Plant and Animal Breeding

19. A field trial was set up to investigate the effect of mass of fertiliser applied and the application of fungicide on growth of barley.

The diagram shows the distribution of plots in the field and the treatments applied.

30	30	50
30	10	30
50	50	10
10	50	30
10	30	10
50	10	50

Key

Fungicide applied

No fungicide applied

10 10 kg fertiliser applied per hectare

30 30 kg fertiliser applied per hectare

50 50 kg fertiliser applied per hectare

Which design feature was included to eliminate bias?

A Application of fungicide to half of the plots

B Randomisation of treatments

C Application of three different masses of fertiliser

D Use of three replicates

11. The average yield, fat and protein content of the milk from each of three breeds of dairy cattle were determined.

The results are shown in the table.

Breed	Average milk yield per cow (kg per day)	Average fat content of milk (%)	Average protein content of milk (%)
Pure bred Holstein	44·80	4·15	3·25
F_1 hybrid Holstein × Normande	48·64	4·25	3·10
F_1 hybrid Holstein × Scandinavian Red	51·52	4·25	3·15

(a) Calculate the percentage increase in average milk yield per cow from the F_1 hybrid Holstein × Scandinavian Red compared to pure bred Holstein cattle. **1**

Space for calculation

_____ %

(b) The fat content of milk is important for butter production.

Calculate the total fat content in the milk produced in a day from a herd of 200 F_1 hybrid Holstein × Normande cattle. **1**

Space for calculation

_____ kg per day

11. (continued)

(c) Select **one** from: average milk yield per cow; average fat content of milk; or average protein content of milk.

For your choice, draw a conclusion about the effects of crossbreeding. **1**

Choice _____

Conclusion _____

_____

(d) The development of pure breeds such as Holsteins has led to an accumulation of deleterious recessive alleles.

State the term that describes this. **1**

_____

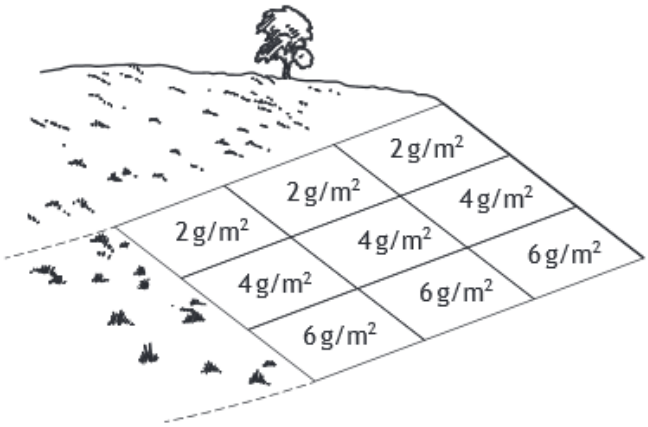
(e) Some F_2 offspring from crosses of F_1 hybrid Holstein × Scandinavian Red cattle will have less desirable milk-producing characteristics than their parents.

Give **one** reason for this. **1**

_____

_____

11. A field trial was carried out to investigate the effect of mass of phosphate fertiliser applied on the growth of barley. The barley was planted in plots of equal area on a hillside and fertiliser applied as shown in the diagram.



Which of the following procedures would improve the field trial design to take into account higher soil moisture levels at the bottom of the hill?

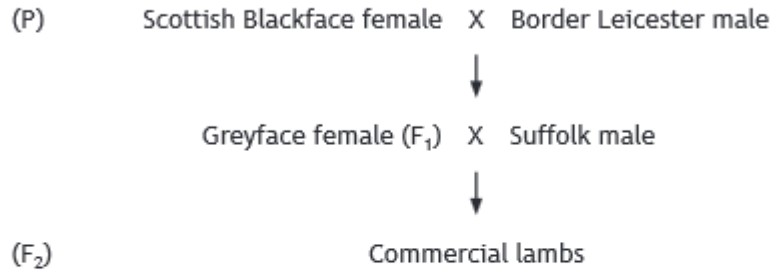
A Increase the range of phosphate fertiliser masses applied.

B Randomise the treatment plots.

C Increase the number of plots.

D Select another hillside.

9. The diagram shows crosses in a breeding programme involving different breeds of sheep.



(a) Suggest a reason why breeding programmes such as this include crossbreeding. **1**

(b) Explain why Greyface sheep are produced by crossbreeding Scottish Blackfaces with Border Leicesters instead of breeding F_1 Greyface sheep together. **1**

(c) To produce commercial lambs which show a desired dominant characteristic, Suffolk males homozygous for that characteristic are used.

(i) Name the type of cross used to identify if the genotype of the desired characteristic in Suffolk males is homozygous. **1**

(ii) Explain the importance of selecting a Suffolk male homozygous for the desired dominant characteristic. **1**

(d) Spider lamb syndrome is a hereditary condition in sheep caused by a recessive deleterious allele which results in limb deformities.

State why inbreeding could cause an increase in the number of lambs born with this condition. **1**

13. Inbreeding depression is a result of

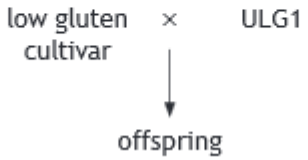
A an increase in heterozygotes

B a genetically variable population

C crossbreeding for improved characteristics

D an accumulation of recessive deleterious alleles.

(b) The allele for ultra low gluten is recessive. To investigate if the cultivar LG was heterozygous for gluten, it was crossed with the cultivar ULG1 which was homozygous for this recessive allele.



(i) Name this type of cross. **1**

_____

(ii) Describe the expected phenotypes of the offspring if LG was heterozygous. **1**

_____

_____

(c) Barley is a naturally inbreeding plant.

Explain why inbreeding depression would be unlikely to be a problem when a barley cultivar self-pollinates for many generations. **1**

_____

_____

18. Which of the following are features of naturally inbreeding crop plants?

1 Susceptible to inbreeding depression
2 Deleterious alleles eliminated by natural selection
3 Self-pollinating

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3