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SUPERVISOR'S USE ONLY

Level 1 Agricultural and Horticultural Science, 2018

90919 Demonstrate knowledge of soil management practices

9.30 a.m. Thursday 22 November 2018
Credits: Four

| Achievement | Achievement with Merit | Achievement with Excellence |
|---|--|---|
| Demonstrate knowledge of soil management practices. | Demonstrate in-depth knowledge of soil management practices. | Demonstrate comprehensive knowledge of soil management practices. |

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Merit

TOTAL

15

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QUESTION ONE: SILT SOILS

Soil texture refers to the size of the particles that the soil is made up of.

- (a) Describe the particle and pore size of a silt loam soil, and explain how these influence the physical properties of that soil.

A silt loam soil has medium sized particles, this means that the pore space is small enough to have a constant water capacity but large enough that the pores are not full of water and flooding is not relevant to the soil. //

- (b) Constant or continuous cropping in the same soil can lead to over-cultivation. Describe what happens to soil structure when it is over-cultivated, and explain how this affects soil properties and plant growth.

Over cultivation leads to the soil structure being destroyed and its top soil being ruined. Once overcultivation takes place the soil is very easily used to erosion. The top soil can be blown or washed away meaning that vital nutrients are no longer available to the soil or plants sown back in. Continuous cropping already uses a specific nutrient so with the rest in short supply the crop will struggle to grow. With the soil being overcultivated soil compaction may occur meaning that soil properties such as water will have trouble infiltrating roots and supplying plant with water. pH may also rise or fall depending on nutrients being absent from the soil. This will affect the amount of organic matter in the soil. //

When a grower needs to irrigate their paddocks, they can use either a centre pivot irrigator or a gun irrigator.

Centre pivot irrigator



Source: www.southernwatercompany.com/products-services/irrigators-pivots.

Gun irrigator



Source: <http://www.rainer.co.nz/assets/Uploads/SAM4.jpg>.

- (c) Select either a centre pivot irrigator or a gun irrigator as the most suitable method of irrigating.

Justify your selection by comparing and contrasting it with the other method.

Selected method: Centre Pivot irrigator //

In your answer, consider:

- the efficiency of application
- the effect each one has on the physical, chemical, and biological properties of soil
- the effect on plant growth.

The Centre pivot administers large amounts of water over great surface area, it is high in cost but low in labour as it can also go over fences by its self. It does not need to be moved from paddock to paddock like the gun irrigator so is very efficient in its job. The physical effects on the soil are how reliable it is all year around at supplying water to crops, especially when it is in dire need. Farms in ~~central~~ Canterbury are very dry and the landscape is littered with Centre pivots. This is because without water being irrigated out onto every paddock nothing would grow, without water the plant cannot absorb its nutrients needed for the plant to grow. //

More space for this answer is available on the next page.

The chemical effects on the soil are to do with the pH of the soil and how much water is needed. Plants thrive in a pH of around 6.2 in a soil, however again water is needed for the plant to grow. If the soil is too acidic earthworms will not be present, affecting the amount of organic matter and nutrients ^{that} will be in the soil. These biological properties are relevant in how easily the plant can respire due to the water in its pores spaces and the ped / particles sizes. All three of these properties along with irrigation is vital in for a grower to provide much needed water to plants. //

QUESTION TWO: SOIL TESTING

A soil drop test is when a spadeful of soil is dug up and then dropped onto the ground. The soil then breaks into peds, which are clumps of soil.

Soil drop test



- (a) Explain how the size and shape of the soil peds show what the drainage and aeration of that soil will be like.

The size and shape effect the water holding capacity of a soil. Sand have large peds which has poor water capacity but good aeration. Silt has medium sized ~~specie~~^{peds} which gives the soil alright or constant capacity to hold water with the same degree of aeration. Clay has small particles which leads to great water holding capacity but poor aeration of the soil. //

After completing a soil drop test, a grower noticed that the soil had very little organic matter.

- (b) Describe a management practice that could be carried out on soil to improve its organic content, and explain how adding organic matter will affect soil properties.

Applying lime to a soil to lower pH would bring back earth worm activity to the area. Earthworms would produce organic matter by excreting and dying in the soil. Organic matter effects how much nutrients is available to the plants, plus helps hold water to be used in diffusion especially in a sandy loam soil. Liming will affect the biological and chemical properties and help with the physical side of the water too, therefore adding organic matter to the soil. //

After a laboratory had carried out a soil test on samples taken from a farm, it was recommended that lime be applied to the paddocks.

(c) Justify why a grower would apply lime to the paddocks.

In your answer, consider:

- how lime can be applied to soil
- how lime affects the physical, chemical, and biological properties of soil
- the effects on plant growth.

A grower would apply lime to a soil to increase or decrease ~~the acidity of~~ ^{how acidic a} soil is. Lime can be used to increase organic matter and earthworm activity. Lime can be applied by air such as a helicopter or plane but most commonly by a bulky truck spreading it across desired paddocks. Lime affects the physical properties such as the soil profile by the flocculation of soil particles. By doing so more water can be taken up through the roots and allow the plant to respire. The chemical effects on the pH determines the acidity of the soil, lime is used to increase/decrease to a pH of a desired 6.2 in order for the plants to do the best in growing wise. The biological effects are the earthworm activity being increased. A soil being too acidic pushes earthworms to leave as it burns their skin, with increasing the pH earthworms activity will increase. This means that aeration will also be better since worms tunnel down creating larger pore spaces for carbon dioxide to reach the plants roots. Lime and pH has a very large effect on how well the plant quality will be, it has lead on effects to growth rates in stock and then farm production down the line. //

QUESTION THREE: SOIL NUTRIENTS

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The nutrient status of soil is very important. Nutrients in the form of fertilisers need to be applied to the soil in specific ratios.

(a) Explain the effects that applying excess (too much) nutrients can have on soil properties and plant growth.

- Leech through the soil entering water ways
- too much nutrients decreases plant growth due to smothering of plant. Too rich of a solution to handle.

In order to improve plant growth on a dairy property, a farmer can apply either dairy shed effluent or fertiliser.

(b) Select the better method, and justify your selection by comparing and contrasting it with the other management practice.

Selected management practice:

Effluent //

In your answer, consider:

- how each method is carried out
- the effect on the physical, chemical, and biological properties of soil
- how application rates can be managed.

~~Both methods are carried out by~~

Dairy shed effluent is carried out by irrigation from K lines, Centre pivots and gun irrigators. Fert is carried out by bulky trucks, or by the air. By applying extra nutrients to the soil it affects how well the plant will do, it is a boost to the plant. Fert is used to supply specific nutrients to specific plants to get the most desired outcome and plant growth. Effluent is returning all the nutrients the cow ~~has~~ has taken in ^{is back} ~~and re~~ to the soil. It is cost effective as you don't have to buy it in, it is collected at the dairy shed during milking. The effects effluent has on the soil are positive if the application rates are managed //

Properties
(chemical
biological
physical)

accordingly by the farmer. He can determine how much goes out and to which paddock. Soil tests are a good way of testing where nutrients are needed, normally in paddocks which are low in grass or have previously been eaten out by stock or cattle. If the rates are not managed effluent can leech through the soil into water ways, this is why cattle are fenced off from creeks and feed pads are 50m from any source of water (creek, river, pond). Effluent is better than fert for farm production as it is cost effective and returns all the nutrients back to the soil in a natural way. All nutrients are targeted instead of specific ones //

Merit Exemplar 2018

| Subject | Level 1 Agricultural and Horticultural Science | | Standard | 90919 | Total score | 15 |
|---------|--|---|----------|-------|-------------|----|
| Q | Grade score | Annotation | | | | |
| 1 | M6 | The student has a good understanding of particle and pore size, has made links to cultivation and erosion. They have a good understanding of some differences between the two types of irrigation and their effects. It is not E as they have not understood application rates and their effect. | | | | |
| 2 | A4 | Although they understand pore sizes they have not understood what peds are. A basic understanding of adding organic matter is shown but have not understood what organic matter is. Although they have shown an understanding between acidity and earthworm activity they have not really understood the effects of adding lime. Thus this is only an achieved. | | | | |
| 3 | M5 | They have a reasonable understanding of adding effluent and its problems, and realise how fertilizer can target required specific nutrients. This is not an E as the student has not understood effluent is organic matter and that it is adding water to the pasture, and the advantages of these. | | | | |