

ASSESSMENT GUIDELINES

Unit 21558

Describe calibration, and calibrate agrichemical application equipment.

Level 3, Credit 3, Version 1

Describe calibration, and calibrate agrichemical application equipment

Unit standard 21558

Level 3, Credit 3, Version 1

Level of performance required for this unit standard

This is a level 3 unit standard. At this level trainees are expected to demonstrate the following abilities when completing assessment tasks:

- To work under general supervision, with some independence; with significant responsibility for the standard of the outcome achieved.
- To apply technical skills and knowledge to complete the task to the specified standard, in a familiar context.
- To interpret available information, and use discretion and judgment.

Workplace assessment:

For guidelines on Workplace Assessment, please refer to the NZHITO Workplace Assessors Manual, and for further information, please contact: NZHITO, P O Box 8638, Christchurch. Ph 03 9644 735, Fax 03 9644 737, Website: www.hortito.org.nz

Special notes:

- 1 *Agrichemical application equipment* may include but is not limited to – knapsack, boomspray, air blast sprayer, mist blower, drench gun, high volume spray race, weed wiper, controlled droplet application (CDA) sprayer, mister, sheep shower; evidence is required for at least two different pieces of equipment, one of which may be an animal drench applicator.
- 2 Legislation and relevant regulations relevant to this unit standard include but are not limited to – Hazardous Substances and New Organisms Act 1996, and relevant regulations; Health and Safety in Employment Act 1992.
- 3 The New Zealand Standard applicable to this unit standard is NZS 8409:2004 *The management of agrichemicals*, available from <http://www.standards.co.nz>.

- 4 Codes and related documentation applicable to this unit standard include but are not limited to: *Responsible Care Management System*, available from the New Zealand Chemical Industry Council (NZCIC, PO Box 5069, Wellington).
- 5 Definition - *agrichemical* – any substance, whether inorganic or organic, man-made or naturally occurring, modified or in its original state, that is used in any agriculture, horticulture or related activity, to eradicate, modify or control flora and fauna. It includes agricultural compounds, fertilisers, vertebrate pest control products and oral nutrition products (this definition differs to that in NZS 8409:2004, where *agrichemicals* exclude fertilisers, vertebrate pest control products and oral nutrition products).

Acknowledgement

At the back of this assessment guide is an *Agriculture ITO* endorsed question paper, with answers attached, which has been developed for this unit standard. The attached question paper maybe used by the Workplace Assessor to carry out assessment and marking of this unit standard on-job.

If you do decide to use the question paper as your method of assessment we only require you to submit the completion form to the NZHITO once the student is deemed to be competent, as is our normal practice.

**Unit 21558: Describe calibration, and calibrate
agrichemical application equipment.
(Apprentice copy)**

ELEMENT	Competent	Range of evidence an assessor should consider
<p>Element 1 Describe the importance of agrichemical equipment calibration, and factors which determine effectiveness of spray applications.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Describe the importance of calibration in terms of achieving coverage and dose. ▪ Describe the importance of checking equipment for function and soundness. Range: may include but is not limited to – tank, tank volume, pump, hose lines, screens, filters, nozzles, gauges, covers, power source, computerised control equipment, mixing system, agitation; evidence is required for at least five. ▪ Describe the factors which determine the effectiveness of spray applications. Range: includes but is not limited to – application volume, chemical concentration, evenness of application, method of application, speed, terrain, target, chemical rate, water volume, weather and environmental conditions, equipment maintenance, nozzle type, nozzle size.
<p>Element 2 Calibrate agrichemical application equipment, evaluate calibrations, and make changes according to results.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Identify calibration variables specific to the type of application equipment. Range: variables may include but are not limited to – travel speed, output or pump pressure and volume, swath width, application rate, nozzle type, nozzle size, nozzle spacing, air output, profile, volume; evidence is required for at least four. ▪ Obtain information for calibration calculations for identified variables. ▪ Perform calculations appropriate to completed calibration tasks. ▪ Check and calibrate measuring equipment for the job. ▪ Evaluate the calibration set-up and calculations for suitability for the task, and changes are made according to results.

_____ (Name of Apprentice)

is **Competent / Not yet competent** in Unit Standard 21558, version 1

Signed (Assessor): _____

WPA Registration Number: _____ Date: _____

**Unit 21558: Describe calibration, and calibrate
agrichemical application equipment.
(Assessor copy)**

ELEMENT	Competent	Range of evidence an assessor should consider
<p>Element 1 Describe the importance of agrichemical equipment calibration, and factors which determine effectiveness of spray applications.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Describe the importance of calibration in terms of achieving coverage and dose. ▪ Describe the importance of checking equipment for function and soundness. Range: may include but is not limited to – tank, tank volume, pump, hose lines, screens, filters, nozzles, gauges, covers, power source, computerised control equipment, mixing system, agitation; evidence is required for at least five. ▪ Describe the factors which determine the effectiveness of spray applications. Range: includes but is not limited to – application volume, chemical concentration, evenness of application, method of application, speed, terrain, target, chemical rate, water volume, weather and environmental conditions, equipment maintenance, nozzle type, nozzle size.
<p>Element 2 Calibrate agrichemical application equipment, evaluate calibrations, and make changes according to results.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Identify calibration variables specific to the type of application equipment. Range: variables may include but are not limited to – travel speed, output or pump pressure and volume, swath width, application rate, nozzle type, nozzle size, nozzle spacing, air output, profile, volume; evidence is required for at least four. ▪ Obtain information for calibration calculations for identified variables. ▪ Perform calculations appropriate to completed calibration tasks. ▪ Check and calibrate measuring equipment for the job. ▪ Evaluate the calibration set-up and calculations for suitability for the task, and changes are made according to results.

_____ (Name of Apprentice)

is **Competent / Not yet competent** in Unit Standard 21558, version 1

Signed (Assessor): _____

WPA Registration Number: _____ Date: _____

Please send this page to your NZHITO Regional Manager, who will forward it to National Office to register the credits on your NZQA Record of Learning.

Unit 21558: Describe calibration, and calibrate agrichemical application equipment.

(Name of Apprentice)

is Competent in Unit Standard 21558. (version 1)

Signed (Assessor):

WPA Registration Number: _____

Date: _____

Describe Calibration & Calibrate Agrichemical Application Equipment

Instructions:

1. Write your name, address and the date you hand in this Assessment in the box below.
2. Answer all questions. Use more paper if required.
3. All answers must be in your own words.
4. You must show that you have achieved the standard in all elements of the unit standard.
5. If you do not attain the standard you will have an opportunity to attempt part or all of the assessment again either orally or written, after some further study.
6. If there are any questions you don't understand, or if you have any difficulty reading the questions, please ask your tutor or supervisor for some help.
7. This is an OPEN book assessment

Student To Complete:

Student Name:	
Address:	
Date Handed In:	
Declaration:	This assessment is all my own work (Your signature)

Assessor To Complete:

Course Number/Name:	
Standard Achieved:	Yes / No (Delete One)
Assessor's Name & Signature:	
Date:	
Comments:	
Questions to Resit:	

Assessment Retake Date:	
Standard Achieved:	Yes / No (Delete One)
Assessor's Name & Signature:	

Describe Calibration, and Calibrate Agrichemical Application Equipment

Unit 21558

Level 3

Credits 3

1. What is calibration and why is it important to calibrate agrichemical application equipment?

2. Before using agrichemicals and calibrating the equipment it is essential to check that equipment it is in good operating condition. For at least five of the items of equipment listed below briefly describe what you would check (at least two checks for each item are required).

Equipment Item	What you will check (give at least two checks for each bit of equipment)
Tank	
Pump	
Hose Lines	
Screens & Filters	
Nozzles	
Gauges	
Guards & Covers	
Agitation System	
Mixing Induction System	
Fan & Air Output	
Spray Controller Equipment, Flow Meters & Valves	

3. Circle the best weather conditions for spraying systemic herbicides along a fence line to kill thistles. On the other side of the fence is a crop of cabbages. Choose one answer from each list and give your reasons.

- (a) Wind Strength
- i. Calm
 - ii. Light breeze towards cabbages
 - iii. Light breeze away from cabbages
 - iv. Strong wind

Explain why you chose this answer: -

- (b) Temperature
- i. Cold
 - ii. Cool
 - iii. Warm
 - iv. Hot

Explain why you chose this answer: -

- (c) Humidity
- i. Low humidity
 - ii. Medium humidity
 - iii. High humidity

Explain why you chose this answer: -

4. What effect will raising the height of a boom spray have on: -

- (a) The application rate?

- (b) Spray drift?

- (c) Target coverage?

5. What is the effect on application rate of turning off some boom sections assuming that speed and spray pressure remain the same?

6. If spray pressure increases, what happens to: -

(a) The volume from the nozzle?

(b) The droplet size?

7. If the diameter of the nozzle is doubled but the pressure is kept the same, what happens to the volume through the nozzle? (Be accurate in your answer.)

8. What affect will increasing the speed of the sprayer have on the application rate?

9. For each of the application tasks described below, choose the equipment, nozzle type, pressure range and droplet characteristic that you would choose to provide good efficacy and minimize potential off-target damage. Describe why you would choose these setups.

(a) You are using a Non-selective contact herbicide to kill weeds within a crop (or very close to a sensitive crop)?

(b) You are using Non-selective systemic and partly systemic herbicides to kill weeds within a crop (or very close to a sensitive crop)?

(c) You are going to use a Soil active pesticide?

10. Two common calibration formula are shown using letters to represent variables that are adjustable and the calibrator must take into account. Accurately describe what each of these variables represents.

$$S \text{ (km/hr)} = \frac{D(m) \times 3.6}{T \text{ (sec)}}$$

$$AR \text{ (L/ha)} = \frac{V(L/min) \times 600}{W(m) \times S \text{ (km/hr)}}$$

- (a) S = _____
- (b) D = _____
- (c) T = _____
- (d) AR = _____
- (e) V = _____
- (f) W = _____

11. Use the formulae above to help you answer the following questions: -

- (a) If you double the speed at which you are driving the tractor and spray tank what happens to the application rate?

- (b) If you use a boom that is only half the width of the one you have previously used but speed, pressures and nozzle flows remain the same, what happens to application rate?

- (c) If there is an inlet blockage and volume is halved what happens to the application rate?

- (d) If the length of the rows you are spraying are doubled (but you don't increase speed), how much longer will it take you?

- (e) If you change the nozzles to give you twice as much volume and you double the speed you are going what happens to the application rate?

12. You have been called in to calibrate your neighbor's sprayer because he is concerned that it doesn't seem to be applying enough volume. Describe four possible causes of this?

- (a) _____
- (b) _____
- (c) _____
- (d) _____

13. What would be your actions above to determine the cause? List your actions in order from first to last.

14. Why is it essential to calibrate: -

(a) Measuring equipment?

(b) Spray tanks?

15. Describe how you would go about calibrating: -

(a) Measuring equipment?

(b) Spray tanks?

16. Select two of the calibration scenarios provided. Complete the theoretical or actual calibration for each scenario and answer the additional questions included.

EXAMPLE OF SCENARIO:

Scenario 1

The equipment requiring calibration is;

A 12m air assisted boom spray with 50cm nozzle spacing and foam marker. Tank size is stated as 2000 litres.

The application task is;

Regular agrichemical application of fungicide to onions at application rate of 300L/ha.

Task

Decide on a suitable setup and fill in the theoretical-setup information below.

1. Information required;

(a) Nozzle type and size = _____

(b) Operating pressure = _____

(c) AR = _____

(d) S = _____

(e) V = _____

(f) W = _____

How will you test that the set up is delivering the required application rate?

2. If you decided that you needed to increase the application rate by 50% (i.e. 450L/ha) with this equipment what are your practical options to achieve this;

(a) _____

(b) _____

3. If you decided that you needed to improve the spray coverage, what adjustments could you make to the equipment to achieve this?

(a) _____

(b) _____

EXAMPLE OF SCENARIO:

Scenario 2

The equipment requiring calibration is;

An oral drench gun for cattle.

The application task is;

You are going to worm the heifer mob. Each animal requires a dose of 20mL.

Task

1. How will you set up the drench gun and determine that it is delivering 20mL reliably?
2. If you do the older cattle tomorrow and need to increase the dose to 30mL how will you do this?

MARKING SCHEDULE

Describe Calibration, and Calibrate Agrichemical Application Equipment

Unit 21558

Level 3

Credits 3

Note to Assessors:

- Two scenarios involving two different items of application equipment are included for question 16. Alternative or additional scenarios may be inserted at the assessor's discretion. Equipment for the scenarios may include: knapsack, boom spray, air-blast sprayer, mist blower, drench gun, weed wiper, controlled droplet application (CDA) sprayer, mister, and dip shower.
- Answers for the alternative or additional equipment and scenarios set will need to be inserted to the marking schedule (under evidence for question 16).
- Alternative assessment for question 16 would be to have trainees actually calibrate equipment that has been supplied for a given scenario (rather than just describe it), or have attestation from employer (or other suitably qualified witness) that calibration of equipment has been carried out on job.

Question	Element	Evidence	Judgement
1	1	The importance of calibration is described in terms of <u>achieving coverage and dose and minimising off-target application.</u>	Underlined words or similar are mentioned.
2	1	Tank – check for damage, cleanliness, leaks, volume check Pump – check for valves and diaphragm soundness and operation, leaks, operation check, Hose lines – check for soundness, size appropriate, damage, kinks and/or blockages. Screens and filters – check for damage to filters, blockages, and correct fit without air or water leaks. Nozzles – check for blockages, pattern, type, uniformity, wear, all same brand. Gauges – check for operation and correct pressure. Guards and covers – check that appropriate covers are in place, are sound and operational. Agitation system – check for operation, leaks, blockages, adequate flow. Mixing induction – check for decontamination, leaks, damage, operation. Fan and air output – check for gearbox noise, oil levels, guards, blade pitch, fan gear or rpm, air volume at operation speed. Spray controller equipment, flow meters and valves – check for operation, calibration of meters, speed and pressure, leaks, connections.	Two (2) appropriate equipment checks described for five (5) articles of equipment from the list.
3	1	(a) iii – a light breeze is more predictable and spray drift is less than dead calm conditions. (b) Answer may vary depending on how it is qualified with the explanation but generally ii – because less chance of droplet evaporation and volatilization from plant surfaces thereby reducing vapour drift potential and improving plant	Three (3) correct answers with appropriate description of why for each.

		uptake.	
--	--	---------	--

Question	Element	Evidence	Judgement
3	1	(c) iii - high humidity reduces evaporation and volatilization thereby reducing vapour drift potential and maximises plant uptake. Also plant is in a less stressed state and can better take-up chemical.	Three (3) correct answers with appropriate description of why for each.
4	1	(a) Zero effect – application rate will remain the same. (b) Spray drift is likely to increase because droplets are released further from the target. (c) Coverage should improve if off target drift is not an issue.	Three (3) correct answers.
5	1	AR (L/ha) will remain the same	Correct
6	1	(a) It increases (b) It decreases	Both correct
7	1	The volume through the nozzle increases four fold	Correct
8	1	Increasing speed will reduce AR proportionately	Correct
9	1	Answers may vary and must be correct when qualified with the reasons why. (a) Contact pesticides require good coverage for efficacy and therefore small droplets are desirable. However there is a trade-off between coverage and damage caused to non-target plants through spray drift. In this case medium droplets would be used and other techniques such as higher AR or adjuvant use employed to improve coverage. Example of setup; Flat fan nozzles, low to medium pressures, with adjuvant or higher AR. Could also mention use of a shield. (b) Larger droplets because coverage is not so critical and spray drift potential is lower. Example of setup; flat fan with larger nozzle sizes and medium pressures or flat fan air induction nozzles with higher 4-6bar pressures. May also mention that Adjuvants can used if necessary with an appropriate reduction in AR (c) Large to very large droplets with as much water as possible to deliver the pesticide to the soil surface. Example setup; large nozzle sizes for high AR flat fan or even flood jet type nozzles. Note; flat fan has more even distribution than flood jet type nozzles. Low to medium pressures 2-4bar.	Two appropriate set-ups are given with valid explanations as to why these setups were chosen.
10	2	(a) S = Speed in Km/hr (b) D = Distance in metres (m) (c) T = Time in seconds (s) (d) AR = Application Rate in litres per hectare (L/Ha) (e) V = Volume from nozzle or volume from all nozzles on sprayer (L/minutes) - depending on method used. (f) W = Boom width or bout width in metres or row spacing for single row horticultural sprayers.	All correct

Question	Element	Evidence	Judgement
11	2	(a) AR is halved (b) AR remains the same so long as twice the number of rows/bands are sprayed (c) AR is halved (d) T doubles (e) AR remains the same because changes in V counteract changes in S. (This is how a computerised spray controller operates.)	All correct
12	2	Answers may include but are not limited to; (in approximate order of checking.) (1) Filters blocked or suction hoses kinked, squashed or wrong size. (2) Sucking air on suction side of pump (3) Blockages or constriction on delivery side of pump including too small hoses and blockages of high pressure nozzles (4) Too small nozzles (5) Pump diaphragms or valves faulty (6) Calibration incorrect i.e. travelling faster than thought, flow meter not calibrated, tank not calibrated.	Four correct
13	2	Answers may include but are not limited to; NOTE: The order is not critical but it is necessary to check and repair faults with equipment before checking calibration setups. (1) Check return line/agitation for flow (2) Check filters suction and pressure (3) Check O-rings and washers on pump suction side (test with grease if necessary) (4) Check nozzle sizes and calibration calculations (5) Check speed calibration (6) Check flow-meter calibration (7) Check for restrictions and high pressure losses in delivery side e.g. may be caused by modification or build up of chemical in lines.	Actions described in a logical order to determine each of the causes described in Question 12
14	2	(a) To ensure that chemical measured is accurate (b) To ensure that the volume of water being measured and used is accurate. (It is common for tank volumes to vary by up to 20% from tank volume indicators, or tanks volumes stated in sprayer literature)	Both correct
15	2	(a) Check volumes or measuring equipment with a standard accurate measure e.g. laboratory measure or use a laboratory measure with accuracy marked on measuring device as your chemical measuring device. OR Check volumes by weight on an accurate scale. e.g. 1 litre equals 1kg, 1ml equals 1g. (Don't forget to take into account the weight of the measuring cylinder. (b) Check volumes of spray tank either with an accurately calibrated flow meter OR by filling with containers with and accurately known volume.	One correct method described for each

Question	Element	Evidence	Judgement
16	2	<p>Completes calibration calculations and clarifying questions for two items of agrichemical application equipment in theoretical.</p> <p>Answers and setups will vary. The setup must be appropriate for the task being carried out and calibration calculations correct.</p> <p>Example setup – scenario 1 Boom sprayer to deliver 300L/ha of fungicide spray to onion crop. 24 nozzles, 05 flat fan extended range Teejet nozzles delivering 1.97L/min @ 3 bar.</p> <p>(1) (a) Nozzle type and size chosen; Flat fan 05 nozzles (b) Pressure chosen; 3 bar (c) AR = 300L/ha (d) S calculated at 7.88km/hr (e) V per nozzle theoretical is 1.97l/min/nozzle or 47.28l/min for the spray unit. (f) W = 24 nozzles X 0.5m spacing = 12m</p> <p>(2) (a) Slow down travel speed to 66% of current speed i.e. 7.88km/hr X 66% = 5.2km/hr (b) Change nozzles and recalibrate to find out speed e.g. 06 nozzles travel speed calculates to 6.3km/hr</p> <p>(3) (a) Increase pressure to increase AR and decrease droplet size, and adjust speed higher to offset higher output e.g. recalibrate or use compensating controller (b) Change nozzle type or size and recalibrate (c) Slow down to increase AR and recalculate chemical rates to allow for higher AR. (d) Reduce adjuvants to reduce run off with high AR or increase adjuvants to improve coverage with lower AR.</p> <p>Scenario 2 Drench gun to give 20mL dose of anthelmintic to cattle: - Dial on drench gun set to appropriate mark or scale (if visible on drench gun), or guess a position. Draw up quantities of water and deliver 5 or 10 doses into a calibrated measuring jug - check that quantity delivered gives 100mL or 200mL (depending on number of squirts). If not adjust dial up or down and repeat until correct volume is delivered. Repeat above to change dose to 30mL</p>	<p>Appropriate setups and variations described, demonstrated or actually carried out for two separate scenarios and application equipment provide by the assessor. All calculations and adjustments need to be correct. In the case of computer controlled equipment being used then manual calculations still need to be carried out and a description of checks that are required to ensure that the controller is operating within the parameters required.</p>