should be taught to spell words correctly through repeated work and assessments.
- Candidates should be encouraged to attempt every question and take note of the marks allocated to each question part as a guide to how much detail is required.
- Candidates should be made aware of the different types of graphs and when to be used depending on the data given.
- Teachers must encourage the candidates to proof read their answers before submitting.
- Teachers should seek assistance when they are challenged in some topics.
- Time management is very important to ensure content coverage.