LandWISE

Best Management Practice of Nitrates in Process Cropping

Milestone Report 1: 24 March 2022

Prepared by Dan Bloomer

McCain

HAWKE'S BAY REGIONAL COUNCIL

Wattie's

Ministry for Primary Industries
Manatū Ahu Matua

Contents

Contracted Milestone

Date: 1 Mar 2022	Milestone 1
Milestone description	Project initiation
Target Outcome	Paddocks selected, crops established, monitoring underway.
Activities undertaken	To provide written confirmation that the approval condition Formal inclusion of a member of the Sustainable Vegetable Systems scientific team on the project's Advisory Group has been met. Team meeting and paddock selection: 2 each of Sweetcorn, Beans, Tomatoes and Beetroot (At least 6 completed in Year 1) Grower survey completed – current nutrient management practices (based on Fert Association BMPs) Soil testing – pre-plant by treatment in bands to rootzone depth Planting – (grower task) Fert application equipment calibrations – if grower has not done Monitoring – agronomic crop walks to observe Pre-plant Nutrient budgets – estimated nitrogen balance and fertiliser need
Deliverables / evidence of completion / achievement of Outcome	To provide written confirmation that the approval condition Formal inclusion of a member of the Sustainable Vegetable Systems scientific team on the project's Advisory Group has been met. A Milestone Report as per Schedule 1 clause 8, and detailing achievements and calibration summaries Team meeting minutes
MPI Funding amount	$24,793
Co-Funding cash	$14,847
Co-Funding in-kind	$6,200
Total	$45,840

On completion of each Milestone, the Recipient must submit a report to MPI (through the Portal) that includes:

- a description of the Milestone(s) to which the report relates
- evidence that the Milestone has been completed
- a copy of any physical output/deliverable required for the completion of the Milestone
- a web portal update
- any other information reasonably requested by MPI concerning the Milestone or the Activities; and
- the Payment Request for the applicable portion of Funding for completion of the Milestone.

Activities Undertaken

Written confirmation of inclusion of SVS Scientific Team member

Confirmation that Bruce Searle, who is a Scientific Team member on SVS and sub-contracted to provide scientific support to BMP of NIPC, will link the two projects. Emails copied in Appendix 1

Dan Bloomer is also a member of the SVS Regional team, providing another linkage.

Team Meeting and Paddock Selection

The project management team has met regularly in person, on-line and by email. These meetings finalised details of project aims and the crop selections and confirmed 6 paddocks/crops for monitoring this season.

Key meeting dates: 27/10/2021, 1/11/2021, 24/11/2021, 11/01/2022

Paddock/Crop Selections

The late project start contributed to some delays identifying and confirming trial sites. Six sites were finally confirmed, and trials established: 2 tomatoes and 1 beetroot (Heinz-Watties), 2 sweetcorn and one green beans (McCain Foods).

Tomatoes


Sweetcorn


Beetroot

Green Beans

Grower Survey

All six growers responded to the survey, which shows some differences to other regions. General nutrient risk assessment is less structured than regions where farm environment plans have been required for a longer period. Formal nutrient budgeting is not common, although the factors influencing application rate determinations are generally considered. Fertiliser handling appears to meet requirements of schemes such as NZ GAP and processors. A separate Survey Summary is attached as Appendix 4.

Soil Testing

At each site, four sets of paired plots have been established with "Grower Rate" fertiliser applied to one set and an alternative rate to the other. Soil was sampled and sent to Eurofins for testing. Individual plots nitrate concentrations were determined at three depths to the full root depth of the crop. This varies depending on soil type and crop, extending to either 450 mm or 600 mm depth.

Each treatment was sampled, and standard soil test suite laboratory analyses obtained. Every plot had soil nitrate assessed at each depth using the Nitrate Quick Test. As a calibration, composite samples were sent to Eurofins for laboratory determinations. Composite samples were also used to determine potentially available nitrogen (PAN or AMN). There was good correlation between the laboratory and Quick Test nitrate results processed using the FAR calculator to convert concentration to kg N/ha. However, in very wet soils, the FAR processed Quick Test results appear more prone to error.

Additional Quick Test measurements were made before side-dressing fertilisers were applied.

Figure 1 MQuant StripScan Reference Cards showing very low (left) and high (right) nitrate concentrations from solution prepared from soil samples. A phone app is used to capture the image and determine concentration based on colour comparisons.

Pre-plant Nutrient budgets

Pre-plant nutrient budgets were completed using collected data and the online LandWISE Nutrient Budget Calculator (https://nutrient.landwise.org.nz). Completed budgets were discussed with the relevant processors and growers and alternative fertiliser rates agreed. Results are summarised in Table 1. An example is presented in Appendix 2.

The calculator uses recommendations drawn from "Nutrient Management for Vegetable Crops in New Zealand" by Reid and Morton. This is understood to be in review.

Table 1 Summary of Pre-plant Nutrient Budgets and Fertiliser Plans

Crop	Farm	Treatment	Budget Yield t/ha	Test	Sample Depth cm	Soil N kgN/ha	Recom. N kgN/ha	Plan'd Fert kgN/ha	Plan'd Var kgN/ha
Sweetcorn	Swamp	Farm	24	Quick	15	50.5	250	208	-42
Sweetcorn	Swamp	Alternative	24	Quick	15	51	250	130	-120
Sweetcorn	Tiko Rd	Farm	24	Quick	15	53	250	82	-169
Sweetcorn	Tiko Rd	Alternative	24	Quick	15	49	250	38	-212
Tomato	Rosser R	Farm	140	Quick	15	77	21	88	67
Tomato	Rosser R	Alternative	140	Quick	15	77	21	36	15
Tomato	Pivot	Farm	140	Quick	15	75	24	88	64
Tomato	Pivot	Alternative	140	Quick	15	75	24	36	12
GreenBean	Pivot	Farm	12	Quick	15	32	28	46	18
GreenBean	Pivot	Alternative	12	Quick	15	35	28	22	-6
Beetroot	Sears Rd	Farm	80	Quick	15	48	247	196	-51

Monitoring

Visits to sites were maintained over the summer, with repeat sampling before any planned fertiliser applications. Crops grew well, and no apparent health issues were observed.

Fertiliser Application Equipment Calibrations

Only two farms did not have current calibrations for their broadcast spreading equipment. These were tested using trays and analyses completed using the FertSpread.nz calculator. Both showed that acceptable uniformity was being achieved; although one old system required a double pass to get the desired rate and spread. Copies of FertSpread calibration reports are attached as Appendix 3.

Placement equipment used in planting or side-dressing was reported calibrated by the operators who did not wish to have machines retested. Computer controls indicate satisfactory overall application rates but did not necessarily compare individual outlet rates.

Appendix 1 Formal inclusion of SVS Scientific Team member

Copy of email communications

RE: Process Crop Nitrates and SVS

Reply | Reply All | Forward

AB Andrew Barber <andrew@agrilink.co.nz>
To Dan Bloomer
Mon 14/02/2022 4:11 pm

You replied to this message on 14/02/2022 7:55 pm.

Landowner Agreement SVS Final (S7) signed.pdf
471 KB

Hi Dan,
Yes he would definitely be your man.

How are you getting on with the Brownrigg site agreement? It is the last one that we need to finalise.

Cheers, Andrew

From: Dan Bloomer <dan@pagebloomer.co.nz>
Sent: Monday, 14 February 2022 2:17 PM
To: andrew@agrilink.co.nz
Subject: Process Crop Nitrates and SVS

Hi Andrew
MPI have approved our project and we were given go early permission months ago. Now they are trying to finalise the contract and are asking us to have *Formal inclusion of a member of the Sustainable Vegetable Systems scientific team on the project's Advisory Group.* I have Bruce Searle formally noted in the contract, would he be the person to meet the MPI request?
Cheers

Dan

Dan Bloomer

RE: SVS and Process Crops

Reply | Reply All | Forward

BS Bruce Searle <Bruce.Searle@plantandfood.co.r
To Dan Bloomer
Tue 22/02/2022 12:02 pm

You forwarded this message on 22/02/2022 2:30 pm.

HI Dan,

Apologies for a delayed reply!

Yes, happy to be involved

Cheers
Bruce

From: Dan Bloomer <dan@pagebloomer.co.nz>
Sent: Tuesday, 22 February 2022 9:53 am
To: Bruce Searle <Bruce.Searle@plantandfood.co.nz>
Subject: RE: SVS and Process Crops

Hi
MPI would like an email saying yep
Cheers
Dan

From: Dan Bloomer
Sent: Tuesday, 15 February 2022 9:25 am
To: Bruce.Searle@plantandfood.co.nz
Subject: SVS and Process Crops

Hi Bruce
MPI have asked me to have *Formal inclusion of a member of the Sustainable Vegetable Systems scientific team on the project's Advisory Group* in the Process Crops nitrate project. Given you are getting a contract to be in PCN are you OK for me to notify them of that? I asked Andrew Barber what he thought, and he says you too.
Cheers
Dan

Dan Bloomer

Appendix 2: Pre-Plant Nutrient Budget and Fertiliser Plan

LandWISE INCORPORATED

Nitrogen Budget - Fertiliser Plan

Created on 22-06-2022

Admin

Grower/ Agronomist Dan#2
Trading name LandWISE

Paddock

Paddock name Tiko Pivot Farm Rate
Area 20 ha

Crop

Crop name Sweetcorn (high)
Expected yield 24 t/ha
Planting date 26-11-2021
Nitrate Quick Test 53 kg N/ha
Recommended N 250 kg N/ha

Inputs

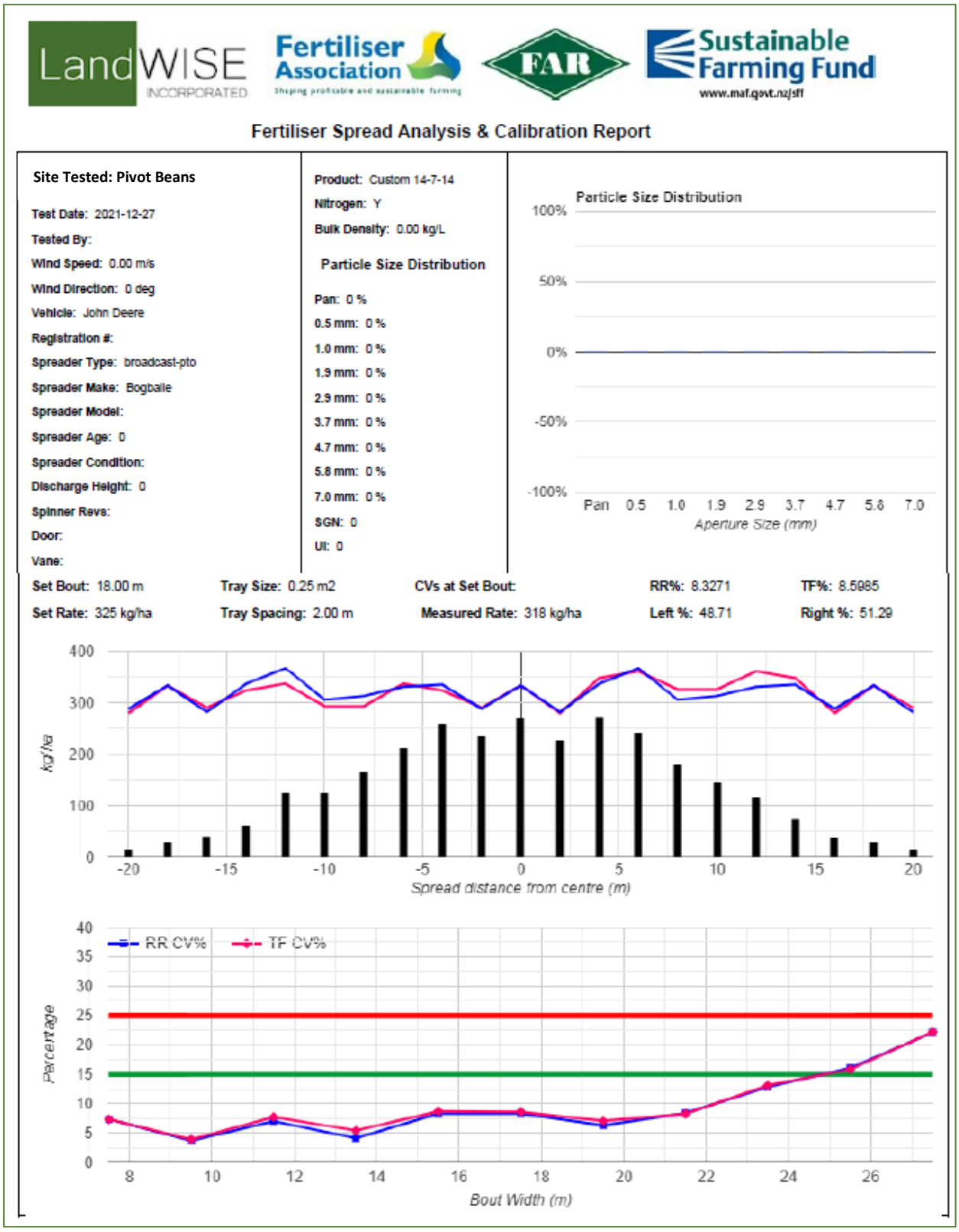
Residue N					0 kg N/ha
Fertiliser planned	**Total**	**%N**	**Rate**		**N rate**
Cropzeal 16N	4,000 kg	14.8	200 kg/ha	+	30 kg N/ha
CropMaster DAP	1,000 kg	17.6	50 kg/ha	+	9 kg N/ha
Cropmaster 15	5,800 kg	14.8	290 kg/ha	+	43 kg N/ha
			Total input	=	81 kg N/ha

Total input		81 kg N/ha
Recommended N	–	250 kg N/ha
Planned Nitrogen Variance Positive = N surplus Negative = N deficit	=	- 169 kg N/ha

Development of this calculator was supported by funding from MPI Sustainable Farming Fund, Horizons Regional Council, Potatoes NZ, Ballance AgriNutrients, Gisborne District Council and LandWISE Inc. It uses information from "Nutrient Management for Vegetable Crops in New Zealand" by JB Reid and JD Morton, published in 2019. Book preparation was jointly funded by Plant & Food Research (Sustainable Agricultural Ecosystems Programme), the Fertiliser Association of New Zealand, and the Vegetable Research and Innovation Board of Horticulture New Zealand Incorporated.

Appendix 3: Fertiliser Calibrations

Bogballe



Agriquip (older)

Fertiliser Spread Analysis & Calibration Report

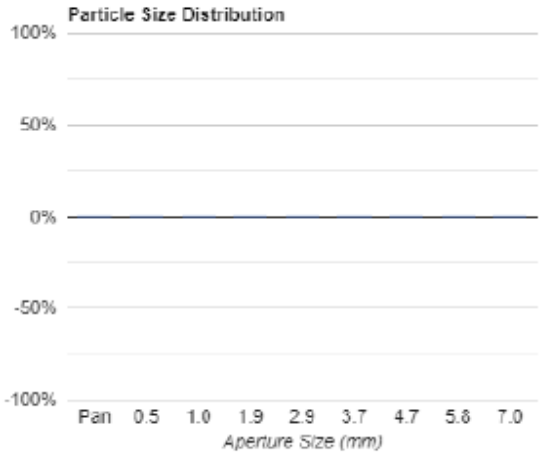
Site Tested: Tiko Rd Corn

Test Date: 2021-12-30
Tested By
Wind Speed: 0.00 m/s
Wind Direction: 0 deg
Vehicle: Ford
Registration #:
Spreader Type: broadcast-pto
Spreader Make: Agriquip
Spreader Model: SP500P
Spreader Age: 35
Spreader Condition: Average
Discharge Height: 76
Spinner Revs:
Door:
Vane:

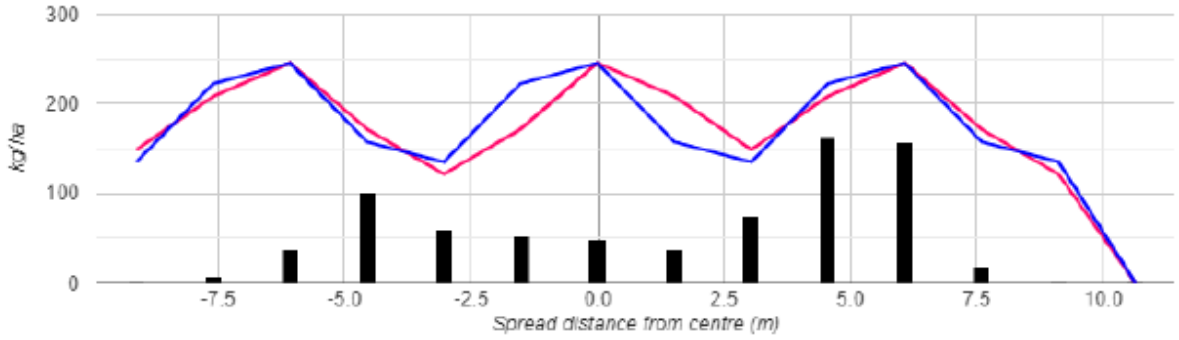
Product: Cropmaster15
Nitrogen: Y
Bulk Density: 0.00 kg/L

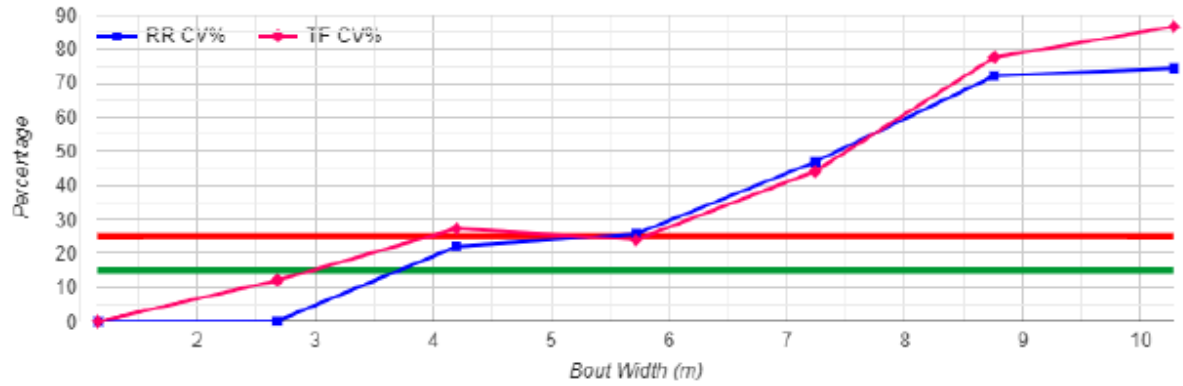
Particle Size Distribution

Pan: 0 %
0.5 mm: 0 %
1.0 mm: 0 %
1.9 mm: 0 %
2.9 mm: 0 %
3.7 mm: 0 %
4.7 mm: 0 %
5.8 mm: 0 %
7.0 mm: 0 %
SGN: 0
UI: 0



Set Bout: 6.10 m
Set Rate: 290 kg/ha
Tray Size: 0.25 m2
Tray Spacing: 1.52 m
CVs at Set Bout:
Measured Rate: 186 kg/ha
RR%: 25.6823
Left %: 36.31
TF%: 23.9706
Right %: 63.69





Appendix 4: Grower Nitrogen Management Survey

Introduction

The survey conducted was a development of the Fertiliser Association Nutrient Code of Practice, a format previously used in the SFFF project, "Future Proofing Vegetable Production". Growers were asked whether they always, usually, sometimes or never completed each management practice listed.

The six growers interviewed to date together produce about 750 ha of process crops annually, in addition to other cereal, maize, squash and onion crops.

Summary

This is a very small sample size, and four major Hawke's Bay process crop growers are not represented.

In contrast to growers in other regions such as Horizons and Gisborne, the Hawke's Bay growers show lower use of Land Management Units and lower adoption of risk management practices typically associated with environmental farm planning. This is likely to change as newer regulations come into force, and growers become used to the language.

Nutrient management and application records kept reflect requirements of other environmental management schemes such as NZ GAP and processor requirements.

Only one grower reported "Always" using nutrient budgets, and one "Usually" uses them, with a nutrient budget defined for this survey as "a written record with calculations to demonstrate justified use". However, growers do report taking into consideration the factors that would contribute to a formally prepared budget.

Practices such as ensuring fertilisers are fully contained during transport, storage and handling are generally adopted. Most recommended practices for application are generally met.

Sections

1. Risk Assessment

Management practices	Never	Sometimes	Usually	Always	N/A
Land Management Units (LMUs) are identified for all farmed blocks	33.3	16.7	0	0	50
Surface water bodies that may be affected are identified for all blocks	33.3	0	33.3	33.3	0
The current nutrient load status in surface water is checked	100	0	0	0	0
Ground water bodies that may be affected are identified for all blocks	33.3	0	33.3	33.3	0
The current nutrient load status in ground water is checked	83.3	0	16.7	0	0
A nutrient management plan is prepared for each LMU	33.3	16.7	0	0	50
A nutrient risk assessment is completed for each LMU	33.3	16.7	0	0	50
Risk assessment considers contamination of surface and ground waters	33.3	0	33.3	33.3	0
Risk assessment considers undesired changes in soil nutrient status (+)	33.3	16.7	16.7	0	33.3
Risk assessment considers fertiliser application to non-target land	16.7	0	33.3	33.3	16.7
Risk assessment considers accumulation of non-nutrient impurities in soil	33.3	0	33.3	33.3	0
A sediment management plan is completed for each LMU	33.3	16.7	0	0	50
A sediment risk assessment is completed for each LMU	33.3	16.7	0	0	50

2. Nutrient Records

Management practices	Never	Sometimes	Usually	Always	N/A
Nutrient management records are kept	16.7	0.0	0.0	83.3	0.0
Nutrient management records cover fertiliser types	16.7	0.0	0.0	83.3	0.0
Nutrient management records cover application rates	16.7	0.0	0.0	83.3	0.0
Nutrient management records cover timing of application	16.7	0.0	0.0	83.3	0.0
Nutrient management records cover non-fertiliser additions	16.7	16.7	0.0	66.7	0.0
Nutrient management records cover untreated areas (buffer zones, headlands)	50.0	0.0	33.3	0.0	16.7
Nutrient management records cover soil and herbage test results	0.0	0.0	33.3	66.7	0.0
Nutrient management records cover surface water measurements	50.0	0.0	16.7	0.0	33.3
Nutrient management records cover ground water measurements	50.0	0.0	16.7	33.3	0.0
Nutrient management records cover risk factors – irrigation, rainfall	16.7	0.0	50.0	33.3	0.0
GPS and GIS technology are used for precise recording	50.0	16.7	16.7	16.7	0.0

3. Nutrient Budget

Management practices	Never	Sometimes	Usually	Always	N/A
A nutrient budget is prepared	66.7	0.0	16.7	16.7	0.0
Nutrient budget is supported by soil testing	66.7	0.0	16.7	16.7	0.0
Nutrient budget includes nutrients in mineral fertilisers	66.7	0.0	16.7	16.7	0.0
Nutrient budget includes nutrients in organic fertilisers or amendments	66.7	0.0	16.7	16.7	0.0
Nutrient budget includes nutrients in crop and/or stock returns	66.7	0.0	16.7	16.7	0.0
Nutrient budget includes nutrients from soil fixation and mineralised OM	66.7	0.0	16.7	16.7	0.0
Nutrient budget includes nutrients in irrigation and rainfall	66.7	16.7	0.0	16.7	0.0
Nutrient budget includes nutrients in produce leaving the block	66.7	0.0	16.7	16.7	0.0
Nutrient budget includes nutrients leaching below the root zone	66.7	16.7	16.7	0.0	0.0
Nutrient budget includes nutrients in runoff including sediments	83.3	0.0	16.7	0.0	0.0
Nutrient budget includes nutrients fixed or immobilised in soil	66.7	0.0	33.3	0.0	0.0
Nutrient budget includes nutrients lost to the atmosphere	66.7	0.0	33.3	0.0	0.0

4. Fertiliser Use

Management practices	Never	Sometimes	Usually	Always	N/A
Fertiliser is fully contained during transport, storage and handling	0.0	0.0	0.0	100.0	0.0
N, P and soluble fertilisers contained within storage area on impervious floor protected from rain	0.0	0.0	0.0	83.3	16.7
Storage facilities >50m from waterways, avoiding areas subject to slope failure or significant flood risk	0.0	0.0	16.7	66.7	16.7
All storm water discharges are collected and diverted away from the storage area	0.0	0.0	16.7	66.7	16.7
The storage facility is designed to effectively contain stored fertiliser	0.0	0.0	16.7	66.7	16.7
Fertiliser loading sites >50m from any open waterway or wetland on areas not susceptible to flooding	16.7	0.0	33.3	50.0	0.0
Vegetated riparian buffer strips of sufficient width (10m – adjust for slope) to filter any run-off are maintained adjacent to all waterways	16.7	16.7	16.7	33.3	16.7
Fertiliser spills on the loading area are collected and returned to the storage facility	33.3	0.0	0.0	66.7	0.0
Excess or unwanted fertiliser is spread onto suitable land or crops	0.0	0.0	16.7	83.3	0.0
Selected fertilisers best meet identified nutrient needs while minimising environmental risks	0.0	0.0	0.0	100.0	0.0

5. Application Rate

Management practices	Never	Sometimes	Usually	Always	N/A
Fertiliser application rate for situation based on rate of nutrient required by the plants	0.0	0.0	33.3	66.7	0.0
Application rate considers soil and plant tissue analysis results	0.0	33.3	33.3	33.3	0.0
Application rate considers nutrient budget reports	0.0	16.7	0.0	16.7	66.7
Application rate considers crop type, yield and quality targets	0.0	0.0	0.0	100	0.0
Application rate considers maintenance or capital needs	0.0	0.0	16.7	83.3	0.0
Application rate considers local fertiliser trials	16.7	50.0	16.7	16.7	0.0
Application rate considers local land manager experience	0.0	0.0	16.7	83.3	0.0
Application rate considers previous crop and fertiliser history on-site	50.0	0.0	0.0	50.0	0.0
Application rate considers difference LMU requirements	16.7	0.0	0.0	16.7	66.7
Application rate is limited where groundwater underlies permeable soil	50.0	16.7	16.7	16.7	0.0
Application rate is limited where there is a high water-table	50.0	0.0	0.0	33.3	16.7
Application rate is limited on areas with mole and tile drainage	50.0	16.7	0.0	16.7	16.7
Application frequency matches nutrient availability to plant demand	0.0	0.0	33.3	66.7	0.0
Mobile nutrients are applied in split applications	0.0	0.0	16.7	83.3	0.0
Highly mobile nutrients are applied when plants are actively growing	0.0	0.0	0.0	100	0.0
Nitrogen fertilizer is applied in split dressings of 50 kg N/ha when 200 kg N/ha is required	0.0	0.0	33.3	0.0	66.7
Nitrogen is applied in proportion to other nutrients according to plant requirements	0.0	0.0	33.3	66.7	0.0
Soluble P fertiliser applied in split dressings if single application rate >100kg P/ha	0.0	0.0	16.7	16.7	66.7
Phosphate is applied in proportion to other nutrients, according to plant requirements	0.0	0.0	33.3	66.7	0.0

6. Application Technique

Management practices	Never	Sometimes	Usually	Always	N/A
The selected application method applies nutrient sufficiently accurately for its purpose	0.0	0.0	33.3	66.7	0.0
Application method is suitable for the terrain and soil conditions	0.0	33.3	16.7	50.0	0.0
Application method is suitable for the fertilizer type	0.0	0.0	0.0	100	0.0
Application method is certified to meet accuracy requirements	0.0	0.0	33.3	66.7	0.0
Application timing considers rainfall forecasts and irrigation plans	0.0	0.0	16.7	83.3	0.0
Nitrogen is not applied when 10cm soil temperature at 9am is less than 6ºC and falling	0.0	0.0	0.0	16.7	83.3
GPS and GIS technology are used for precise application	0.0	16.7	0.0	83.3	0.0
Non-target application is avoided by direct placement	0.0	0.0	16.7	66.7	16.7
Non-target application is avoided by application in bands when sowing	16.7	0.0	0.0	83.3	0.0