

90919



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

1

SUPERVISOR'S USE ONLY

# Level 1 Agricultural and Horticultural Science, 2011

## 90919 Demonstrate knowledge of soil management practices

9.30 am Thursday 17 November 2011  
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 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 2–8 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.**

Paper has clear, concise answers with an obvious progression between steps and the effect/implication of the practices. Correct terminology used in well-structured arguments.

TOTAL

Excellence

24

ASSESSOR'S USE ONLY

You are advised to spend 60 minutes answering the questions in this booklet.

### QUESTION ONE: REDUCING SOIL COMPACTION

Soil compaction can sometimes cause problems in lawns and on sports fields. It is also a problem when growing crops in clay soils when a hard layer, called a clay pan, has formed.

#### Compacted soil



(a) Select ONE of the following problems:

- soil compaction caused by people on lawns or sports fields
- soil compaction caused by machinery, resulting in a clay pan.

Selected problem: *soil compaction caused by machinery, resulting in clay pan*

(i) Describe the tool or equipment that could be used to reduce soil compaction.

*by using a plough the soil is turned over and broken up, the using a rotary hoe those large clumps are broken into smaller particles //*

(ii) Describe how the equipment is used to cultivate the soil.

*The plough turns the soil over, breaking up the clay pan into more manageable sizes, the rotary hoe then takes these clumps and breaks them into small particles which can then be used //*



- Temperature  
 - drainage  
 - aeration  
 - water holding

ASSESSOR'S USE ONLY

(b) Explain how soil compaction affects:

(i) physical soil properties

when soil is compacted the particles are tightly pressed together, this means that air pore spaces are reduced. Drainage also becomes difficult as water is unable to drain through the soil. Clay particles hold tightly

onto water because of their charge therefore plenty of water would be present in the soil. The soil would be ~~clay~~ <sup>plant growth</sup> because of this meaning the soil would be colder.

When there is ~~the~~ poor drainage in soil, plants tend to rot and get to the point of ~~p~~ saturation, this often kills plants or stops growth. Also because of the poor aeration plants are unable to reach oxygen which is used in the plant process respiration to release the ~~used~~ energy needed for cell division - plant growth. Because of the damp soil it is difficult to heat up as air heats faster than water, this means chemical reactions are slowed down, resulting in slower growth.

(c) Justify the method you have chosen to reduce soil compaction. In your answer, you should consider the advantages and disadvantages of your chosen method compared with other methods of reducing soil compaction for the problem you have chosen.

By using ploughs and rotary hoes there are many advantages and disadvantages, a different method would be ~~the~~ minimal tillage. Some disadvantages of using a plough and rotary hoe, is that the heavy machinery has to travel over the same area over and over again this breaks up soil structure, when using minimal tillage the machinery only ploughs the area your crop is going to be planted, this leaves areas between rows ~~that~~ untouched and holds that soil structure, as advantages, both get the job done, however even minimal tillage does cost less, only one machine is needed and only passes over the crop once, therefore does not risk overcultivation.

EB

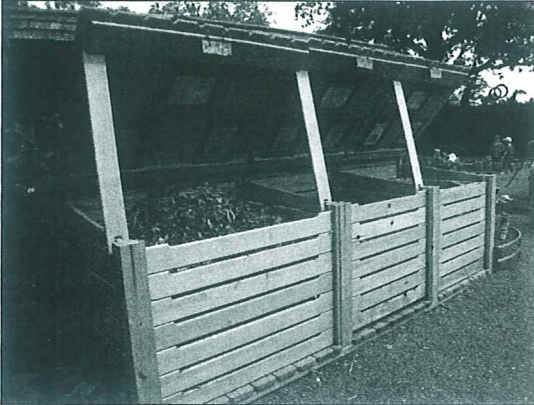


## QUESTION TWO: SOIL NUTRIENTS

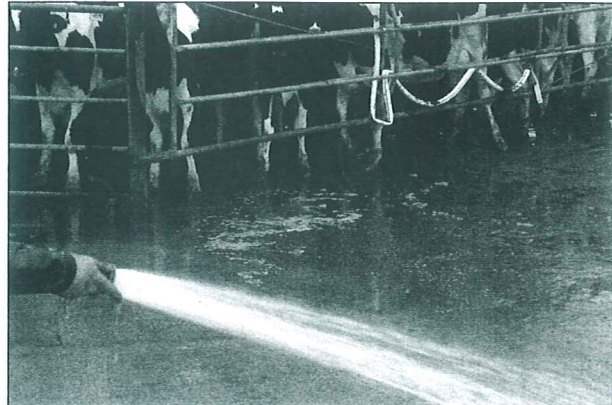
ASSESSOR'S  
USE ONLY

The use of compost and the return of animal effluent are regarded as having beneficial effects on soil fertility.

**Compost bins**



**Effluent from dairy sheds**



(a) Select ONE of the following practices:

- adding compost material to garden soil
- the application of animal manure from dairy sheds to farm paddocks.

Selected practice: *effluent - application of animal manure*

(i) Describe the form in which the compost/effluent is applied.

*effluent is applied in liquid form.*

(ii) Describe the method of application.

*when applying animal effluent it is hoosed off from the dairy sheds and drained into a pond here the double pond process is usually taken out before using the effluent as irrigation to be dispersed in liquid back onto the soil via sprinklers*

(b) Your selected practice will improve soil conditions for plant growth.

Explain how it will affect:

(i) soil properties such as physical, chemical, or biological properties

*By adding effluent it returns nutrients back into the soil, because it is organic and in large particles it is broken down slowly, meaning it will have long term benefits, organic matter when broken down by decomposition forms a substance called humus, this is a jelly like substance in which improves soil structure.*

(ii) plant growth requirements

plants need nutrients to keep them healthy and effluent provides that, the nutrients can be dissolved in water and then absorbed by plants to assist with growth. because of the way it is applied it also adds rich water in which water is used in the plant process photosynthesis to create the glucose which is needed to help with plant growth.

ASSESSOR'S  
USE ONLY

(c) The use of inorganic fertilisers is an alternative to adding compost or animal effluent to improve soil fertility.

Justify the use of fertilisers by comparing the ability of fertilisers with the ability of compost or effluent to improve soil fertility.

Include in your answer:

- nutrient availability
- soil chemical and physical properties
- environmental considerations.

inorganic vs organic

Inorganic fertilisers and organic fertilizers such as compost and effluent, both have advantages and disadvantages. Organic fertilisers are often used for instant need, because they are already soluble in water plants are able to absorb the nutrient with rich water and use them almost immediately. however organic fertilizers need to be broken down, as an advantage it stays in the soil longer but the disadvantage is that it is not available right away. In saying this inorganic fertilisers are often leached through the soil after the first rain and need to be re applied. This can become very costly. as an advantage of inorganic fertilisers you can tell exactly what proportions of nutrients are in it, therefore are able to apply the exact amount needed, in organic fertilizers this cannot be done unless scientifically tested, even then the EXACT amounts are not calculated. organic fertilisers benefit the structure of soil, organic material is broken down by decomposers into a substance called humus, this improves soil structure which can be beneficial. inorganic fertilisers can also leave behind toxic salts in the soil which is not good for the environment, organic fertilizers do not do this.



**QUESTION THREE: LIMING**

Plant growth on a large farm property is described as poor. The soil on the property has the following description:

Soil description	
•	sandy silt loam
•	pH = 5.8
•	organic matter = 3%.

To improve plant production, especially during summer months, a soil consultant has advised that the soil should be limed before new crops are sown.

(a) Describe how this property should be limed.

In your answer you should describe:

- the method of application
- the time of year lime should be applied.

lime is applied into the soil in either a powder or liquid form. It should be applied in spring, before new crops are to be sowed.

(b) Explain how liming the property will help improve plant growth.

In your answer you should explain:

- soil nutrient availability - pH
- biological activity in the soil. - increases worms.

by liming the property it increases the pH level making it more basic and less acidic, in doing this nutrients are more available. Nutrients are only soluble in water and certain pH levels, plants need the nutrients dissolved so they can be absorbed by the root hairs and used throughout the plant for plant growth. <sup>worms and other decomposers</sup> ~~The more basic the soil~~ do not enjoy acidic soils by adding lime it attracts and brings about more biological activity things like worms can then travel through the soil mixing layers which can bring more nutrients closer to the plant so they can then be absorbed. ~~They also~~ <sup>there</sup> tunneling also improves drainage and ~~ventilation~~ <sup>aeration</sup> aeration. Oxygen is needed to release the energy needed for growth. therefore improving growth.

- (c) The owner had considered that the use of irrigation and crop rotation may be better practices than liming for improving plant growth on this property.

ASSESSOR'S  
USE ONLY

Select EITHER irrigation OR crop rotation.

Selected practice: crop rotation

Justify the use of your selected practice compared to liming as being the better practice to use to improve plant growth.

In your answer you should consider:

- soil physical and chemical properties
- plant growth requirements
- how practical both practices are on this property.

crop rotation is a method used where different crops are planted in a cycle, rotating these different crops in areas. by using the crop rotation method soil structure is kept well. After the previous crop is removed it can be used as organic matter, this organic matter is then broken down by decomposers into a substance called humus this is what improves soil structure. it also adds nutrients to the soil which can be absorbed by the plants to improve growth. With good soil structure there will be plenty of aeration and oxygen will be accessible and used in respiration to release the energy needed for growth. liming on the other hand does increase pH levels but does not help with soil structure. if the property had clay it would be able to flocculate these particles however this property consists of sand and silt. benefits of crop rotation is that different plants need different nutrients, therefore, plants before hand may have left nutrients they did not use behind and other plants who need that can benefit off the nutrient rich soil. The organic matter left behind also darkens the soil meaning it can absorb more heat energy, which means chemical reactions can happen more quickly resulting in faster cell division which in turn means faster growth. liming cannot aid to directly adding nutrients however makes them available, it also does not encourage heat. liming can be applied fairly easily, but because of the large area could be costly, crop rotation can happen simply, as new crops need to be planted.