CODE OF PRACTICE

For the Placement of Fertiliser in New Zealand

The Spreadmark Code of Practice

1. Introduction

The Spreadmark programme was established by the NZ Groundspread Fertilisers Association in 1994. It was subsequently expanded by a group with representatives from Federated Farmers, the NZ Groundspread Fertilisers Association, the NZ Agricultural Aviation Association, fertiliser companies the Fertiliser Association of New Zealand.

The Spreadmark scheme is a fertiliser placement quality assurance programme. It has as its objective the placement of fertilisers in locations where they can be of the most agricultural benefit and the least environmental harm. The scheme registers fertiliser spreading companies, both aerial and groundspread, provided they have certified spreading machinery, trained operators and an appropriate quality management system which ensures that farmer/grower outcomes are met and environmental sustainability is protected. Overall systems are subject to a regular independent audit to ensure that both farmers/growers and Regional Councils can have confidence in the programme.

There is no doubt that the proper placement of fertiliser is of considerable agronomic benefit to farmers and growers and will help protect the environment from the undesirable side effects of poor fertiliser spreading practices.

The precision placement of fertiliser depends on a number of factors. It requires the careful integration of operator skills, sound equipment and appropriate fertilisers. It is the integration of these factors that is at the heart of the Spreadmark scheme.

Registration is voluntary but the scheme has been designed and will be operated and promoted in such a way as to encourage all reputable operators to become involved.

The Spreadmark scheme is governed by the Fertiliser Quality Council. This Council has representatives from fertiliser user groups, fertiliser applicators and fertiliser manufacturers.

The Spreadmark scheme operates closely with its sister scheme, Fertmark. The two schemes operate to ensure that high quality fertiliser is manufactured, mixed and spread in a way that precision agriculture is fostered and the environment is protected. Both programmes have strong links to the Code of Practice for Fertiliser Use.

This Code is structured in three parts:

- The Spreadmark Operational Rules
- Groundspread Fertiliser Application Practices
- Aerial Fertiliser Application Practices

Anders Crofoot
Chairman Fertiliser Quality Council

Spreadmark operation rules

This section of the Spreadmark Code of Practice contains the Operational Rules that relate to both the aerial application of fertiliser and the groundspread application of fertiliser. Information that relates specifically to Groundspread Fertiliser Application Practices and/or Aerial Fertiliser Application Practices can be found in the sections following this.

2. TABLE OF CONTENTS

3. Acknowledgements

The Fertiliser Quality Council gratefully acknowledges the contribution of the following groups - without whose input this scheme would not have been possible:

1. NZ Groundspread Fertilisers Association for creating the original Spreadmark scheme and contributing to its further development.

2. Federated Farmers NZ Inc, and in particular Graham Robertson as inaugural Chairman and Kevin Geddes, as Executive Director for driving the development of this Code.

3. The Fertmark registered fertiliser companies for contributing funding and for providing inputs during the development of the Code.

4. The Ministry for the Environment for representing the interests of the environment and for providing funding.

5. The Fertiliser Manufacturers' Research Association of NZ (FertResearch) for providing funding and for inputs during the Code's development.

6. The Centre for Precision Agriculture, Massey University and Lincoln Ventures Limited for technical input.

7. The Sustainable Farming Fund of the Ministry of Agriculture and Forestry for providing funding and recognising the value of the programme.

8. Agmardt for providing funding support in the early stages of the Spreadmark project.

9. The NZ Agricultural Aviation Association for contributing funding and for providing inputs during the development of the Code.

4. Glossary of terms

TERM	EXPLANATION
Approved Aerial Pattern Test Certificate	This is a report produced by an Approved Spreading Equipment Tester that the fertiliser application equipment has been tested and the track spacing (bout width) required to achieve a CV% of 15 for nitrogenous fertiliser and 25% for all other products has been shown. The report will also include other data collected, as required.
ACVM Act	The Agricultural Compounds and Veterinary Medicines Act 1997.
Bout Width (BW)	The distance between successive passes or runs of an aircraft or ground spread vehicle. See also track spacing.
Buffer Zone	The distance between an identified sensitive area and the edge of an area where fertiliser is being applied
Bulk Density (BD)	The weight per unit volume of bulk fertiliser, kg per m^3 or tonnes per m^3 (t/m^3).
CAA	Civil Aviation Authority.
CV%	Coefficient of variation. It is the ratio of the standard deviation to the mean and is used to indicate the evenness of spread. A CV% of zero would mean perfectly even spreading.
Fertiliser	Any substance that is primarily intended to sustain or increase growth, productivity or quality of plants or animals through application of essential nutrients to the plant or soil. The term fertiliser includes lime and can be in a solid or fluid form. ***Note*** that the term nutrient in the Spreadmark Code relates only to those substances that fit the above definition.
GIS	Geographical information system – an "electronic" or computerized map.
GPS	Global Positioning System.
HSE Act	The Health and Safety in Employment Act 1992.
HSNO Act	The Hazardous Substances and New Organisms Act 1996.
MCTOW	Maximum certified take-off weight.
Micron	A length measurement. I mm = 1000 microns.

Nitrogenous Fertiliser	A fertiliser with more than 3.0% total nitrogen.
Nutrient Budget	Statement of the total nutrient balance for a farm taking into account the starting (nutrient pool) and finishing positions (objective for nutrient status).
Nutrient Management Plan	A nutrient management plan (NMP) is a written plan that describes how the major plant nutrients (nitrogen, phosphorous, sulphur and potassium) are to be managed annually on a particular farm or part of a farm.
NZAA	New Zealand Agricultural Aviation Association
NZGFA	New Zealand Groundspread Fertilisers Association
Operator	Owner or proprietor of an aerial application company. The operator in many cases is also the pilot. For ground applications the term operator means the driver.
OSH	Occupational Safety and Health
Overseer	A computerized system for nutrient budgeting
RMA	The Resource Management Act 1991
SDS	Safety Data Sheet
Sensitive Area	Any area where fertiliser should not be applied. Sensitive areas, for example water, wetlands, organic farms (for some fertiliser) may be designated in a Regional Council resource plan.
SGN	Size Guide Number – the mean or average particle size, expressed as mm x 100. e.g., SGN of 350 = 3.50 mm diameter.
Specific Gravity	The ratio of the mass of a given volume of a substance to the mass of an equal volume of water. The load (weight) carried by an agricultural aircraft is usually indicated by the volume in the hopper. Some fertilisers which have a high specific gravity (.e.g., suspension) can lead to overloading.
Spreader	Any device or system fitted to the hopper outlet that is designed to increase the spreading width of fertiliser as it is discharged.
Spreadmark Registered	The application equipment used has been pattern tested and the operator has satisfied the audit requirements for NZAAA Registration or Spreadmark Registration.
Standard Deviation	A statistical term which means a measure of the extent of scatter of sample values about their mean value. About two thirds of sample values will be within one standard deviation on either side of the mean. It is the square root of the sum of the squares of the differences between each of the sample values and the mean value divided by the number of samples minus one.

Suspension Fertiliser	The solid fertiliser components have been ground to reduce particle size and mixed with water to form a suspension. Note that the solid particles will settle out of suspension if the particle size is too large. Also note that the specific gravity of the suspension can be higher than solid fertilisers.
Swath Width	The width of a spread pattern from one pass of the aircraft or ground spread vehicle.
UI	Uniformity Index – a ratio of small particles to large particles and indicates the range of particle sizes. A UI of 100 would mean all particles are the same size. For “well granulated” fertilisers (e.g., DAP) the UI is normally about 50. For fertilisers with a wide range of sizes the UI may be less than 10.

5. Document control

All of the documents in the Spreadmark Code of Practice will be controlled. Each part of the Code will have name, version date and page number.

Changes will only be made to the Spreadmark Code after they have been approved by an AGM of the Fertiliser Quality Council.

The updated version of the Spreadmark Code will be placed on the website of the Fertiliser Quality Council (www.fertqual.co.nz).

6. Constitution

The following document is the official constitution of the Fertiliser Quality Council. It has been lodged with the Registrar of Incorporated Societies. If changed, the amended copy must be lodged.

The Constitution defines the scope, authority and membership of the Fertiliser Quality Council and the Fertiliser Quality Council Executive Committee. The Executive Committee represents the interests of users and is advised by appointed technical experts. The Council has a wider representation and oversees fees and changes to rules.

CONSTITUTION OF THE FERTILISER QUALITY COUNCIL (INCORPORATED)
A REGISTERED SOCIETY UNDER THE INCORPORATED SOCIETIES ACT 1908

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1 NAME

The name of the Society will be the Fertiliser Quality Council Inc. formerly called Fertmark Society Incorporated, hereafter referred to as the "Fertiliser Quality Council" or "the Society".

2 OBJECTS

The objects of the Society is to administer under licence, from the proprietor of the Fertmark registration, the Spreadmark registration and the Aerial Spreadmark registration (the "Codes"), the registration processes and all relevant matters, for the benefit of the New Zealand agricultural industry.

3 POWERS

The Society will have the powers of a natural person.

4 MEMBERSHIP

The members of the Society are:

- Federated Farmers of New Zealand Inc. [Founder Member]
- Horticulture New Zealand [Inc]
- NZ Institute of Primary Industry Management [Inc]
- New Zealand Groundspread Fertiliser's Association [Inc]
- Aviation Industry Association of New Zealand represented by New Zealand Agricultural Aviation Association.
- Fertiliser Association of New Zealand [Inc]
- The Chairman of the Fertiliser Quality Council.

5 VOTING

5.1 The voting rights of the Society will be divided into two groups: founder member 4 votes, ordinary members 1 vote each.

5.2 Federated Farmers of New Zealand Inc will have 4 votes,
Horticulture New Zealand 1 vote;
New Zealand Institute of Primary Industry Management 1 vote;
New Zealand Groundspread Fertiliser's Association 1 vote;
Aviation Industry Association of New Zealand, represented by New Zealand Agricultural Aviation Association 1 vote;
Fertiliser Association of New Zealand 1 vote;
Chairman of the Fertiliser Quality Council 1 vote, plus 1 casting vote.

5.3 At AGM's or EGM's, 50% of the members of the Society will form a quorum, provided that one member of the quorum is the representative of the Founder Member.

6 QUALIFICATION FOR MEMBERSHIP OF THE SOCIETY [Executive Committee]

6.1 Any person or incorporated group who at the discretion of the Executive Committee [refer to Clause 9] has a sufficient interest in, or is significantly affected by the activities of the Society. The decision of the Executive Committee will be final.

6.2 A member will continue to be a member of the Society until a notice in writing is given to the Executive Committee of the member's intention to resign.

6.3 A member will continue to be a member of the Society until such time as the Executive Committee resolves that the member no longer has a sufficient interest in, or is sufficiently affected by, the activities of the Society. No determination will be made by the Executive Committee unless the member has had no less than 12 days notice of a meeting at which the determination will be made. A member subject to such a process will have the right to address the Executive Committee at such a meeting. The decision of the Executive Committee will be final.

7 REVOCATION OF MEMBERSHIP

Any member whose conduct is inimical to the purpose of the Society will be expelled by a unanimous vote at a meeting of the Executive Committee. An expulsion order will not be made unless the member has had no less than 12 days notice of the meeting. A member subject to such processes will have the right to address the Executive Committee at such meeting. The decision of the Executive Committee will be final.

8 MANAGEMENT

8.1 Subject to the direction of the Annual General Meeting, or an Extraordinary General meeting of the Executive Committee of the Society, the management and control of the Society will be vested in the Executive Committee.

8.2 Annual General Meeting [AGM]. An AGM will be held within a year of the close of the Society's financial year.

8.3 The AGM of the Society will elect the Chairman, who must be a user or a representative of users of fertiliser.

8.4 The Chairman will review the past year's work and submit a report and the financial statements. A financial reviewer will be appointed. The names of representatives of members to the Executive Committee will be tabled.

8.5 The AGM of the Society will determine the membership of Ordinary Members of the Executive Committee for the forthcoming year and shall elect the members to that committee.

9 FERTILISER QUALITY COUNCIL EXECUTIVE COMMITTEE

9.1 Membership of the Executive Committee of the Society will be restricted to representatives of users of fertilisers, and/or persons representing Industry Associations, or persons schooled in the technology of fertiliser and/or fertiliser placement. The AGM of the Society will be free to co-opt other persons with any necessary technical knowledge to the Executive Committee as it believes fit.

9.2 An Ordinary committee member will hold office for a term of 1 year, at which time the member will be eligible for reappointment.

9.3 The Executive Committee will meet at such times and at such places as the Chairman thinks fit.

9.4 The Executive Committee may be convened by notice agreed to by three committee members and filed with the Executive Director. Within ten working days of receipt of such notice the Executive Director shall advise all Committee members of the date of meeting. Such a meeting shall be held within ten working days of the date of filing of the notice.

9.5 The Executive Committee will fix the date and venue of the AGM which will be advised in writing to all members.

9.6 Any vacancy occurring on the Executive Committee may be filled by an appointment made by the Chairman after consultation with the Committee. Such an appointment will hold office until the close of the next AGM or until a successor has been appointed and accepted office.

9.7 Fifty percent [50%] of the members of the Executive Committee will form a quorum, provided that one of the quorum represents the Founder Member.

10 FERTILISER QUALITY COUNCIL FORUM [FQC FORUM]

10.1 There will be a Forum of the Society which will meet annually, or more frequently as needed.

10.2 If present the Chairman of the Society will preside over the meeting of the FQC Forum.

10.3 If the Chairman is not present, the Society Members will elect one of their representatives to preside over the meeting of the FQC Forum.

10.4 All Members of the Society and all current registered users of the Codes will be members of the FQC Forum. Current registered users of the Codes or their representatives will enjoy full speaking rights.

10.5 The FQC Forum may consider such fees schedules and changes to the Constitution, Codes and Operational Rules as are needed; and approve the appointment of the auditors of the Codes. The FQC Forum may approve the appointment of a financial reviewer. The FQC Forum will operate by general consensus to decide on such approvals. Where general consensus is reached, the Executive Committee may implement changes by exercising Clause 15. Where consensus cannot be reached, the Executive Committee will make a decision based on the best interests of the Society and implement that decision using the provisions of Clause 15.

11 FINANCIAL YEAR

The financial year of the Society will end on 30 June.

12 COMMON SEAL

The Executive Director will be the custodian of the Common Seal which will be affixed by him/her only on the authority of the Executive Committee to such documents as are signed by the Chairman and the Executive Director or in such other manners as the Executive Committee may decide. A schedule of all documents to which the seal has been fixed will be tabled at each Executive Committee meeting.

13 CONTROL AND INVESTMENT OF FUNDS

13.1 All monies received by the Society will be banked in such banking institutions as the Executive Committee decides upon. Such banking accounts will be operated upon the authority and signature of the Executive Director or other such officers as appointed by the Executive Committee.

13.2 True and fair accounts of the assets and liabilities of the Society will be kept. This will include the annual income and expenditure of the Society.

13.3 All income and property must be used solely for the promotion of the Society's Purpose, and no amount or asset may be given or distributed to any Members, except as is reasonable payment for their services.

14 EXECUTIVE DIRECTOR

An Executive Director will be appointed by the Chairman after consultation with the Executive Committee on such terms and conditions as determined by the Executive Committee.

15 ALTERATION OF THE CONSTITUTION, RULES OR CODES OF THE SOCIETY

15.1 Subject to Rule 10.5, these Rules or Codes (but not the Constitution) may be changed by the Executive Committee once a meeting of the FQC Forum has been held to consider such changes. Notice of any proposed change will be given to the Executive Director, not less than 30 days before the date of the FQC Forum. The Executive Director will forward a copy of the proposed changes to Current Registered Users of Fertmark, Spreadmark and Aerial Spreadmark, members of the Society and the FQC Forum, no less than 21 days before any meeting of the FQC Forum.

15.2 Subject to Rule 10.5, the Constitution may be changed by the Annual General Meeting of the Society. Notice of any proposed change will be given to the Executive Director, not less than 30 days before the date of the FQC Forum. The Executive Director will forward a copy of the proposed changes to Current Registered Users, Members of the Society and the FQC Forum no less than 21 days before any meeting of the FQC Forum. Notice to the FQC Forum will also suffice as notice to the Members of the Society for any Annual General meeting of the Society held after the FQC Forum that the proposed Constitution change was considered.

17 LIQUIDATION

17.1 The procedures prescribed in the Incorporated Societies Act 1908 and its Amendments will be followed in the event that the Society was to wind up.

17.2 In the event of the winding up of the Society, the accumulated funds and property of the Society will be left as directed by a majority of the members of the Society, but on no account will funds or property be distributed amongst the members.

18 INTERPRETATION

Any matter that arises which is not provided for in these rules or in the interpretation of these rules, will be decided by the Executive Committee whose decision will be final.

7. Spreadmark Operational Procedures

This section of the Spreadmark Code of Practice contains the following Spreadmark operational procedures:

7.1 Spreadmark Procedure for Complaints; and

7.2 Spreadmark Disciplinary and Deregistration Procedures.

7.1 SPREADMARK PROCEDURE FOR COMPLAINTS

Scope

This is the procedure for the making and resolving of complaints laid by one Spreadmark registered company against another in respect to an alleged breach of any Spreadmark rule. It is also the procedure for farmers or growers or fertiliser companies who wish to use the Spreadmark Scheme as a means of complaining about poor practice.

COMPLAINTS PROCEDURE WHERE THE COMPLAINANT IS A SPREADMARK REGISTERED SPREADING COMPANY OR A FERTMARK REGISTERED COMPANY

1. Before making a formal approach to the Fertiliser Quality Executive Committee (“the Executive Committee") it is expected that the complainant member will have made contact with the company complained against, in an effort to resolve the matter. The complainant company must notify the Executive Director of such action at the time the approach is made. If the Executive Director considers that it may be useful to facilitate a speedy resolution to a potential complaint the Executive Director may alert the Spreadmark Auditor or the Executive Committee or an Expert Panel to the potential for a complaint developing or may convene either group for advice.

   If the two companies resolve the issue the Executive Director must be informed so that there can be verification that the conditions agreed to are in compliance with Spreadmark policy.

2. When placing a complaint before the Executive Director, the written submission from the complainant should define the clauses of the Spreadmark Rules considered to be breached, and advise measures taken to resolve the matter with the defendant company.

3. On receipt of the complaint, the Executive Director (or their nominee) will seek to arrange a mediation meeting of the parties in an endeavour to reach a resolution within a period of no more than 20 working days.

4. If the mediation meeting called by the Executive Director is declined or fails to settle the complaint, the Executive Director (or their nominee) may present the case for resolution to the Executive Committee in accordance with the Spreadmark Disciplinary Procedures and within 10 working days of the mediation failing.

5. Any costs incurred in this Complaints Procedure will lie where they fall.

COMPLAINTS PROCEDURE FOR FARMERS AND GROWERS AGAINST A SPREADMARK REGISTERED COMPANY

1. Before making a formal approach to the Fertiliser Quality Council Executive Committee ("The Executive Committee") it is expected that the complainant will have made contact with the company being complained against, in an effort to resolve the matter.

2. To be considered, complaints by farmers or growers must be in writing and should advise measures taken to resolve the matter with the defendant company.

3. On receipt of the complaint, the Executive Director (or their nominee) will seek to arrange a mediation meeting of the parties in an endeavour to reach a resolution within a period of no more than 20 working days.

4. If the mediation meeting called by the Executive Director is declined or fails to settle the complaint, the Executive Director (or their nominee) may present the case for resolution to the Executive Committee in accordance with the Spreadmark Disciplinary Procedures. The Executive Director may also choose to seek independent advice as to the likely validity of any complaint.

5. Any costs incurred in this Complaints Procedure will lie where they fall. Before costs are incurred by the Expert Committee or the Auditor it will have been decided who is paying them.

7.2 Spreadmark disciplinary and deregistration procedure

Scope

This is the procedure for the proper resolution of issues which may lead to sanctions being applied to a Spreadmark registered company.

1. The sanctions that the Fertiliser Quality Council Executive Committee (the Executive Committee) may apply to members for serious breaches of the Spreadmark Rules are public statements and expulsion. These sanctions can be applied where there are clear and serious breaches of the Spreadmark Rules which are sufficient to damage the integrity of Spreadmark or which may mislead fertiliser users.

2. Where in the opinion of the Executive Director, there is clear and serious breach of the Rules, the Executive Director may convene a meeting of the Executive Committee and advise the relevant company that this action has been taken. The Executive Director may commission an investigation by the Auditor.

3. The Executive Committee will consider such written material as is supplied and will decide on an appropriate course of action. The meeting may be held by a physical meeting or by teleconference and shall be held within 10 working days of the Executive Director deciding there is a clear and serious breach.

4. If the Executive Committee considers that there are matters of a technical nature to be resolved, these may be referred to an Expert Group for an opinion. Where this occurs, the Convenor of the Expert Group shall be one of the members of the Executive Committee who have been co-opted onto the Committee for their technical expertise. The Expert Group shall report to the Executive Committee within 20 working days of the matter being referred to it.

5. When the Executive Committee has reached a decision the affected parties will be advised.

6. If the Executive Committee proposes to make a public statement the Defendant member shall be advised in writing by registered mail and by fax of the proposed publicity and be given at least five working days to respond. The five days will be from the date of receipt of the registered letter which will be deemed to be two working days after its dispatch. The response will be considered by the Executive Committee before it issues its public statement

7. If either of the Parties are unwilling to accept the decision of the Executive Committee made under clause 5, they may appeal that decision to a sole arbitrator.

8. The appeal will take place pursuant to the Arbitration Act 1996, save that clauses 4 (determination of preliminary point of law) and 5 (appeals on questions of law) of Schedule 2 shall not apply. The place of arbitration shall be Wellington, New

Zealand. The jurisdiction of the sole arbitrator will be limited to questions of law and procedural fairness. The sole arbitrator may, in its discretion, vary, revoke or remit a decision of the Executive Committee only in the event (and to the extent) that the sole arbitrator concludes that the Executive Committee has made an error of law or has acted in a procedurally unfair manner.

Any appeal must be lodged by the appellant serving a notice of appeal on the other Party and the Fertiliser Quality Council (naming both entities as respondents to the appeal), within fourteen (14) days of the date on which the decision appealed against was communicated to the appellant. The notice of appeal must specify the grounds of the appeal in sufficient detail to identify the issues raised by the appeal.

Within seven (7) further days, the other Party and the Fertiliser Quality Council must each indicate whether they intend to oppose the appeal, in which case they must do so by serving on the appellant and the other Party or the Fertiliser Quality Council (as the case may be) a notice of opposition to the notice of appeal.

The appellant and (provided they have filed a notice of opposition) the other Party and the Fertiliser Quality Council shall endeavour to jointly agree upon the identity of a sole arbitrator. If they cannot jointly agree within seven (7) days following the service of the notice of opposition, any party to the appeal may request the President of the Arbitrators' and Mediators' Association of New Zealand to appoint the sole arbitrator.

Within fourteen (14) days following the service of the notice of appeal, the Fertiliser Quality Council must make available to all Fertmark registered companies [and members of the Fertiliser Quality Council] a copy of the notice of appeal and, if applicable, a copy of any notices of opposition to the appeal.

Within seven (7) further working days, any Fertmark registered company [or member of the Fertiliser Quality Council] which considers itself affected may elect to join the appeal as a third party by serving on the parties to the appeal a notice of third party joinder. Any such notice must specify that entity's interest in the issues raised by the appeal and the position of the entity in respect of those issues. All Fertmark registered companies [and members of the Fertiliser Quality Council] agree and accept that a third party shall have no right to appoint the sole arbitrator. The nature and extent of a third party's participation in the arbitration proceedings shall be determined by the agreement of all parties to the appeal or, failing this, by the sole arbitrator.

To the extent practicable, the appeal shall proceed expeditiously with the objective of the sole arbitrator producing a short written and reasoned decision within four (4) months of the date of the notice of appeal.

The decision of the sole arbitrator shall be final and no party (including any third party) shall challenge, or seek appeal or review of, such decision, save under article 34 of Schedule 1 of the Arbitration Act 1996.

8. Any costs incurred in this Disciplinary Procedure will lie where they fall.

Deregistration

1. After due consideration of the matter, the Fertiliser Quality Executive Committee may determine to advise the Spreadmark auditor of their decision when any of the conditions outlined below are met:

   - A complaint has been made in respect to a breach of the Code of Conduct and such complaint has been upheld by either the Advertising Standards Complaints Board or the Executive Committee and the breach has not been remedied within the specified time, or
   - The fertiliser spreading company defaults in paying the requisite promotion and administration or audit fees and remains in default after the expiration of the due notice period.

2. The decisions of the Fertiliser Quality Executive Committee on matters of deregistration shall be final.

8. Spreadmark protocols

This section of the Spreadmark Code of Practice contains the following protocols:

8.1 Spreadmark Confidentiality Protocol;

8.2 Spreadmark Levy Policy.

8.1 Spreadmark Confidentiality protocol

Scope

This protocol relates to the protection of information relating to fertiliser spreading companies which have applied for or gained Spreadmark registration.

Confidentiality of information

1. After an application for Spreadmark registration is made by any company the details of the application will only be known to the Executive Director and the Auditor. The identity of the company will not be made available to any other party unless expressly allowed by the applicant company.

2. If any company fails to gain registration that information and the reasons for the failure to register will not be made public. No other party will have access to that information, being the name of the company or the reasons for registration being declined.

3. If a fertiliser spreading company receives registration, then the Executive Director will publicly declare that the company is registered.

4. All information and data collected from a company by the Auditor in carrying out the obligations to Spreadmark is confidential to that company and the Auditor apart from the following exceptions:

    - The normal recommendations from the Auditor to the Executive Director about registrations, de-registrations, and amendments.
    - Requests from the Executive Director (and privy only to the Executive Director) to the Auditor for information needed for the efficient functioning of the Spreadmark scheme. Such requests will generally be sought only in the following circumstances:

        a. when a company is not meeting the requirements of Spreadmark registration as advised by the Auditor;
        b. when there is controversy or confusion; or
        c. when general operational matters are under review.

    - Situations outlined in the Spreadmark Auditor Protocol for Groundspread Companies.
    - Information about spreaders and drivers.

5. All information held by the Auditor relating to a company is available to that company.

6. If a fertiliser spreading company chooses to withdraw from the Spreadmark registration scheme then the Fertiliser Quality Executive Committee reserves the

right to make it publicly known that the company no longer holds Spreadmark registration.

7. If the fertiliser spreading company is deregistered by the Fertiliser Quality Executive Committee then this committee reserves the right to make it publicly known that the company no longer holds Spreadmark registration and also to make publicly known the reasons why that registration is no longer held.

8.2 Spreadmark levy

Scope

This policy describes the collection and utilisation of the Spreadmark levy.

Levy policy

1. The Spreadmark budget will be set by the Fertiliser Quality Council on an annual basis as part of the setting of the Spreadmark budget.
2. Once the budget is set this will be used to determine the Spreadmark levy.
3. If the levy collected is greater than that required to operate on a break-even basis, then the registered fertiliser spreading companies will have the surplus credited to them on a pro rata basis for the following year.
4. The levy will be invoiced annually.

8.3 Spreadmark Policy on Company Mergers

Scope:

This policy relates to the situation when Spreadmark registered companies acquire other companies.

Company Mergers:

1. When a Spreadmark registered company acquires another spreading company and separate company identities are maintained for both companies, the companies must have separate Spreadmark registrations.

2. When a Spreadmark registered company acquires another spreading company and the acquired company disappears from view and is managed by the acquiring company, then the companies can merge their Spreadmark registrations.

9. Spreadmark Codes of Conduct

Codes of Conduct

9.1 Spreadmark Code of Conduct for Advertising and Promotion

9.1 Spreadmark code of conduct for advertising and promotion

Scope

This is the Code of Conduct for the behaviour of fertiliser spreading companies with respect to advertising and promotion.

Code of conduct

1. Compliance with this Code of Conduct is a condition of ongoing registration with the Spreadmark Scheme.

2. It is necessary for members, operating as they do in a keenly competitive industry, to draw attention to the existence and nature of their services by the use of advertising and other promotional measures. It follows that the marketing methods employed should be centred on the provision of standards of ethics and be in good taste. These precepts are embodied in the detailed provisions of the Code as set out hereunder.

3. The Code owes its origin to the determination of the scheme to secure the acceptance and adoption of high standards of conduct in the spreading and application of fertiliser.

4. This Code will be administered by the Fertiliser Quality Council Executive Committee. Complaints by one member against another for alleged breaches of this Code of Conduct will follow the Spreadmark Procedure for Complaints, outlined in the Spreadmark Operational Rules part of this Code.

5. The Code will be kept under constant review and amended from time to time where necessary to clarify it and bring it up to date. Notes for the guidance of member companies will be issued periodically to keep them informed of the rulings and recommendations of the Executive and of any alterations to the Code.

6. Membership of the scheme entitles companies to use the Spreadmark logo in appropriate ways.

7. Services must not be marketed with any direct or indirect reference to Spreadmark unless they comply with all relevant statutory legislation and Spreadmark requirements.

8. When fertiliser spreading companies use spreading equipment that does not have a current Spreadmark test certificate, or use operators that do not have a current Spreadmark training certificate, there must be no suggestion in any marketing or other information that the company's Spreadmark registration covers such machinery or operators.

9. Methods of marketing must never be such as to invite unfavourable comment or bring discredit upon either the fertiliser manufacturing or spreading industries or upon other Spreadmark registered companies.

10. The products, services or personnel of other Spreadmark registered companies shall not be disparaged, either directly or by implication.

11. Information furnished must be accurate and balanced and must not be misleading, either directly or by implication.

12. All claims and/or comparisons, whether written or verbal, as representation or as advertisement, shall abide by the Advertising Standards Authority Code of Practice. In addition, comparisons must be factual, fair and capable of substantiation. In presenting a comparison, care must be taken to ensure that it does not mislead by distortion, by undue emphasis or in any other way.

13. Any complaint regarding advertising by a Spreadmark registered company may be referred to the Advertising Standards Authority or to the Fertiliser Quality Executive Committee.

14. Advertisements must be clearly distinguishable from editorial material, where there could be doubt, the word “advertisement” is required.

15. Promotional material should not imitate the devices, slogans or general layout adopted by other companies in a way that is likely to mislead or confuse.

16. Advertisements which make use of scientific data should clearly state the source of that data, which must not be used out of context or in such a manner that it does not accurately reflect or portray the overall conclusions of that research. Wherever possible, previously unpublished data, including verbal communications on a subject, may not be used for advertising purposes unless specific written consent is obtained from the originating organisations, or the individual(s) concerned, after they have viewed the advertisement in question.

10. Reference Material

The following material is provided to support Spreadmark registered companies:

- The Sieve Box

The sieve box

1. Purpose

The purpose of a sieve box is to get an objective measure of the distribution of particle sizes in a sample of fertiliser. The distribution of particle sizes (along with the bulk density) are important to fertiliser spreaders as these characteristics affect spreading performance. The mean particle size (expressed as a Size Guide Number – SGN), the range of particle sizes (expressed as a uniformity Index – UI) and the bulk density (BD) are the three most important physical characteristics for spreaders. For more information of these characteristics, see the Glossary part of this Code.

Sieve boxes work by separating the fertiliser into different size categories so that the SGN (average particle size) and UI (representing the range of particle sizes) can be estimated or calculated.

2. Description

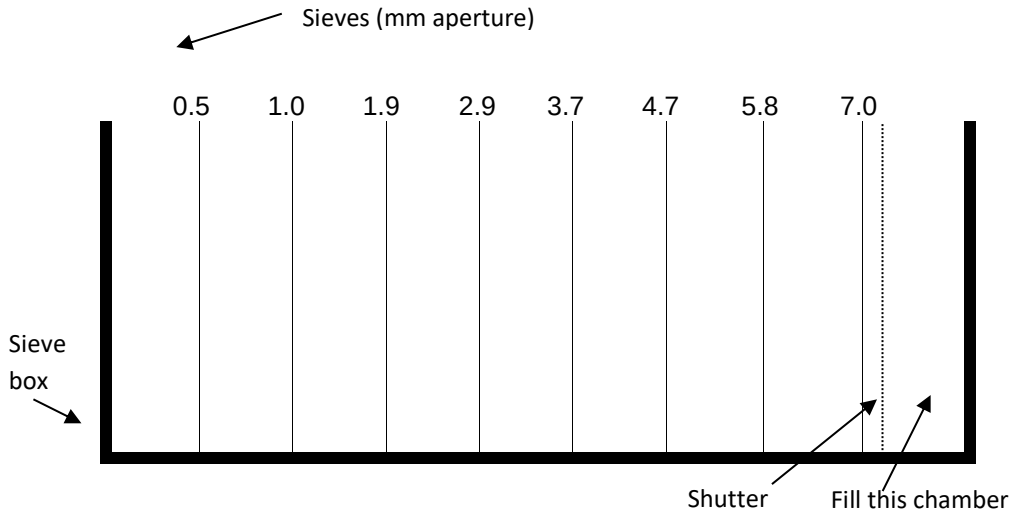
The standard Fertiliser Quality Council sieve box has the following dimensions and sieve sizes:

- Inner Dimensions: 155mm x 60mm x 25mm
- Sieve Sizes (mm, actual aperture) 0.5, 1.0, 1.9, 2.9, 3.7, 4.7, 5.8, 7.0.

3. Use of the sieve box

1. Make sure all sieve chambers are empty.

2. With the coarsest (7mm) screen to the right, place the shutter against the 7mm screen as shown, then fill the right hand column, tapping the box gently to settle the fertiliser. Screed off the surplus fertiliser, then withdraw the shutter.



3. Put the top on the sieve box, then turn the box so the filled chamber is uppermost, and shake the sieve box gently for about 10 seconds.

4. Turn the sieve box upright again and gently tap it so the levels in each column are level.

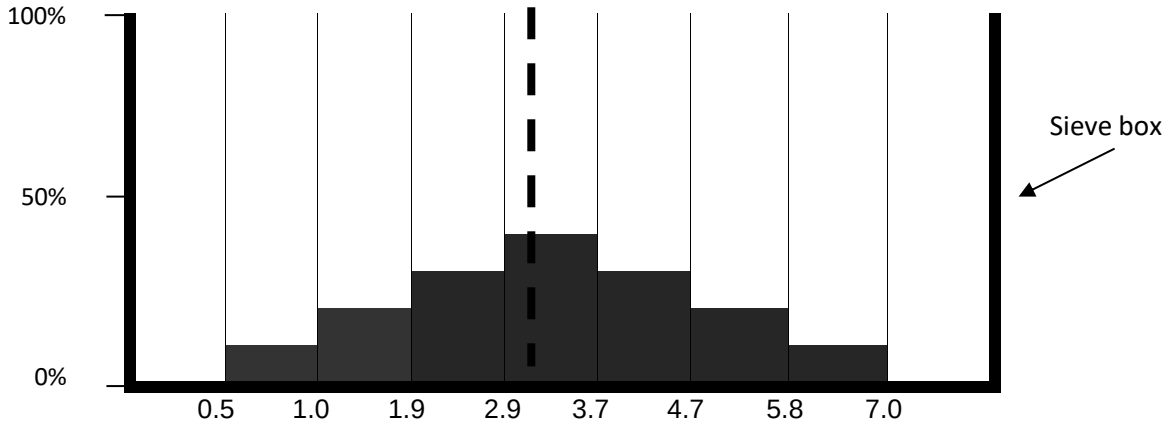
5. Read off the % level in each column.

6. Estimate the SGN and UI values using the notes below.

4. Estimating SGN and UI

4.1 Estimating SGN

Estimating SGN from amounts retained in the sieve box.



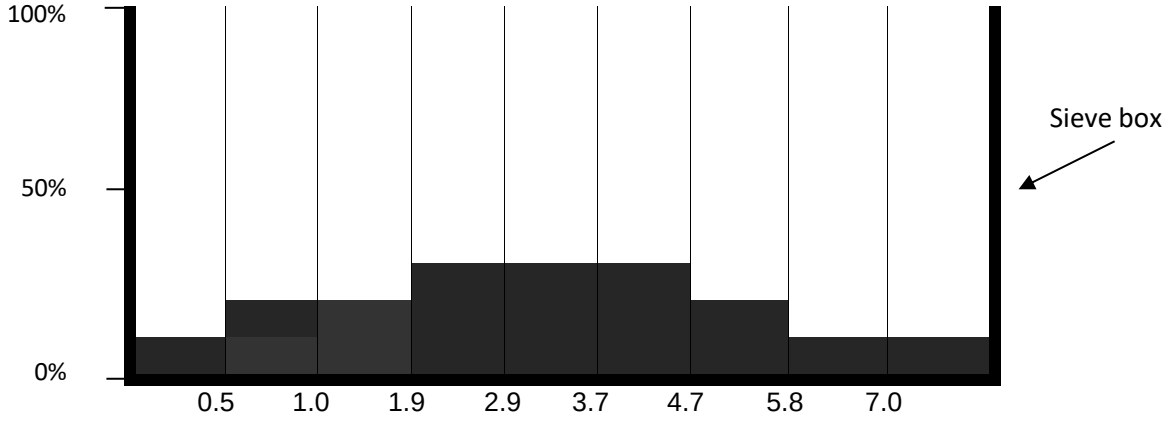
The diagram shows the amounts retained in each chamber after sieving. To estimate SGN the shaded area to the left of the imaginary dotted line must equal the shaded area to the right. In this case the line has been drawn so that these areas are equal, and the line meets the bottom scale at about 3.3. The SGN = 3.3 or 330

4.2 Estimating UI

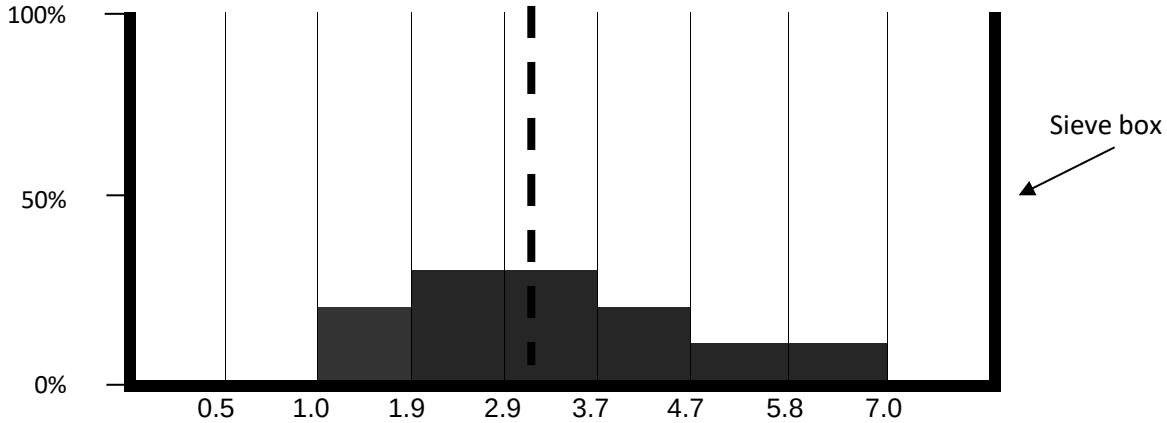
It is more difficult to estimate UI as accurately as SGN. The more chambers that have some material retained in them the lower the UI value will be. If for example, all the material is retained in only two chambers then the UI will be high – probably about 55 or 60. In the above example the UI is 18. There are some rough guides that can be used to help estimate UI. These include:

- If each chamber has more than 5% then the UI will be less than 20
- If any two adjacent chambers in the sieve box add to more than 70% then the UI will be greater than 30
- If any two chambers add to more than 80% then the UI will be more than 50.

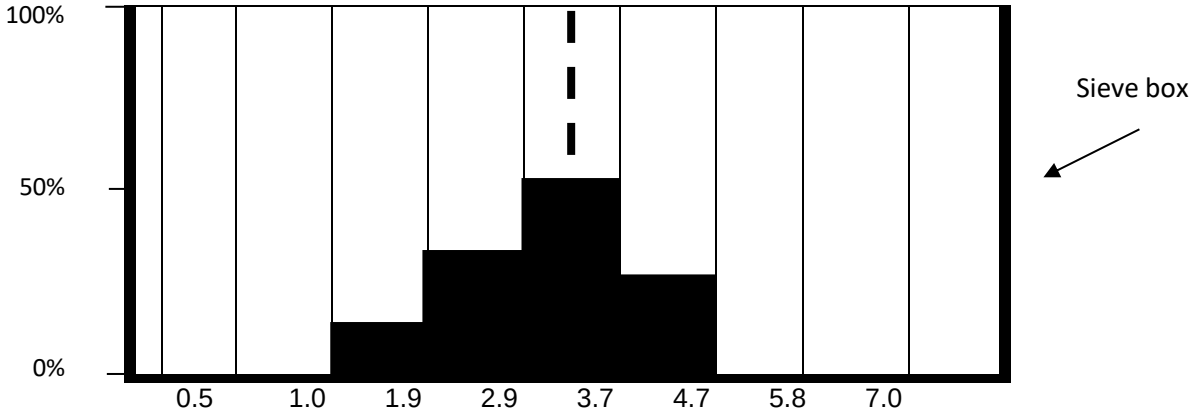
The figures below show three samples with the same SGN but different UI.



Sample A SGN = 300, UI = 11



Sample B SGN = 300, UI = 38



Sample C SGN = 300, UI = 56

5. Sampling

Obtaining a representative sample of fertiliser is important when information on SGN and UI is being obtained. When fertiliser is tipped into a pile all the large particles tend to fall to the outside edge and bottom of the heap. A sample taken from that area would not be typical in terms of particle size or size range.

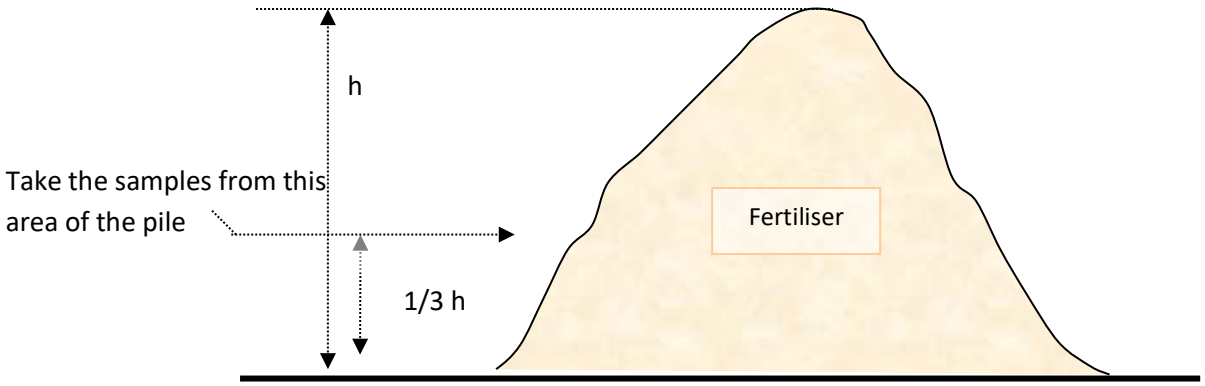
The best sampling method is to use a sampling spear. As this is pushed into the heap of fertiliser it collects and retains a sample of fertiliser that will more closely represent the whole heap. A sampling spear that retains a sample that is MORE than or equal to the volume required to fill the sieve box chamber should be used. If it is less than the sieve box chamber volume then repeated samples are taken until the sieve box chamber is full.

In all cases the sample should not be taken from the lower part of the pile of fertiliser – at least 1 metre from the bottom of the pile is a good guide.

The best sampling procedure is to use the sampling spear and repeat the sample/sieve procedure three times. Drive the spear in horizontally.

The next best option is to take one sample with the spear then use the sieve box.

If a spear is not available, samples should be taken about one third up from the bottom of the pile as shown in the figure below. Dig into the pile a little to avoid taking material from the outside of the heap. Fill the sieve box chamber with several small handfuls. Do not use a shovel to take the sample then tip from the shovel onto the sieve box as this will give a biased sample because the large particles will flow into the box first.



6. Use of SGN and UI values for even spreading

NZ fertiliser products have a range of 95 to 475 for SGN values and 5 to 68 for UI values so there is a wide variation. Some simple guidelines are given here to help make use of SGN and UI data. In the past SGN and UI data have not routinely been obtained for NZ fertiliser products, so it is important to refine these guidelines for NZ conditions and equipment.

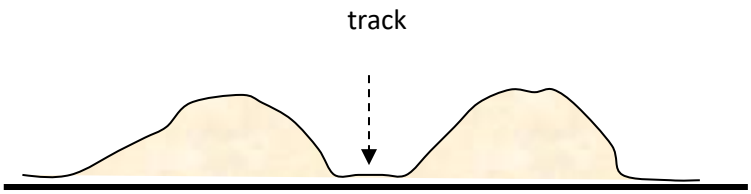
The actual test products used during Spreadmark Certification should be sampled and tested. The measurement of the particle size of the product and the spreading results from the distribution test will form a series of benchmarks of spreader performance. (The SGN and UI of the product will be given on the Spreadmark Certificate).

The three main guidelines are:

- If the SGN is lower than 150 and the UI less than 20 it will be more difficult to get an accurate distribution (Fine product).
- If the SGN is between 250 and 350 and the UI between 20 and 60 then even spreading can be achieved provided the spreader is set correctly (Medium product).
- Where the SGN is 350+ and the UI is 50+ even spreading becomes more difficult and there is an increased risk of crop damage (Coarse product).

These are guidelines only. The three categories given here could be seen as fine, medium and coarse in terms of SGN. Some generalisations are possible.

- Higher SGN values suggest wider swath widths are possible.
- High UI values, i.e., more uniform particle sizes (for any SGN) tend to give a "hollow" transverse spread pattern with many powered spreaders.



- Fine material can be spread evenly but it depends on the machine and the weather.
- Coarse material can also be spread evenly but it depends on machine design.
- An even spread with material classed as medium should be possible.

7. Use of SGN and UI values for blending fertilisers

NZ fertiliser products have a wide range of physical properties and these properties affect the ease with which they can be blended and the degree to which they tend to segregate.

All spreading companies spread blends of fertiliser and some prepare their own blends. The information below is intended to indicate the degree to which blending is likely to be effective.

The compatibility of blend constituents depends on both SGN and UI. The available data suggests the following guidelines:

Difference between SGN or UI values	Compatibility for blending
Less than 10	Good Compatibility
11 – 20	Moderate compatibility – some segregation likely
Greater than 20	Incompatible

Groundspread fertiliser application practices

The section of the Spreadmark Code of Practice contains the rules that relate to Groundspread Fertiliser Application Practices.

Table of Contents

5.2 Collectors Approved for Use with Spreadmark Testing of Groundspreaders

5.3 Spreadmark Type Approved Groundspread Spreading Equipment

1. Spreadmark System Standard

This section of the Spreadmark Code of Practice relates to the Spreadmark System Standard and contains the Spreadmark Internal Audit Checklist.

It contains the following material:

1.1 Spreadmark System Standard for Groundspread Companies

1.2 Internal Audit Checklist

1.3 Spreadmark Groundspread Environmental Code

1.4 Spreadmark Auditor Protocol for Groundspread Companies

1.5 Spreading Equipment Testers Protocol

1.6 Transitional Arrangements

1.1 Spreadmark system standard for groundspread companies

Scope

This is the quality management standard that will be used by the Auditor to assess the degree to which the fertiliser spreading company's management system works to ensure that customer needs and Spreadmark standards are reliably met.

Standard

1. Management

1.1 The fertiliser spreading company must have a documented system which shows how farmer/grower requirements are communicated and reliably delivered.

1.2 The company must designate someone to have overall responsibility for quality assurance.

1.3 Proper records must be kept of orders and deliveries.

2. Customer needs

2.1 There must be a way of recording customer orders completely.

2.2 There must be a way of reliably communicating customer orders to appropriate staff.

2.3 Records of orders delivered must be recorded so that reconciliations between individual orders and deliveries can be made.

3. Environmental concerns

3.1 Fertiliser spreading companies must have an acceptable written environmental care policy (see also the Spreadmark Groundspread Environmental Code of this Code of Practice).

3.2 Companies must follow their environmental care policy.

4. Spreading equipment

4.1 Only equipment with a current Spreadmark Spreader Performance Certificate will be used on jobs where a Spreadmark registration has been requested or specified. In addition, either all fertiliser spreading equipment in the company will hold a current Spreadmark Spreader Performance Certificate or there will be a system in place to ensure that non-certified equipment is not used for jobs where Spreadmark registration has been requested or specified.

4.2 Spreadmark Spreaders will be checked annually. There are a number of different ways that this can be done. Options include all or some of the following:

- using Approved Spreading Equipment Testers annually.
- using Approved Spreading Equipment Testers on a two-yearly basis and a competent person checking the performance of the spreader between Approved Tests, or
- using the self-checking system described in Section 4.9 below.

In order to be considered as Spreadmark Certified Spreaders, machinery will hold a current Spreadmark Spreader Performance Certificate.

4.3 The substantial majority of the spreaders in a Spreadmark registered fertiliser spreading company will hold a current Spreader Performance Certificate at all times. When auditing this requirement due recognition will be made of machines where it is reasonable that they not be certified (e.g. new spreaders which have not yet been tested and specialised orchard machines).

4.4 Spreading machinery must operate at a bout width that is within the limits that are defined by its Spreadmark Test Certificate for the fertiliser being spread. All Spreadmark Certified Spreaders shall have a tracking system (e.g. GPS) installed which has the capability to demonstrate and record that spreaders operate within their certified bout widths.

4.5 All fertiliser spreaders will be provided with a suitable sieve box for testing fertiliser or will have access to a sieve box at the depot.

4.6 All fertiliser spreaders will have a Spreader Maintenance Diary or other document/s which records significant maintenance and repair work which could affect the machine's fertiliser spreading capability. It should also record the results of the subsequent spreading pattern checks on that machine.

4.7 Where the fertiliser spreading company has an acceptable system in place for the regular checking of fertiliser spreading capability, the Auditor shall review this.

4.8 Written records shall be kept of all spreading equipment checks and calibrations.

4.9 Where the company has a Spreadmark Type Approved Spreader, or has spreaders with a demonstrably repeatable performance (i.e. internal company checking shows that the spreader continues to perform consistently to an external calibration check over a sustained period) and where there is appropriate evidence of maintenance and on-going checking of the spread pattern, then the Spreader Performance Certificate issued by the manufacturer/importer (in the case of Spreadmark Type Approved Machines) or by the Approved Spreading Equipment Tester, may have the term of its certificate extended for up to two years at a time by the Spreadmark auditor.

4.10 Spreaders with Spreadmark Certification shall be clearly identified as such and shall carry a copy of their current Spreadmark Spreader Performance Certificate.

5. Operators

5.1 All fertiliser spreading equipment operators shall be competent. There will be training records for each person, signed by a person competent to do so, that record that that person is competent to do the tasks that are assigned to them.

5.2 The substantial majority of operators in a Spreadmark registered company will hold a Spreadmark training certificate. This will generally represent 75% of the drivers. When auditing this requirement due recognition will be made of operators when it is reasonable that they have not been trained (e.g. new drivers or drivers who are enrolled in an approved training course).

5.3 In addition, either all fertiliser spreading equipment operators in the company will hold a current Spreadmark training certificate or there will be a system in place to ensure that operators who do not hold a current training certificate are not used for jobs where Spreadmark registration has been requested or offered.

6. Work instructions

6.1 Fertiliser spreader operators must be provided with appropriate written Work Instructions which detail how all significant facets of the standard tasks involved in fertiliser spreading are done.

6.2 Operator Work Instructions may include information on fertiliser testing with a sieve box, interpretation of the resulting information, using this information to decide on the optimal settings for the spreader and on adjusting spreading machinery.

7. Customer complaints

7.1 The company must have a written procedure for investigating and resolving customer complaints so as to identify the real cause of any problem.

7.2 The company must follow its customer complaints procedure.

8. Internal audit

8.1 The company must conduct an internal audit of its systems to ensure that they remain sound. This audit will be done in the interval between Spreadmark audits. A specimen internal audit checklist can be found in the following section.

8.2 Records will be kept of internal audits.

9. Sub-contracting work

9.1 When spreading work is subcontracted, then these drivers and their spreading equipment shall be considered on the same basis as the drivers and spreading equipment of the Spreadmark registered company (as defined in Rules 4 and 5).

1.2 Spreadmark internal audit checklist

Purpose

The purpose of this checklist is to guide the company internal auditor to ensure that the Spreadmark Quality System continues to operate effectively.

Note that the Code References are to the Spreadmark System Standard for Groundspread Companies.

Checklist

Code Ref	Question	Complied with?
1.2	Is the person with overall responsibility for quality assurance still the person shown in the Quality Manual?	
1.3 &2.1	Are we still keeping proper records or orders and deliveries?	
2.2	Is the method that we use to communicate customer orders to drivers still appropriate?	
2.3	Are reconciliations between orders and deliveries still able to be made?	
3.1	Is our environmental care policy still current?	
3.1	Are we still taking care to ensure that fertilisers are not being spread or blown into waterways?	
3.1	Are our loads still covered when on public roads?	
3.1	Is spreader washdown still being done under controlled conditions?	
4.1	Are enough of our spreaders still certified?	
4.3	Are our spreaders still operating within the bout width limits defined by their Spreadmark test certificates?	
4.8	Are our annual spreader self-checks being carried out and recorded?	
4.10	Are our certified spreaders still identified as such?	
5.1 & 5.3	Are our spreader operators still competent?	
5.2	Do enough of our spreader operators still hold a current Spreadmark training certificate?	
6.1 &6.2	Is the written guideline material provided for the drivers still up-to-date?	

Signed …….. **Date** ……..

1.3 Spreadmark groundspread environmental code

Scope

This is the Environmental Code of Conduct for groundspread fertiliser companies operating within the Spreadmark programme. Fertiliser spreading company environmental care policies and practices, as required by the Spreadmark System Standard, must comply with this Environmental Code.

The application of fertiliser to agricultural land is an activity of profound economic importance but which has the potential to inadvertently cause environmental damage. For this reason, fertiliser spreading companies must comply with good environmental care practices in all parts of their operations.

Environmental code

1. All fertiliser shall be handled, stored and applied in accordance with the Code of Practice for Nutrient Management – in particular, Section 5 “Fertiliser Application” and Section 6 “Handling Fertilisers”.

2. Care will be taken to prevent fertiliser being spread or blown into waterways.

3. Spreaders will not operate on soils that are so wet that serious soil damage or runoff risks are produced.

4. Spillages of fertiliser are to be avoided. If spillages occur they are to be cleaned up in a way that minimises environmental damage and complies with such legal requirements that apply.

5. When on public roads all loads will be covered, whether empty or full, to prevent fertiliser dust blowing over following vehicles or on to roads.

6. The wash down of spreaders will be done under controlled conditions and with measures in place to prevent wash water flowing into water ways.

7. A safety data sheet (SDS) for the fertiliser being carried should be available within the company.

1.4 Spreadmark auditor protocol for groundspread companies

Scope

This protocol sets out the roles and responsibilities of the Auditor for the fertiliser groundspreading industry.

2. Appointment

2.1 The Auditor shall be nominated by the Fertiliser Quality Council Executive Committee, and that appointment shall be approved by the Fertiliser Quality Council, for such a term as the Executive Committee shall determine. This decision will be taken in consultation with the NZGFA.

2.2 The Auditor shall have received appropriate auditor training and shall be familiar with the fertiliser spreading industry.

2.3 The Auditor cannot also be a Spreading Equipment Tester as it is important that the functions of the certification testing of equipment and auditing be kept entirely separate.

3. Company contacts

3.1 The Auditor will maintain a register of fertiliser spreading companies and nominated company contact people. The nominated company contact people are to be the primary points of contact for the Auditor with the company.

4. Notification

4.1 The Auditor will be notified by the Executive Director each time a valid application for Spreadmark company registration is received.

4.2 The Auditor will negotiate with the applicant fertiliser spreading company contact person for a suitable time to conduct the audit.

5. Audits

5.1 During audits the Auditor will assess the fertiliser spreading company quality system and records. The standard used for the audit will be the Spreadmark System Standard. The audit will focus on outcomes and evaluate whether or not they are being achieved.

5.2 During each audit the Auditor will examine the fertiliser spreading companies own spreading machinery test system and records to determine their effectiveness. Where companies have spreaders which have a current Spreader Performance Certificate and which have a demonstrably repeatable performance (i.e. internal

company checking shows the spreader continues to perform consistently to the external calibration check over a sustained period) and where there is appropriate evidence of maintenance and on-going checking of the spread pattern, then the Spreader Performance Certificate issued by the manufacturer/importer (in the case of Spreadmark Type Approved machines) or by the Approved Spreading Equipment Tester, may have the term of its certificate extended for up to two years at a time.

5.3 After the audit is complete a site audit report will be sent to the nominated company contact person. It will include a summary of findings and a statement of the extent to which the company systems and practices meet the Spreadmark Code of Practice.

6. Audit frequency

6.1 Spreadmark audits will initially be carried out one year from the date of registration and then on a two–yearly basis.

6.2 The Auditor may determine that an increased audit frequency (normally annual) is appropriate if there are significant non-conformances or complaints against the company are sustained. An example of a significant non-conformance would be a failure to have 75% of the spreading fleet holding current Spreadmark certification.

6.3 The Auditor may determine that a longer period of registration is appropriate if there are no significant non-conformances at two successive audits. In this event the registration period will be increased to three years. This provision is only to apply where the annual self-check audit has been done and retained for the auditor.

6.4 Supplementary audits will be initiated or authorised by the Executive Director. Supplementary audits will be conducted on an irregular basis and with a relatively short period of notice. Supplementary audits may include the check testing of a spreader or spreaders by an Approved Tester. The principle focus of supplementary audits will be:

- Companies which do their own testing,
- Companies where there were material issues at the previous audit (including excessive slowness at clearing audit conditions),
- Companies which are the subject of a complaint or where there is reason to suspect that Spreadmark standards may not be being adhered to.

Supplementary audits will be paid for by the Fertiliser Quality Council.

7. Status reports

7.1 The Auditor will produce a status report with the name and address of each registered company.

7.2 The auditor will produce an additional report showing the information above plus a description of each spreader and a list of trained drivers.

7.3 The status reports shall be supplied to the Executive Director at least every six months or within ten working days of it being requested.

8. Records

8.1 The Auditor shall maintain proper records. These records will include audit reports, status reports and correspondence.

8.2 Records, or copies of records, shall be supplied to the Executive Director upon request and in accordance with the Spreadmark Confidentiality Protocol.

9. Confidentiality

9.1 With the exceptions noted below, the Auditor will not communicate information about any fertiliser spreading company to anyone other than the company itself through its nominated contact person or the Executive Director. Requests for information are to be referred to the Executive Director.

9.2 The following information about fertiliser spreading companies may be supplied to the Executive Director:

- The names of companies that meet Spreadmark requirements, the nominated contact people and their contact details (The Spreadmark Company List).
- The expiry date of Spreadmark company registration certificates.
- Vehicle certification information.
- The number of trained drivers in each Spreadmark registered company.

9.3 All information held by the Auditor on a company is to be made available to that company on request by the nominated company contact person.

9.4 For further information refer to the Spreadmark Confidentiality Protocol.

10. Deregistration

The Spreadmark registration of a fertiliser spreading company may be withdrawn or not renewed when any of the conditions outlined below are met:

- A recommendation to do so is received from the Fertiliser Quality Executive Committee, or
- The fertiliser spreading company operating systems do not meet the Spreadmark System Standard as determined by the Spreadmark Auditor and the breach has not been remedied within the specified time.

11. Certification of Groundspreader Testers

The FQC has delegated responsibility to the auditor for the approval of groundspreader certification testers, oversight of the testing programme, the review of test reports, and the registering of test results.

Spreaders are required to periodically test ground spreader performance and are required to present current Spreadmark Spreader Performance Certificates to the auditor. The auditor must ensure that:

- Test reports are from a tester registered with FQC.
- Tests (including Type Testing and Type Approvals) are performed and reported in accordance with the ‘Technical Specification for the Testing of Groundspread Fertiliser Machines’.

1.5 Spreading equipment testers protocol

Scope

1.1 This protocol sets out the role and responsibilities of Spreadmark Approved Spreading Equipment Testers.

Approval policies

2.1 Spreadmark Approved Spreading Equipment Testers shall be approved by the Fertiliser Quality Council Executive Committee.

2.2 The term of approval shall be for a term of two years or any other lesser term that the Fertiliser Quality Council Executive Committee determines.

2.3 Spreadmark Approved Spreading Equipment Testers will be appropriately qualified and will be able to display practical experience within the fertiliser spreading industry.

2.4 The certification of a Spreadmark tester will be held in the name of the person certified by the Spreadmark auditor. In the case of a person who transfers to another company, the transfer of the Spreadmark tester certification will be subject to the Spreadmark auditor being satisfied that the testing equipment meets the technical specifications of the Spreadmark Approved Spreading Equipment Tests. All applications to alter the terms of a Spreadmark Approved Equipment Tester's certification must be made in the first instance to the Executive Director.

2.5 A Spreadmark Approved Spreading Equipment Tester will be a fit and proper person capable of managing spreader equipment testing, but who is also able to maintain the integrity of the Spreadmark Spreading Equipment Testing process.

2.6 An Approved Spreadmark Spreading Equipment Tester must not do anything inimical to the interests of the Spreadmark scheme. Any complaint about an approved Spreadmark Spreading Equipment tester must in the first instance be made to the Executive Director for resolution.

Approval processes

3.1 Upon receipt of a request to become a Spreadmark Approved Spreading Equipment Tester the Executive Director will forward the application to the Spreadmark auditor who will, without undue delay, contact the applicant to arrange a suitable time for an audit of their equipment, processes and software to evaluate whether or not they comply with the requirements of this Code.

3.2 The auditor shall report their findings and recommendations to the Executive Director who will seek approval from the Executive Committee for the applicant to be added to the register. Upon approval by the Executive Committee the applicant will be advised that they are able to carry out fertiliser spreading machinery testing

and certification for the Spreadmark programme and that their name will be added to the register of Approved Spreading Equipment Testers.

4. Spreader company contacts

4.1 The Executive Director shall make available the list of Spreadmark Approved Spreading Equipment Testers to all Spreadmark registered companies and to spreading companies that have applied to the Executive Director for Spreadmark registration. All Spreadmark Approved Spreading Equipment Testers shall offer Spreadmark testing services to all Spreadmark registered companies or companies seeking Spreadmark registration.

4.2 Spreadmark registered or registered companies may select the services of any Spreadmark Approved Spreading Equipment Tester at a testing fee to be fixed between the parties.

5. Spreadmark spreading equipment testing

5.1 All testing done by Spreadmark Approved Spreading Equipment Testers for Spreadmark purposes will be done in accordance with the current Spreadmark Code of Practice test standard.

5.2 All Spreadmark Spreader Performance Certificates will be of a form approved by the Spreadmark Executive Director.

5.3 Spreadmark Approved Spreading Equipment Testers will only generate certificates with the Spreadmark name or logo on them for fertiliser spreading companies which hold, or which have applied to hold Spreadmark company registration.

5.4 Spreadmark Approved Spreading Equipment Testers will, on request and without fee, provide spreader test data to the Executive Director if the information is sought for research purposes or to resolve disputes.

5.5 Following Spreadmark spreader equipment testing, the Spreadmark Approved Spreading Equipment Tester will generate a completed Spreadmark Spreader Performance Certificate for their client company. A copy of this Performance Certificate will be sent to the Spreadmark Auditor for review and to enable the Spreader Database to be updated.

6. Audits

6.1 The Spreadmark Approved Spreading Equipment Tester shall be subject to regular audit by the Spreadmark auditor. The audit will be to determine that the standards specified in the Spreadmark Code of Practice are being maintained. The Spreadmark auditor will make available the results of the audit to the Fertiliser Quality Council Executive Director.

6.2 If in the opinion of the Spreadmark auditor the Spreadmark approved specifications are not being met, the Executive Director will require the Spreadmark Approved

Spreading Equipment Tester to provide an explanation within ten days. If the matter cannot be resolved the Executive Director may suspend the Spreadmark Approved Spreading Equipment Tester from Spreadmark testing.

6.3 The Spreadmark auditor may be asked to conduct an audit of the Spreadmark Approved Spreading Equipment Tester if requested by the Executive Director following any complaint.

6.4 In all matters in dispute the decision of the Executive of the Fertiliser Quality Council will be binding on the parties.

7. Disputes

7.1 Disputes that may arise between Spreadmark registered or applicant companies and Spreadmark Approved Spreading Equipment Testers shall be managed according to the Spreadmark Disciplinary and Deregistration Procedure of the Spreadmark Code of Practice.

1.6 Transitional arrangements

Scope

This section of the Spreadmark Code of Practice lists the transitional arrangements that apply from time - to - time to the operational rules. It may also be used to give advance notice of changes that are being phased in. These transitional arrangements shall apply until they lapse by expiry. These transitional rules will then be removed or incorporated into main body of this Code.

Transitional arrangements for groundspread companies

1. There are currently no ‘transitional arrangements’ in the Spreadmark Code.

2. Spreadmark application processes

This section of the Groundspread Application Practices of the Spreadmark Code of Practice contains the following material:

2.1 The Procedure for Spreadmark Registration

2.2 Application Form for Spreadmark Registration of Groundspread Companies

2.1 Procedure for Spreadmark registration

Scope

This is the procedure for the registration of companies under the Spreadmark Scheme.

Application for registration for groundspread companies

1. Enquiries regarding Spreadmark registration of groundspread companies may be directed to the Executive Director of the Fertiliser Quality Council who will forward an official Spreadmark Registration Application Form.

2. Applications for registration from fertiliser spreading companies to the Executive Director will be in writing on the official application form and must be accompanied by the application fee. The application fee is not refundable in the event that the application does not proceed or is unsuccessful.

3. Upon receipt of the application form the Executive Director shall verify that the application is complete and that the appropriate fee is attached. The applicant company is then deemed to be a Spreadmark applicant company.

4. The Executive Director then forwards the application to the Spreadmark Auditor who will undertake a pre-registration audit against the Spreadmark System Standard.

5. If the Auditor finds that the requirements are met the company shall be issued with a signed Spreadmark Company Registration Certificate, with the expiry date noted, and will cause the register of Spreadmark Registered Companies to be amended.

   If the Auditor does not consider the requirements of the Spreadmark Code to be met then the applicant company will be advised in writing of improvements that need to be made.

6. The period of registration will normally be for a period of two years but shorter period may be applied. This will occur if companies have systems that are not fully in conformance. The term would depend on the severity of the non-conformances. In this circumstance the Auditor may also recommend conditional registration. Companies may elect to have additional special audits at their own cost. Refer to Section 6, ‘Audit Frequency’, of the ‘Spreadmark Auditor Protocol’ in this Code for more information.

Application for Spreadmark company registration by a groundspread company

This form is to be used by fertiliser groundspreading companies that seek Spreadmark registration for their company. The form can be emailed to director@fertqual.co.nz or posted to:

The Executive Director
Fertiliser Quality Council
Federated Farmers of New Zealand
Level 5, 169 London Street
PO Box 447
Hamilton

The application fee is $200 + GST ($230).

Pay the application fee either to the Fertiliser Quality Council; Bank Account # 06-0909-0238504-00 Use your company name as a reference.

Company Name:	
Postal Address:	
Physical Address:	
Contact Person:	
Phone Numbers:	
Email Address:	
Fax Number:	
Other Contacts:	

We recognise that the Spreadmark scheme requires companies to have in place:

- spreading machinery with testing performance data as prescribed by Spreadmark;
- drivers trained to an acceptable standard; and
- a simple but documented management system showing how the outcomes will be met.

We agree that upon being granted Spreadmark registration we:

- will abide by the Spreadmark Codes of Conduct;
- will abide by such Rules, Protocols and Policies as are made by the Fertiliser Quality Council;
- will pay the annual Spreadmark levy to the Fertiliser Quality Council;
- allow reasonable access to the appointed Spreadmark Auditor; and
- pay the auditor such audit fees as are due.
- will advise the Fertiliser Quality Council if there are any changes to our company name, postal address or contact person.

We agree that if Spreadmark registration is withdrawn or lapses all mention of Spreadmark made in the companies publications or on the companies vehicles or any other use of the Spreadmark trademark will cease.

…… …… ……...

(Signed) *(Name)* *(Date)*

3. Spreading machinery testing

This section of the Spreadmark Code of Practice contains the following material relating to spreading machinery testing for groundspread vehicles:

3.1 Principles for the Technical Framework for Spreader Certification.

3.2 Technical Specification for the Testing and Certification of Groundspread Solid Fertiliser Machines.

3.3 Technical Specification for the Testing and Certification of Conventional Boom Sprayers applying Liquid Fertiliser

3.4 Principles for the Type Testing of Groundspread Fertiliser Machines.

3.5 Procedure for the Type Testing of Groundspread Fertiliser Machines.

3.6 Guidelines for Checking Spread Patterns.

3.1 Principles for the technical framework for spreader certification

Scope

In order to ensure that nutrients are spread according to the requirements of the programme the following principles will be followed with regard to the testing of fertiliser spreading machines. Operational matters are covered in the Code of Practice for Fertiliser Use.

Principles

1. The spreader test procedure that will be used will allow each spreader to be characterised so as to enable it to be set according to variable fertiliser characteristics. The test procedure has been linked to international methods and practice, adapted to New Zealand conditions.

2. Both indoor and outdoor testing will be permitted for ground spreading equipment. For outdoor testing, requirements for wind speed and direction, angle of slope and nature of surface will be set. Outdoor testing will be carried out in a way that does not cause environmental contamination by overloading the test site. For indoor testing the test facility will be of such a size as to not interfere with the test result and sufficient to accommodate reasonable computer start up issues.

3. The evenness of fertiliser spreading is expressed as a Coefficient of Variation (CV). The evenness of spread both across and along the direction of spreader travel is important. Application rate at the time of test and application rate calibration settings will also be recorded.

4. For agronomic reasons the current minimum acceptable performance for groundspreading equipment will be a transverse CV of 15% for fertilisers containing nitrogen and 25% for all other products.

5. The spreadability of fertiliser depends on its physical characteristics. The usual physical characteristics that are used to describe fertilisers are: bulk density (BD); uniformity index (UI); and size guide number (SGN). Spreading equipment will be tested on a sufficiently wide range of fertilisers to evaluate performance over the range of fertiliser characteristics available in the market. It is intended to test spreaders over a range of fertilisers sufficient to provide a guide to the maximum safe bout width for each particular product that the spreader distributes. The aim of this is to allow the trained operator to set the spreader appropriately. Spreaders will be tested with products with a wide range of physical characteristics and will be certified for a maximum certified bout width.

6. Spreader certification testing will be done on a two-yearly basis by Approved Spreading Equipment Testers who will test spreaders in accordance with the Spreadmark Technical Specification for the Testing of Groundspread Fertiliser Machines and who will prepare Spreader Performance Certificates and forward them to the company and to the Auditor.

7. Spreader operators will use simple field tools (sieve box and bulk density measure) to estimate these parameters in the field, and on the basis of their training, be able to adjust the equipment accordingly.

8. Where spreading equipment manufacturers can demonstrate that their equipment can reliably comply with Spreadmark requirements then individual spreading machine certification may be able to be replaced with type certification.

9. To facilitate spreader identification for certification purposes, a unique spreader identification system will be used. This system will be based either on the vehicle registration plate number, the manufacturers bin identification number or a bin plate supplied by the FQC. Whatever spreader identification system is used, spreader test certificates will show the unique spreader identification number used. Spreader certification lapses if the bin changes to another vehicle".

10. When spreaders are sold from a Spreadmark registered company to another Spreadmark registered company, the current Spreadmark Test Certificates can be transferred to the new owner. When spreaders are sold from a Spreadmark registered company to a non-Spreadmark registered company then the certificates lapse.

3.2 Technical specification for the testing and certification of groundspread solid fertiliser machines

1. Introduction

There are two primary factors that determine whether fertiliser is applied evenly and at the correct rate; the performance of the spreading device and the fertiliser flow rate to that spreading device.

The performance of the spreading device is determined by measuring the evenness of transverse and longitudinal distribution.

The fertiliser flow rate has two components; the average flow, which determines the application rate, and the momentary flow, which determines the longitudinal variation. The average flow rate is measured either directly when calibrating the spreader computer or can be determined by experience – the amount of product spread per unit area. Variations in momentary flow can be measured directly or indirectly by measuring the evenness of the longitudinal distribution.

The interaction of these factors is complex and momentary changes in flow may effect transverse as well as longitudinal distribution.

These two primary factors also interact with the operational conditions under which they are measured. It is necessary therefore to define the conditions under which they are measured. These are defined below.

2. Facilities

Certification tests may be conducted either indoors or outdoors providing all the following specifications are met:

	INDOOR	OUTDOOR
Size	Width sufficient to allow the swath to reach the collectors without hindrance and length sufficient to allow the machine to stabilise prior to passing the collectors (see 4 below)	Width sufficient to allow the swath to reach the collectors without hindrance and sufficient run-up to allow the machine to stabilise prior to passing the collectors (see 4 below)
Slope	Flat	< 5^o (the plane of the collectors must be the same as the spreader)
Wind	Nil	< about 15 km/hr and < +/- 15^o in the direction of travel [1,2,3, 4]
Surface	Flat and hard	Firm and smooth
Anti-bounce	Lime or similar inert material at 20-25mm depth	Short grass or other vegetation
Site usage	Unlimited	Not to exceed local environmental requirements

Notes [1]In winds speeds between 10 and 15 km/hr, both the test entrant and the Tester have the right to call a halt to testing if either considers the machine will be unduly advantaged or disadvantaged by the conditions.

[2]Where the spreader performance appears to be unduly advantaged by a crosswind component, the Tester may set aside the result and request a repeat test.

[3]With the agreement of the Tester, the direction of travel may be either "into wind" or "down wind".

[4]This windspeed is Beaufort wind scale 3, gentle breeze – i.e. 'leaves and small twigs move and flags flap'.

It should also be noted that because of the vagaries of wind speed and direction, outdoor testing can only define the performance achieved under those specific conditions and, that performance may be less than the optimum performance the machine is capable of under ideal conditions.

3. Test products

To obtain a meaningful measure of a fertiliser spreader's performance, certification requires testing over a will be chosen to represent the physical range of fertiliser characteristics. The spreader will be tested with three products which have been chosen to represent the physical range of characteristics that are normally spread by the company. One of the three products used will be urea or treated urea.

Dedicated spreaders which are only used on one type of fertiliser (typically, chicken litter or lime) need only be certified on that type of fertiliser.

For the guidance of companies, the following table describes the characteristics of typical fertiliser products.

	SGN[1]	UI[2]	PRODUCT EXAMPLE
1	20 – 60	4 – 10	Lime or RPR
2	120	20	Standard Ammonium Sulphate
3	250 – 350	30	Superphosphate
4	320	55	DAP or Granulated Ammonium Sulphate
5	320	60	Urea

Notes [1]The Size Guide Number (SGN) is the Mean Particle Size (MPS) in millimetres multiplied by 100.

[2]UI = Uniformity Index which indicates the range of particle sizes within the sample. A low number indicates a wide range of particle sizes.

While the SGN's of superphosphate, DAP and urea are not greatly different, their spreading performance can be. Super may spread differently from DAP because of the different UI. Urea may spread differently from DAP because the bulk density is significantly less.

It is noted that the physical properties of generic fertilisers, such as superphosphate, urea and lime vary over time and between suppliers.

The following measurements will be carried out on each test product:

- size guide number
- uniformity index
- bulk density

4. Test conditions

The following conditions must be met for measuring transverse and longitudinal distribution.

Spreader equipment	Spreaders are to be clean and in sound working condition. Spinning disc units must have a display of disc speed that can be observed by the operator while spreading. Evidence of the use of an auditable GPS tracking device is mandatory for spreaders that are to have Spreadmark Test Certificates. It is expected that the positioning accuracy of the GPS is to within one meter. The tracking system is to be able to verify that the placement of fertilizer (mapping) is within the target area and in accordance with the Spreadmark test protocols so that fertilizer is not spread into environmentally sensitive areas.
Hopper loading	Sufficient to completely cover the feed mechanism and the hopper outlet throughout the duration of the test.
Application rate	Application rates used during test are to be the typical rates for that product by the operator[1]
Speed over the collectors	As near as possible to the typical operating speed as is consistent with safety considerations
Distance prior to passing the collectors	20 metres minimum [2]
Number of passes over collectors	Between one and three[3]

Notes [1]Otherwise, the default nominated test rates are to be:.

- Urea 70 kg/ha
- Single super 300 kg/ha
- DAP and mixes 200 kg/ha
- Lime 2500 kg/ha

[2]Mechanically driven metering units require significantly less than 20m to achieve normal flow. For machines with computer controlled metering, the run-up distance may depend on the sensitivity of the software controlling the flow rate. All

spreaders should be able to achieve stabilised flow within 20 metres of travel if they are to give acceptable performance in the field.

[3]The number of passes of the spreader over the trays will be between one and three. Where the nominal application rate is above 80 kg/ha a single pass will be used. Where more than one run is made, the runs will be in the same direction and with no alteration to the settings of the machine, there will be one weight for the three runs and the number of runs will be recorded on the test sheet.

5. Collectors and collector layout

Collectors and collector inserts used for Spreadmark testing will be of a type approved by the Fertiliser Quality Council for that purpose. Refer to the register of approved collector types in this Code for details.

Collectors used for transverse and longitudinal measurement will also comply with the following specifications:

- Collector size will be nominally 500 x 500 with a minimum collector depth of 95 mm.
- Collectors will have suitable anti-ricochet inserts to ensure that as much fertiliser as practicable is collected.
- Only trays of exactly the same dimensions will be used for Spreadmark certification tests.

For transverse distribution measurement, a single line of collectors at right angles to the direction of travel will be used. The length of the line will be sufficient to ensure the significant single pass pattern is measured.

Tray spacing will be at the discretion of the Tester but will not be greater than 1.0 meters.

For border spreading measurement the collector layout will be as for transverse distribution measurement except that there must be sufficient trays laid out that no fertiliser is collected in the last trays, i.e., there is a clear end to the swath.

The fertiliser caught in each collector will be weighed and used to produce a Spreader Performance Certificate. (See item 10, Reporting, below).

When measuring transverse distribution patterns there is a need to remove collectors to allow the spreader to pass. The weight of fertiliser collected in these places will be deemed to be the interpolated weight from the boxes on either side of the gaps.

The centre trays will be three boxes parallel to the direction of vehicle travel. The weight entered into the testing software to be the average of the weights collected in the three trays.

6. Measurement standards

The following measurements will be made and recorded for each certification test.

Factor	Measurement	Standard
Weight of fertilizer	gm/collector	Scales accurate to +/- 0.1 gm
Application rate [1]	kg/ha	generally within 30% of set rate
Transverse distribution	Coefficient of Variation	< 15% for N fertilisers and 25% for all others
Longitudinal distribution	Coefficient of Variation	To be advised in future when limits are applied
Border spreading	Distance from spreader to pattern edge and shape of pattern	N/A

Notes [1]Where the measured application rate varies from the set application rate varies from the set application rate by more than 30% then the collected information should be reassessed.

7. Schedule of tests

The following tests will be conducted:

- Transverse distribution tests - all fertiliser products certified

Product description - SGN, UI and BD measurements will be carried out on samples of all products used.

8. Field Report

The following records will be kept for each test:

Identification	**Date:**				
	Operator:				
	Machine:				
	Technician:				
	Location:				
Facilities	Indoor / outdoor:				
	Size of venue:				
	Slope:				
	Wind speed:				
	Direction in relation to wind:				
Test Products		**Rate**	**SGN**	**UI**	**DB**
	Product 1				
	Product 2				
	Product 3				
	Product 4				
	Product 5				
Test Conditions	Speed over collectors: Transverse: Longitudinal:				
	Spreader condition:				
	Hopper loading:				
	Distance/time of run-up: Transverse: Longitudinal:				
Collectors	Number per pass: Transverse: Longitudinal:				
	Distribution: Transverse: Longitudinal:				
Certification	Certified Bout Width Product 1 = Product 2 = Product 3 = Product 4= Product 5= Shape of CV v Bout Width graph=				

9. Certified bout widths

The tester will generate a CV versus bout width graph from the test information obtained for each fertiliser tested and will determine the Certified Bout Widths from these graphs.

The Certified Bout Width of a spreader will be the bout width where the test result is 15% or less for nitrogenous fertilisers and 25% or less for non-nitrogenous fertilisers. Refer to the Glossary of Terms (Section 4) in this Code for a definition of nitrogenous fertiliser.

Spreaders will have both their 'Round and Round' and their 'To and Fro' bout widths determined for each fertiliser tested.

If the CV versus bout width graph is 'S shaped' and intersects the appropriate CV limit at more than one bout width then this is to be recorded as, for example, "Up to 16 m and 22 to 29 meters".

For border spread certification the certified border width will be the tray beyond the one where the last grain of fertiliser was collected. In addition, in order to ensure that the spread pattern is not overly compromised when the spreader is set to 'border spread', the distance where the spreader returns to 80% of the average application rate should be recorded. In this way the machine can be compared with others of the same border spread capability.

10. Reporting

Approved Spreading Equipment Testers will, at the conclusion of the test, produce a Spreadmark Spreader Performance Certificate.

The Spreadmark Spreader Performance Certificate must show, at least:

- The spreading company name and a vehicle identification number and the bin unique identification number.
- The tray weights collected
- The Certified Bout Width (or Bout Width Range) for each fertiliser tested (see item 9, for details) for both 'Round and Round' and 'To and Fro' patterns.
- A description of the physical characteristics of that fertiliser. The description to include: product name, bulk density (BD), uniformity index (UI), size guide number (SGN) and a graph of the particle size distribution.
- The date of the test and the expiry date of the certificate. The expiry date will be two years after the date of the test.
- The certified application rate range for each product. This rate range is to be ± 30% of the set application rate.

Spreadmark Spreader Performance Certificates will not be issued for spreaders where the Certified Bout Width, when tested on urea, is less than 12 meters for either 'To and Fro' or 'Round and Round' spread patterns. An exception to this rule is made for machines with single spinners which only travel 'Round and Round'. These machines can be issued with Spreadmark Spreader Performance Certificates if they can achieve 12 meters on a 'Round and Round' spread pattern.

Dedicated orchard spreaders do not need to be evaluated for evenness of spread pattern but do need to be fit for purpose on rate and band width in order to be certified.

On completion the Spreader Performance Certificate will be sent to the company with a copy to the Auditor.

3.3 Technical specification for the testing and certification of conventional boom sprayers applying liquid fertiliser

1. Introduction

Conventional boom sprayers apply liquids through manufactured hydraulic nozzles usually at 0.5m spacing. Bout width is predetermined by this spacing and the number of nozzles. For example 24 nozzles at 0.5m spacing will cover 12m width. The distance between the nozzles and the target (soil) is significantly less with a conventional boom at 0.4 to 0.8m as compared spinning discs applying granule fertiliser where the distance may be up to 15m between the application mechanism and the target. As a result conventional boom applications of liquid fertiliser achieve relatively discrete and accurate application rates.

There are two primary factors that determine whether liquid fertiliser is applied evenly and at the correct rate; the flow rate of the liquid fertiliser and the quality and performance of the nozzles.

Flow rate - For conventional boom sprayers the liquid fertiliser flow rate determines the application rate which is a function of the spray pressure. The average flow rate is measured either directly when calibrating the sprayer controller or can be determined by experience based on the amount of product applied per unit area. For computer controlled liquid fertiliser applications, system pressure is increased or decreased in relation to forward speed to maintain target application rate[1]. For these tests it is assumed the flow and speed inputs to the sprayer controller are accurate and the operator is continually comparing volumes applied with area covered. Flow and speed measurement devices may have also been checked by a 3rd party sprayer calibrator.

Nozzles - At least two types of nozzle may be used. Specialist nozzles for liquid fertiliser application or standard (flat fan type) spray nozzles designed for application of herbicides, insecticides and fungicides.

Fertiliser Nozzles

Specialist nozzles apply liquid fertiliser as a stream. These are preferred to standard nozzles which can cause leaf burn. Specialist fertiliser nozzles produce streams of liquid at intervals of 0.1m or less along the width of a conventional spray boom. Common liquid fertiliser nozzle options are shown in Figure 1.

[1] This certification procedure assumes a controller is always used to automatically adjust flow in relation to forward speed.

Stream type nozzle	Dribble bar type nozzle

Figure 1 Common Liquid fertiliser nozzle types

Reports of evenness of spread for fertiliser nozzles are less common than for standard nozzles. One report shows a C of V of 3.4% for a Lechlar FD 04 nozzle (Figure 2).

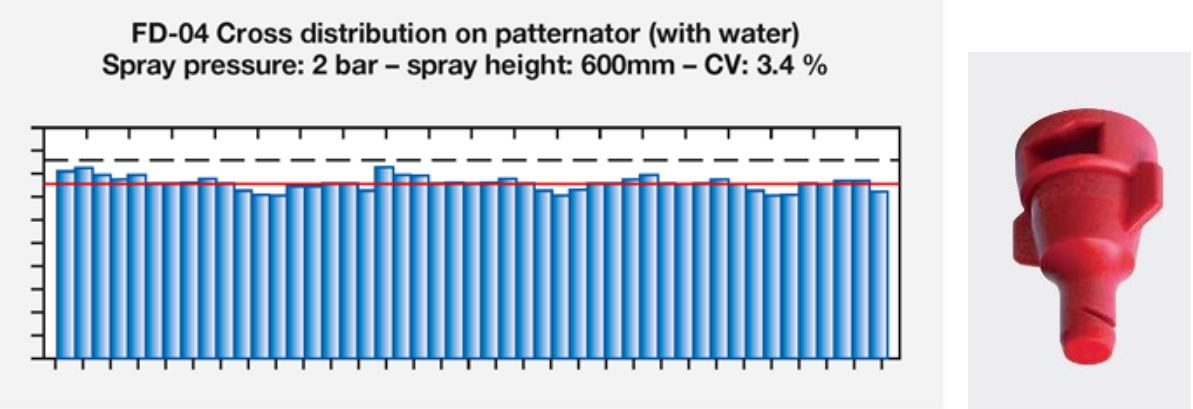


Figure 2 Evenness of spread for a Liquid fertiliser nozzle

Standard Spray nozzles (flat fans)

Standard nozzles used for applying agrichemicals may also be used to apply fertiliser in some situations. These precisely manufactured hydraulic nozzles are usually at 0.5m spacing along the spray boom and are manufactured in ISO certified facilities. They are designed to achieve a coefficient of variation (C of V) of about 6% for evenness of application transverse to the forward movement of the vehicle. This low level of C of V requires that all nozzles on the boom are of the same size, produce the same pattern, are arranged correctly on the boom and the boom is operating at an appropriate height above the target.

General - Manufacturers specifications list pressure and flow expectations by nozzle. For example a typical nozzle might be a Teejet StreamJet SJ7-06—VP. Flow charts show expected flow is 2.01 litres/minute at 2.0 bar. Convention / good practice would be to

replace nozzles when flow is 10% higher than design specifications due to wear which affects the flow and pattern emitted.

Given that fertiliser and standard nozzles are fitted at relatively close intervals, are precisely manufactured and meter product at a relatively close distance to the target, pattern testing or testing of individual nozzle flows is unlikely to add significant value to any testing aimed at certifying evenness of spread[2]. Certification testing should focus on boom section pressures and comparison of test flow with expected performance.

Note that longitudinal distribution will be determined by the consistency of the liquid fertiliser used and homogeneity of mixing processes[3].

Measurement conditions are defined below.

2. Facilities

Certification tests may be conducted either indoors or outdoors providing all the following specifications are met:

	INDOOR	OUTDOOR
Size	Width sufficient to unfold the spray boom	Width sufficient to unfold the spray boom
Wind	Nil	< about 15 km/hr
Surface	Flat and hard	Firm and smooth
Test Material	Water for boom section and nozzle flow tests	Water for boom section and nozzle flow tests
Site usage	Not to exceed local drainage capacity	Not to exceed local drainage capacity

3. Test products

It is proposed that water is used as the test product in lieu of actual product. Suggested tests are for a stationary sprayer. Safe disposal of liquid fertiliser from a stationary sprayer could pose and environmental problem for stationary tests so water is preferred.

[2] Determining if nozzle flow is within 10% of specifications requires flow tests on individual nozzles. C of V for fertiliser nozzles operating in NZ should be carried out during the development of this specification unless this data is available from manufacturers.

[3] Longitudinal distribution is discussed in the existing Spreadmark COP for dry fertiliser but no testing procedure or standards are apparent

Likely application products include nitrogen as the dominant nutrient subject to liquid fertiliser application. By default any nutrients applied as a liquid are dissolved[4], dissolved Urea[5] being the most common.

	%N[1]		PRODUCT EXAMPLE
1	18		Flow Fert N (18% N)
2	19		Nrich Liquid Urea 19N
3	?		Dissolved Urea
4	?		Other?

Notes [1]The proportion of nitrogen on a weight to weight basis.

4. Test conditions

Two stationary tests are proposed, boom section pressures and combined nozzle flow test. The following conditions must be met for measuring transverse distribution.

Conventional spray boom	Sprayers are to be clean and in sound working condition. The spray systems must have a display of pressure that can be observed by the operator while applying liquid fertiliser. Operators should also be confident their flow meter is accurate and in sound working condition so that target application rates are being achieved. This should be continually tracked by keeping a running tally of volume used and hectares covered. Evidence of the use of an auditable GPS tracking device is mandatory for sprayers that are to have Spreadmark Test Certificates. It is expected that the positioning accuracy of the GPS is to within one metre. The tracking system is to be able to verify that the placement of fertiliser (mapping) is within the target area and in accordance with the Spreadmark

[4] There may be a need to define a liquid as compared with a slurry of fine (ground) particles in water as compared with a sludge. For the former the fertiliser dissolves in water whereas the latter the product remains solid but is in suspension. The concentration or specific gravity of the material in a tank may also indicate liquid versus slurry although some agrichemicals are suspension concentrates but are termed liquid rather than slurry. Viscosity describes the sheer resistance of a fluid.

[5] Common dissolved Urea products contain up to 19% N along with other macro-nutrients such as sulphur and micro-nutrients such as copper

	test protocols so that fertiliser is not spread into environmentally sensitive areas.
Tank fill	Sufficient to carry out boom sections tests and combined nozzle flow test with water (usu. half full).
Application rate	Application rates used during test are to be the typical rates for that product by the operator[1]
Wheel speed sensor	At least 50m distance, preferably 100m distance, average of two runs

Notes [1]Otherwise, the default nominated test rates are to be:

- 150 L/ha
- 25 kgN/ha

5. Measurement techniques

Two tests are proposed to be performed on a stationary conventional boom sprayer.

1. Boom section test

Aim: Ensure each boom section is operating at the same pressure.

Sprayers will have at least three boom sections and may have up to seven. Unfold the boom and with the fertiliser nozzles turned on, run the stationary sprayer at required operating pressure for the selected forward speed and target volume application rate (e.g. 15 km/hr, 150 l/ha). Once the operator is happy that the system is running at target rate, fit a pressure gauge to each boom section in sequence (suggest work left to right looking forward). Figure 3 shows potential methods for measurement of spray boom pressure. The cap and nozzle are removed, a gauge is fitted and the nozzle is fitted to the base of the gauge. Record the pressure for each boom section. Boom pressures should be within 10% of each other e.g. range of 0.2 bar for an average pressure of 2 bar.

			
Commercially available option (Spot On®, electronic)	AAMS Salvarini (courtesy of M. Keane)	Bottom entry ¼" Isometric 63 mm Gauge fitted on a ¼" Tee with Quick TeeJet cap*	Bottom entry standard mechanical 100mm pressure guage (Silvan NZ)

*other fittings may be needed for systems supplied by other manufacturers eg HARDI, ARAG, BFS.

Figure 3 Possible methods set up for boom pressure measurement

The test pressure gauge should be calibrated to ensure it is reading true pressure in the target range which is likely to be between 1 and 4 bar. A range on the gauge of 0 to 6 bar would be suitable. Check the test gauge after testing six boom sprayers or more often if necessary and at least annually.

Pressure gauge calibration – Several methods can be used to check the test gauge.

A. On a test rig fit a calibration[6] gauge and your test gauge with tee junction. They should read the same pressure at 250 kPa (2.5 bar) within +/- 10 kPa

B. Purchase 5 gauges, compare them on a test rig, choose the most consistent two, one as test gauge and one as a calibration gauge. These two gauges should read within 10 kPa of each other.

C. WIKA brand pressure gauges can be sent to WIKA Instruments Ltd in Auckland for bench testing. A calibration report can be provided.

D. Custom Pressure Systems NZ Ltd also provide a testing service with offices in Auckland, New Plymouth and Christchurch.

2. Combined nozzle flow test

Aim: Ensure the nozzles are operating within 10% of their specification

Even application across the width of the boom will be achieved as long as each nozzle is performing as designed and nozzles are at least 0.5 m above the target. The flow meter used by the sprayer controller can be used for combined nozzle flow test for the boom.

[6] The calibration gauge is likely to be physically larger than a gauge found on a sprayer and should be compared with another calibration gauge annually or biannually. Note 1 bar = 100kPa = 14.5 psi

For Stream type and standard nozzles

Check that all nozzles are the same along the length of the boom. Identify the specified flow rate for 2 bar pressure from the manufacturers flow chart e.g. 2.01 litres /minute. Calculate the expected total boom flow per minute (flow per nozzle x number of nozzles) e.g. 48 nozzles x 2.01 litres/minute = 96.48 litres/minute. With the boom unfolded, fit a pressure gauge to boom section as for 1 (boom section test). Run the sprayer and adjust pressure and flow so that boom pressure is 2 bar. Turn the boom sections off, set the total flow on the controller to zero or record the total flow to date or maybe current tank volume (depends on the controller set up). This is the start volume. Turn on the whole boom for exactly 2 minutes. Record the volume sprayed from the controller. Compare this with expected flow per minute x 2. Where the flow is more than 5% different from than expected e.g. actual total flow less than 183 litres or more than 202 litres, the flow from some individual nozzles is likely more than 10% different from expected. At this point individual nozzle flow should be checked to identify and replace (or clean) any such nozzles.

For Dribble bar type nozzles

Dribble or Stream bar type nozzles have manually adjustable flow systems to change orifice size. These systems are not manufactured with the same precision as stream type or standard nozzles so it is not practical to compare actual with expected flows. Also they can be subject to variation in positioning with manual adjustment.

Unfold the boom and check that all dribble bars have the same orifice setting. Run the stationary sprayer at required operating pressure for the selected forward speed and target volume application rate (e.g. 15 km/hr, 150 l/ha). Once the operator is happy that the system is running at target rate, collect the flow from every second dribble bar for with Spreadmark trays or bucket for one minute[7]. The volume of water collected can be measured with a 5 litre calibrated measuring jug or weighed and used to calculate a C of V for evenness of spread across the boom (See item 10, Reporting, below).

6. Measurement standards

The following measurements will be made and recorded for each certification test.

Factor	Measurement	Standard
Boom section pressure	Bar or kPa	Test gauge +/- 10kPa of calibration gauge
Distribution of boom pressure	Coefficient of Variation	< 5%
Combined nozzle flow (Stream or standard nozzles type)	Litres/minute at 2 bar nozzle pressure	+/- 5% of manufacturers specification[1]

[7] Suggest use a 5 litre jug and collect for sufficient time to fill jug with more than 2.5 litres of water

Individual nozzle flow (Dribble type)	Litres/minute at nominated boom pressure	Measuring Jug, 5 litre, calibrated OR Scales[2] accurate to +/- 10 gm
Distribution of nozzle flow (dribble type)	Coefficient of Variation	< 15%

Notes [1] Manufacturers flow chart per nozzle multiplied by the number of nozzles.

[2] 1 millilitre (ml) of water = 1 gram

7. Schedule of tests

The following tests will be conducted:

For conventional spray boom with standard nozzles

- Boom section test
- Combined nozzle flow test

For conventional spray boom with dribble bar type nozzles

- Individual nozzle flow test

All tests to be carried out with water with stationary sprayer

8. Field Report

The following records will be kept for each test:

Identification	**Date:**			
	Operator:			
	Machine:			
	Technician:			
	Location:			
Sprayer detail	Spray Controller:			
	Number of nozzles and spacing:			
	Number of boom sections:			
	Application Volume rate (L/ha)			
	Forward Speed (km/hr)			
	Operating pressure (bar)			
Test Nozzles	Nozzle	Expected flow at 2 bar		
Test Conditions	Sprayer condition:			
	Tank size:			
	Flow meter calibration value: (pulse per litre)			
	Wheel speed sensor calibration value: (pulse per metre, if fitted)			

Certification	Nozzle	Bout Width (m)	Application Volume (litres/ha)	Speed (km/hr)	Pressure (bar)

9. Certified bout widths

The tester will generate a CV for boom section pressures. The Certified Bout Width of a sprayer will be set by the number of nozzles and nozzle spacing where the test result for boom section pressures is 5% or less.

The tester will also generate a comparison of measured combined nozzle flow with expected combined nozzle flow for Stream type and standard nozzles at 2 bar boom pressure. The Certified Bout Width of a sprayer will be set by the number of nozzles and nozzle spacing where the combined nozzle flow test shows the nozzles are within 5% of flow expected by manufacturers.

The tester will generate a CV for dribble bars. The Certified Bout Width of a sprayer will be set by the number of nozzles and nozzle spacing where the test result is 15% or less for water.

10. Reporting

Approved Spreading (Spraying) Equipment Testers will, at the conclusion of the test, produce a Spreadmark Sprayer Performance Certificate.

The Spreadmark Sprayer Performance Certificate must show, at least:

- The spraying company name, a vehicle identification number, sprayer and tank size.
- The boom section pressures
- Comparison of combined nozzle flow with manufacturers expected combined flow
- The Certified Bout Width for each nozzle tested (see item 9, for details).

- The date of the test and the expiry date of the certificate. The expiry date will be two years after the date of the test.

- The certified application rate for each nozzle.

On completion the Sprayer Performance Certificate will be sent to the company with a copy to the Auditor.

3.4 Principles for the type testing of groundspread fertiliser machines

Scope

The Fertiliser Quality Council wishes to encourage the development and use of fertiliser spreading equipment that can effectively and reliably spread fertiliser.

To facilitate this the principles below will be followed with regard to the Type Testing and Type Approval of fertiliser spreaders. A list of fertiliser spreading equipment models that have Spreadmark Type Testing Approval will be maintained in this Code.

Principles

1. "Good spreaders" will be recognised by being Spreadmark Type Approved. Spreaders which meet the following general criteria can become Spreadmark Type Approved. Spreadmark Type Approved spreaders will:

   - be able to achieve satisfactory spreading performance over the range of the fertiliser types (particles sizes) specified by the spreader manufacturer.
   - perform satisfactorily over the normal range of application rates for the fertiliser types specified by the spreader manufacturer.
   - have transverse spreading patterns that are substantially unaffected when operating on hill country compared to the flat (Note: this criteria will be added later when the following bullet point will be added to section 1 of the Assessment Criteria for Type Tested Spreaders: "the effect of operating on hill country will be assessed by comparing the performance on one product up and down hills with performance on the flat").
   - have longitudinal distribution patterns that are satisfactory over a representative range of fertiliser types and application rates.
   - have substantially the same performance characteristics between different units of the same model.
   - be provided with suitable, user-friendly operator's handbook that has sufficient information to enable that the operator is able to achieve satisfactory spreading with the fertilisers and application rates defined above.

   Satisfactory spreading performance is defined as meeting the Spreadmark evenness standards at the range of bout widths for which the spreader has been designed at the required application rates for a given fertiliser specification.

2. It is recognised that the spreading characteristics of spreaders are largely defined by the disc design, disc speed and the design of the drop off zone. The evaluation process and the model description will accommodate this.

3. There is much that is not fully understood about the characteristics of spreaders (e.g. stability of spreading characteristics when the properties of the fertiliser changes slightly and reproducibility between machines). Best practice in these areas is not well understood and will change over time. We will learn from our experience with Type Approval and it is recognised that this will probably lead to alterations of the rules and the criteria.

4. Type Approval will be subject to a re-approval process.

5. In order to maintain credibility, testing for Spreadmark Type Approval can only be done by a Spreadmark Approved Equipment Tester who is not an employee of a spreader manufacturer or importer.

3.5 Procedure for the type testing of groundspread fertiliser machines

1. Evaluation process

1.1 Manufacturers or importers of fertiliser spreading equipment wishing to gain type certification for their spreaders should contact:

The Executive Director
Fertiliser Quality Council
Federated Farmers of New Zealand
Box 715
Wellington

Email: director@fertqual.co.nz

1.2 Upon receipt of an application for a particular model/s of fertiliser spreading equipment to be considered for Spreadmark Type Approval the Executive Director will forward the application to the Spreadmark auditor who, without unreasonable delay, will contact the applicant to evaluate whether the proposal meets the requirements of this Code.

1.3 The Spreadmark auditor will provide such guidance as is appropriate, consider the information provided from reputable overseas sources or from the recognised Spreadmark Equipment Testers, who have followed the assessment criteria below, and formulate a recommendation to the Spreadmark Executive Director. This recommendation must include whether or not to grant Spreadmark Type Approval for the model/s under consideration and, if the recommendation is to grant approval, any limitations to that approval.

1.4 The Spreadmark auditor shall report their findings to the Executive Director. Where appropriate, the Executive Director will issue a Spreadmark Type Approval certificate and will cause the register of Spreadmark Type Approved fertiliser spreading equipment to be altered.

2. Assessment criteria

The criteria that will be applied to assess whether a particular fertiliser spreader model should be Spreadmark Type Approved are described below.

2.1 Spreading performance envelope of the type.

The purpose of this part of the testing programme is to ensure that satisfactory spreader performance can be achieved over an appropriate range of fertilisers and application rates and that spreaders have reasonably stable operating characteristics over small variations in fertiliser characteristics.

In order to do this one spreader unit will be tested as follows:

- The evenness of distribution will be tested with a range of fertiliser types representing the particle size ranges (SGI and UI) that the spreader has been designed to spread. Normally six to nine fertiliser types will be used.

- The effect of application rate on the evenness of distribution will be tested by transverse distribution measurements at the minimum, median and maximum agronomic rate for each product.
- The effect of flow rate on the transverse distribution pattern will be assessed at the lowest application rate at the slowest forward speed and at the highest rate at the highest forward speed with a limited number of products.
- Longitudinal variation will be measured with three products covering the range of SGNs at their median application rates.

As the intention is to identify where differences occur, it may not be necessary to test all products at all rates. Products may be grouped and one product used as a representative product once it has been established that their spreading performance is the same. If however, differences appear between similar products, more intensive testing will be done to define the extent of the differences and where they occur. The actual amount of testing will be determined by the need to have enough information to decide whether the spreader performance is satisfactory over the appropriate range of fertilisers and application rates and whether or not the spreader has reasonably stable operating characteristics over small (normal) variations in fertiliser characteristics.

The manufacturer/importer may self-impose limits to the testing of the spreader model. Examples of this could be to test on lime only, to test only on the flat or upper limits to the application rate could be set. Any such limits will be recorded and reported on the type test certificate and on the published list of Approved Spreaders. All tests will be carried out in accordance with the Technical Specification for the Testing of Groundspread Fertiliser Machines.

2.2 Reproducibility of the type

A number of units of the same model will be tested to identify whether different units of the same model of spreader have substantially the same performance characteristics. These tests will be carried out at critical points identified during the testing of the type performance envelope (e.g. at low application rates with difficult to spread products).

The number of units that will need to be evaluated to check reproducibility between machines will normally be two or more and the number of transverse distribution measurements made will normally be six per unit. Spreadmark test data may also be used as reproducibility evidence. The actual number of vehicles tested and transverse distribution measurements needed will be sufficient to enable a clear opinion to be formed about the reproducibility between machines for that model of spreader.

In order to be type approved the shape of the curves on the Spreader Performance Certificates, under the same test parameters, will need to be substantially the same. Where fertilisers with slightly different characteristics are used on different machines an attempt will be made to correct for this when comparing the shapes of the curves.

Reproducibility testing may be carried out at different times and places to the type performance envelope testing described in section 2.1, above. Reasonable care will be taken to use fertiliser products with the same or very similar SGN and UI values to those used for spreader performance envelope testing. It may be necessary to retain product between type tests or reconstitute product by particle size to ensure that products of the same SGN and UI are used for type testing.

2.3 Documentation

In order to be Spreadmark Type Approved, machines will be provided with a suitable, user-friendly operator's manual describing their performance characteristics and adjustments. The information in the operator's manual must be consistent with the information found in the spreader performance envelope testing (see section 2.1, above).

3. Standard design

Manufacturers or importers wishing to apply for type approval need to define the spreader model that is being described, have the facility to manufacture spreaders reproducibly and make a commitment to advise of changes to the spreader design.

The design shall be defined on a set of drawings showing the critical dimensions of the spreading equipment. These will include the vane and disc dimensions and the dimensions which characterise the drop-off zone (the area in which the fertiliser enters the spinning disc). These drawings will be used to check that the design of the approved models remains the same.

The spreader manufacturer must have processes that are capable of ensuring that approved designs are made consistently.

4. Testers

Testing for Spreadmark Type Approval will be by a person recognised by the Fertiliser Quality Council as being able to do so.

Testing for Spreadmark Type Approval may not be done by a Spreadmark Approved Equipment Tester who is an employee of a spreader manufacturer or importer.

5. Costs and fees

Manufacturers and importers seeking Spreadmark Type Approval pay the tester for the costs of producing the reports that describe the results of the testing for each of the assessment criteria outlined.

Applicant manufacturers and importers also pay the Fertiliser Quality Council for:

- Direct costs incurred in gaining and maintaining Type Approval, and
- An annual levy of $500 + $100 per unit sold in that year + GST per spreader type listed. This levy shall not exceed $2,000 plus GST per spreader type listed in any one year.

Where fertiliser spreading companies manufacture their own Type Approved fertiliser spreaders for their own use, the number deemed to be "sold" will be the total number of that type manufactured in that year.

6. Revision of type testing rules

From time-to time there will be a need to revise the Spreadmark Type Testing Rules. Revised rules will apply to applications received after the date of the change and to all re-approvals.

Manufacturers and importers of fertiliser spreaders will be consulted about proposed changes.

7. Modified designs

When approved designs are modified they will normally not require the full testing required of a new application. There shall be sufficient testing to show that the modified design is an improvement on the performance envelope of the original type test.

8. Re-approval

Manufacturers and importers holding a Spreadmark type testing approval will be asked periodically to confirm that the design has not altered and may be asked to demonstrate that the approved design still conforms to the current version of the Type Testing rules.

Checks on the distribution pattern of Type Approved spreaders may be carried out from time-to-time to confirm that type performance for that model is being maintained. Spreadmark certification test data may be used to re-confirm type performance characteristics.

9. Spreader performance certificates

Type tested spreaders must be sold with a Spreader Performance Certificate for that model covering the products used during type testing and showing the Coefficient of Variation (CoV) versus Bout Width (BW) performance for that model. This certificate, which must be dated, gives the fertiliser spreading company a Spreadmark certificate, valid for a two year period.

These manufacturer/importer supplied Spreadmark Performance Certificates for Type Approved machines can be given an extended life where it can be demonstrated to the Spreadmark Auditor’s satisfaction that there is appropriate evidence of maintenance and on-going checking of the spread pattern.

10. List of type approved machines

A list of Spreadmark Type Approved Groundspread Spreaders can be found in this Code. The list will, from time to time, be given appropriate publicity.

3.6 Guidelines for checking spread patterns ("The Quick Test")

1. Introduction

The purpose of this guide is to assist companies wishing to check the spread pattern of their fertiliser spreaders.

Spread pattern checks should be carried out:

- After damage or a major service of the spreading mechanism,
- Between two–yearly checks to meet the annual spreader checking requirement (see section 4.2 of the Spreadmark System Standard),
- In order to prepare machines for testing by Spreadmark Approved Spreader Testers,
- In order to demonstrate a checking history to substantiate a request for the extension of a Spreadmark Spreader Performance Certificate (see section 4.9 of the Spreadmark System Standard).

The procedure for checking the spread pattern of fertiliser testers is based on the process used by Spreadmark Approved Spreading Equipment Testers but is considerably simpler.

Note that there is a considerable amount of information and background material available to spreader checkers in earlier sections of this Code. Checkers are referred to "Principles for the Technical Framework for Spreader Certification" and the "Technical Specification for the Testing of Groundspread Fertiliser Machines".

2. Procedure

Test site

Select a suitable site for checking the spreaders. This will generally be outdoors on flat land with relatively short grass. Testing should ideally be either directly into or with the wind. The wind speed should not be so high as to distort the spread pattern (generally up to about 15 kph).

Do not conduct too many tests in the same location to avoid over-fertilising the land.

If testing indoors ensure that the test venue is large enough to give a proper run up and also large enough to avoid ricochet effects.

Participation

It is recommended that operators will be involved in the testing of machines that they drive. This will enhance their knowledge of factors affecting the performance of their machine.

Test products

Spreaders should be checked with more than one fertiliser. The fertilisers used for testing should be typical of those normally spread with that machine.

When testing, record the bulk density and the sieve box results for the fertilisers used.

Collectors

Collectors should be laid out across the direction of travel. Anti-bounce inserts should be fitted. Collectors may be laid out continuously or at one meter spacings – depending on the number of trays available.

Collectors should collect a reasonable amount of the swath. For most machines it has been found that about 20 trays at a one meter interval provides sufficient information to allow sound assessments of spreader performance to be made.

Material Collected

The fertiliser collected in each tray should be weighed to the nearest 0.1 gram or the volume measured using graduated tubes.

Graphs

The test information gathered should then be graphed to produce a spread pattern graph which can be compared with the original test pattern.

In order to demonstrate that the Recommended Bout Width remains valid the test information (tray placement vs weight or volume collected) should be loaded into the appropriate computer software. Alternatively, this service may be available from one of the Spreadmark Approved Testers listed in this Code.

4. Operator training

This section of the Spreadmark Code of Practice contains the following material for groundspread fertiliser companies:

4.1 Spreader Operator Training Principles;

4.2 Spreader Operator Training Outcomes;

4.3 Approved Training Courses

4.1 Spreader operator training principles

1. Philosophy

The Fertiliser Quality Council are committed to the implementation of the Spreadmark Code of Practice and to that end has supported the development of a training syllabus to assist with the successful achievement of the programme's objectives. The Council believes that the successful achievement of the objectives of the Code is dependent on sound knowledge and understanding within the context of the activity of placement of fertiliser in New Zealand, and that through training of the operator/driver such knowledge and understanding will be gained.

2. Methodology

Training outcomes have been determined which are based on the material contained in the Spreadmark Code of Practice. The training outcomes are focused on developing the understanding and knowledge that are required by a competent operator/driver in the activity of spreading fertiliser.

Training programmes have been developed based on these training outcomes. Relevant notes, extracts, explanations, demonstrations, worked examples and practical activities support the syllabus units. The material to used is structured to suit a wide range of operator/drivers with varying levels of knowledge and understanding. In all training activities, the emphasis is on technically sound information and direction, and all essential information will be presented in clear, concise terms and supported by illustrative material and practical aids.

3. Approval

Courses which the Fertiliser Quality Council accepts as meeting the operator training requirements of the Spreadmark Code of Practice are listed in this section of the Code.

4. Competency

Competency will be assessed at a number of points during the training using a range of appropriate instruments including:

- Written tests
- Multi-choice questions
- Non-verbal graphical interpretation
- Workshop activities
- Verbal recording
- Practical tests

The assessment methods will support and enhance the training with provisions having been made to identify at an early stage those participants who may require extra assistance to achieve the training outcomes.

Each participant will be required to reach a minimum level of competency in all aspects of the training programme in order to achieve certification.

A sample of all assessment outcomes will be subjected to independent moderation relative to the training objectives stated in the syllabus.

Any person failing to meet the required standard will be advised of the areas of concern and given further coaching and re-tested to ensure he/she achieves the required standard.

5. Admission requirements

The Fertiliser Quality Council encourages all persons actively involved in, associated with, or interested in the placement of fertiliser in New Zealand to be trained in the requirements of the Spreadmark Code of Practice. To facilitate this there should be no limitations of prior learning or employment placed on people entering this training.

6. Certification

Certification is only to be available upon the successful completion of an approved training course by an registered provider. This includes all on-course activities and evaluation tasks, and any pre- and/or post-course activities.

4.2 Spreader operator training outcomes

Scope

This material describes the outcomes sought of an operator training programme to be acceptable as suitable training for operators involved in the Spreadmark scheme. The purpose of the training is to ensure that fertiliser spreading machinery operators are competent.

Outcomes of training

The competence of fertiliser spreading machinery operators is ensured by them completing a training course with the following training outcomes:

1. Fertiliser knowledge

This will involve a basic knowledge of fertilisers and lime.

- Types.
- Safety Data Sheets.
- Factors which could lead to problems e.g. mixes of fertilisers with very different particle sizes (SGN) or incompatible mixes.
- How the bulk density (BD), SGN and uniformity index (UI) of various fertilisers interact and affect how well various fertilisers can be spread.
- How to measure SGN and BD with a sieve box.

2. Spreader skills

The operator skills relating to spreaders are:

- Consequences of poor spreading (agronomic and environmental), awareness of the influence of wind.
- Choosing an appropriate bout width (BW) for particular loads of fertiliser.
- Interpreting information to be able to know what settings on spreading machinery are needed for various fertilisers and fertiliser characteristics in order to achieve the correct application and BW.
- Adjusting spreader equipment.
- Factors affecting the performance of the machine over time (build-up).
- Handling spillages.
- Being able to operate to a particular bout width.

3. Communication skills

Sufficient communication skills with farmers to ensure that the fertiliser is applied in the correct place and that local hazards are identified.

4. Environmental awareness

An awareness of the consequences for stock health and of environmental damage from fertiliser, the actions taken to avoid this (waterways, riparian areas and soakage zones) and the effect of wind drift.

4.3 Approved training courses

For training completed prior to 31 December 2020, the following training courses are recognised by the Fertiliser Quality Council as meeting the operator training outcome requirements of the Spreadmark System Standard:

1. The National Certificate in Commercial Road Transport (Ground Spreading).

2. A course approved by the National Council of the NZ Groundspread Fertilisers Association (NZGFA) for the purposes of meeting the training requirements of Spreadmark certification.

3. The Spreader Operator Training Course previously operated by the Fertiliser Quality Council.

For training completed after 1 January 2021, the following training courses are recognised by the Fertiliser Quality Council as meeting the operator training outcome requirements of the Spreadmark System Standard:

1. A course approved by the National Council of the NZ Groundspread Fertilisers Association (NZGFA) for the purposes of meeting the training requirements of Spreadmark certification.

5. Registers

This section of the Spreadmark Code of Practice contains the following registers:

5.1 Approved Spreading Equipment Testers,

5.2 Collectors Approved for Use with Spreadmark Testing, and

5.3 Spreadmark Type Approved Spreading Equipment.

NOTE:	*The Executive Director will maintain, and make public, a list of fertiliser spreading companies which hold Spreadmark registration. This list is not included in this Code*

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Approved spreading equipment testers for groundspreaders

The list of people, and the organisations that they are employed by, that are recognised by the Fertiliser Quality Council as being able to carry out solid fertiliser groundspreading machinery testing and certification for the Spreadmark programme can be found on the website of the Fertiliser Quality Council, www.fertqual.co.nz.

Any person wishing to be considered for recognition as an Approved Spreading Equipment Tester should contact:

The Executive Director
Fertiliser Quality Council
Federated Farmers of New Zealand
Box 715
Wellington

Email: director@fertqual.co.nz

Collectors approved for use with Spreadmark testing

The following is a list of collector and collector insert designs approved by the Fertiliser Quality Council for use in Spreadmark testing:

1. The collector and baffle design of Spreader Calibration Services.

2. The collector and baffle design of EuroAgri Import Ltd (James McCloy, phone (03) 307-7445).

Organisations wishing to have an additional collector and collector insert designs approved should advise the Executive Director, Fertiliser Quality Council at director@fertqual.co.nz with an appropriate comparative test report.

Spreadmark type approved spreading equipment

Companies manufacturing fertiliser spreading equipment and wishing to gain type certification for their groundspreaders should contact The Executive Director, Fertiliser Quality Council, Federated Farmers of New Zealand, Box 715, Wellington.

The protocol for type-testing can be found in this Code.

There are currently no fertiliser spreader types which are recognised by Spreadmark as being able to reproducibly comply with Spreadmark requirements.

Aerial fertiliser application practices

This section of the Spreadmark Code applies to the aerial application of fertiliser and is in two parts. Part A deals with Spreadmark protocols and procedures. Part B is the Aerial Spreadmark Code of Practice.

Contents

PART A The Aerial Spreadmark protocols

PART B The aerial Spreadmark code

SECTION PAGE

Appendices

Part A The Aerial Spreadmark Protocols

1. Spreadmark System Standard for Aerial Operators

1.1 Scope

Spreadmark Registered operators shall have an active quality management programme. The programme shall include the requirement for a quality policy, and quality indicators, a recording system for non-conformances, corrective and preventive actions, internal audit reviews and management reviews. This programme shall also include requirements dealing with work instructions and customer complaints. The quality management standard that will be used by the auditor to assess the degree to which the operator's management system meets customer needs and Spreadmark standards is described in the Quality Assurance, Rules and Procedures section of the NZ Agricultural Aviation Association's Registration programme.

1.2 Spreading equipment

1.2.1 With only the exception noted below, all spreader types in a Spreadmark registered aerial operators fleet will hold a current Spreadmark Test Certificate. The exceptions to this are new spreader types which have not yet been tested but for which testing is intended.

1.2.2 Spreading equipment must operate at a bout width that is within the limits that are defined by its Spreadmark Test Certificate for the fertiliser being spread when that standard is requested by the customer.

1.2.3 Helicopter underslung bucket spreaders will be re-tested every two years by both self-testing and by an Approved Spreadmark Pattern Tester as follows:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Spreadmark	Self	Spreadmark	Self	Self	Self
			Auditor Discretion	Auditor Discretion	Auditor Discretion

Fixed Wing aircraft will be re-tested every two years by both self-testing and by an Approved Spreadmark Pattern Tester as above unless they have an acceptable risk-based programme in place to manage the risks that the pattern has changed.

1.2.5 Acceptable risk-based pattern management programmes will:

- Be based on properly defined Risk Assessment Principles.
- Include the management of risks from:
    - changing flow characteristics of fertilisers,
    - changing machine performance,
    - environmental conditions.

- Will include the provision that aerial spreaders are initially certified by an Approved Spreadmark Pattern Tester.

1.2.6 Risk-based pattern management programmes will be audited by the Spreadmark auditor who will review the Aerial Spreadmark Pattern risk assessment management programme and the associated verification records. If these requirements have been met, the validity of the original Pattern Test Certificate will be extended until the next routine Spreadmark audit.

1.2.7 Written records shall be kept of all spreading equipment checks and calibrations.

1.3 Operators

1.3.1 All pilots shall be competent in relation to their understanding and application of the Approved Aerial Pattern Test Certificate and Spreadmark Registration.

2. Spreadmark Auditor Protocol for Aerial Operators

2.1. Scope

This protocol sets out the roles and responsibilities of the Auditor for Spreadmark Registration of Aerial Operators.

2.2 Appointment

2.2.1 The Fertiliser Quality Executive Committee shall nominate the Auditor and approve the appointment, for such a term as the Executive Committee shall determine. This decision will be taken in consultation with the NZAAA.

2.2.2 The Auditor shall have received appropriate auditor training and shall be familiar with the agricultural aviation industry.

2.2.3 The Auditor cannot also be a Spreading Equipment Tester as it is important that the functions of testing equipment and auditing be kept entirely separate.

2.3. Company contacts

2.3.1 The Auditor will maintain a register of operators and nominated contact people. The nominated contact people are to be the primary points of contact for the Auditor with the operator.

2.4. Notification

2.4.1 Applications for Spreadmark Registration will normally be made to the NZAAA, as part of an application for NZAAA Registration. NZAAA will advise the Executive Director, FQC each time a valid application for Spreadmark Registration is received. The Auditor will be notified by NZAAA.

2.4.2 Applications from operators directly to the Executive Director for Spreadmark Registration independently from NZAAA Registration shall also be considered.

2.4.3 The Auditor will negotiate with the contact person for the operator for a suitable time to conduct the audit.

2.5. Audits

2.5.1 During audits the Auditor will audit the operator against the Aerial Spreadmark Code of Practice. The audit will focus on outcomes and evaluate whether or not they are being achieved.

2.5.2 After the site audit is complete a recommendation as to the suitability of the operator for Spreadmark Registration will be sent to the Executive Officer, NZAAA who will advise the Executive Director FQC, who will confirm to the Executive Officer that Spreadmark Registration has been approved.

2.5.3 An audit report will be sent to the nominated operator contact person. It will include a copy of the recommendation relating to Spreadmark Registration sent to the Executive Officer NZAAA.

2.6. Audit frequency

2.6.1 Spreadmark Registration audits will normally be carried out on a two yearly basis from the date of the Registration audit.

2.6.2 The Auditor may determine that an increased audit frequency (1 year) is appropriate if there are non-conformances or complaints against the company are sustained, or a decreased audit frequency where the candidate has been Spreadmark Registered for 4 years (ie 2 cycles) and no non-conformances have been found. The operator may be subject to 1 audit during the 4-year period. Registered operators shall send a copy of an annual internal audit report to the Spreadmark Auditor during the 4 year audit cycle.

2.7. Status Report

2.7.1 The Auditor will maintain a status report showing the current status of each Spreadmark Registered operator, when it is next due to be audited and any current issues that relate to it.

2.7.2 The status report shall be supplied to the Executive Director every six months or within ten working days of it being requested.

2.8. Records

2.8.1 The Auditor shall maintain proper records. These records will include audit reports, status reports and correspondence.

2.8.2 Records, or copies of records, shall be supplied to the Executive Director upon request and in accordance with the Spreadmark Confidentiality Protocol.

2.9. Confidentiality

2.9.1 The Auditor will not communicate information about any operator to anyone other than the operator itself through its nominated contact person, the Executive Officer NZAAA or the Executive Director, FQC. Requests for information in relation to Spreadmark Registration are to be referred to the Executive Director.

2.9.2 All information held by the Auditor on an operator is to be made available to that operator on request by the nominated operator contact person.

2.9.3 For further information refer to the Spreadmark Confidentiality Protocol.

3. Approved aerial spreading equipment testers protocol

3.1. Scope

3.1.1 This protocol sets out the roles and responsibilities of Approved Spreading Equipment Testers for pattern testing of aerial spreading equipment

3.2. Approval policies

3.2.1 In consultation with NZAAA, the Fertiliser Quality Council Executive Committee shall approve Aerial Spreading Equipment Testers.

3.2.2 The term of approval shall be two years or any other lesser term that the Fertiliser Quality Council Executive Committee determines.

3.2.3 Approved Spreading Equipment Testers will be appropriately qualified and will be able to display practical experience relevant to the agricultural aviation industry.

3.2.4 The register of Approved Spreading Equipment Testers, by name, will be held by the Executive Director or his nominee. All applications to alter the terms of an Approved Equipment Tester's approvals must be made in the first instance to the Executive Director.

3.2.5 An Approved Spreading Equipment Tester will be a fit and proper person capable of managing spreader equipment testing, but who is also able to maintain the integrity of the Spreading Equipment Testing process.

3.2.6 Any complaint about an Approved Spreading Equipment tester must in the first instance be made to the Executive Director for resolution.

3.3. Approval processes

3.3.1 Upon receipt of a request to become a Approved Spreading Equipment Tester the Executive Director or his nominee will contact the applicant to arrange a suitable time for an audit of their equipment, processes and software to evaluate whether or not they comply with the requirements of this Code.

3.3.2 On the advice and recommendation from his nominee, the Executive Director will seek approval from the Executive Committee of the Fertiliser Quality Council for the applicant to be added to the register of Approved Testers for aerial operators. Upon approval by the Executive Committee the applicant will be advised that they are able to carry out pattern testing and certification for the Spreadmark programme for aerial operators and that their name will be added to the register of Approved Spreading Equipment Testers for aerial operators.

3.4. Operator contacts

3.4.1 Approved Aerial Spreading Equipment Testers shall offer testing services to all operators seeking Approved Aerial Pattern Test Certification.

3.4.2 Candidates for Spreadmark Registration may select the services of any Aerial Approved Spreading Equipment Tester at a testing fee to be fixed between the parties.

3.5. Spreadmark spreading equipment testing

3.5.1 All testing done by Approved Spreading Equipment Testers for Spreadmark purposes will be done in accordance with the Aerial Spreadmark Code of Practice.

3.6. Audits

3.6.1 The Approved Aerial Spreading Equipment Tester shall be subject to regular audit by the Executive Director, Fertiliser Quality Council or his nominee. The audit will be to determine that the standards specified in the Aerial Spreadmark Code of Practice are being maintained through the Spreading Equipment Certificate test. The auditor will make available the results of the audit to the Fertiliser Quality Council Executive Director on request.

3.6.2 If in the opinion of the auditor the Spreadmark approved specifications are not being met, the Executive Director will require the Approved Spreading Equipment Tester to provide an explanation within ten days. If the matter cannot be resolved the Executive Director may suspend the Approved Spreading Equipment Tester from Spreadmark testing.

3.6.3 The auditor may be asked to conduct an audit of the Approved Spreading Equipment Tester if requested by the Executive Director following any complaint.

3.6.4 In all matters in dispute the decision of the Executive of the Fertiliser Quality Council will be binding on the parties.

3.7. Limitations

3.7.1 Disputes that may arise between Spreadmark Registered companies and Approved Spreading Equipment Testers shall be managed according to the Spreadmark Disciplinary and Deregistration Procedure in the Spreadmark Operational Rules

4 Procedure for Spreadmark Registration

4.1 Scope

This is the procedure for the Registration of aerial operators under the Spreadmark Scheme.

4.2 Application for Spreadmark registration

4.2.1. Enquiries regarding Spreadmark Registration may be directed to the Executive Director, FQC or the NZAAA, who will forward an official Spreadmark Registration Application Form

4.2.2. Applications for Spreadmark Registration will normally be made to NZAAA in writing on the official application form and must be accompanied by the application fee. These applications will normally be as part of an application for NZAAA Registration. The application fee is not refundable in the event that application does not proceed or is unsuccessful.

Applications from non-members of NZAAA for Aerial Spreadmark Registration only will be made to the Executive Director FQC. The application fee in this case is $700 + GST

4.2.3. Upon receipt of the application form the NZAAA shall verify that the application is complete and that the appropriate fee is attached and shall then advise the Executive Director.

4.2.4. The NZAAA advises the Aerial Spreadmark Auditor to audit the candidate operator.

4.2.5. Following the audit the auditor will report with a recommendation to the Executive Officer NZAAA as set out in the auditor protocol. If the Auditor does not consider the requirements of Spreadmark to be met then the applicant company will be advised in writing of the findings and actions to be made.

4.2.6 If the operator applicant has been recommended for Spreadmark Registration the Executive Director FQC amends the register of Spreadmark Registered Operators.

Application for Spreadmark Registration

This form is to be used by operators that seek Aerial Spreadmark Registration.

When complete, attach a cheque for $200 + GST ($225) to cover the application fee and send to:

The Business Manager
NZAAA
PO Box 2096
WELLINGTON

Operator Name:	
Postal Address:	
Physical Address:	
Contact Person:	
Phone Number:	
Fax Number:	
Other Contacts:	
Number of Aircraft:	

We recognise that the Spreadmark scheme requires operators to have:

- An Approved Aerial Pattern Test Certificate
- An active quality management system.

We agree that upon being granted Spreadmark Registration we:

- will abide by the Spreadmark Codes of Conduct;
- will abide by such Rules, Protocols and Policies as are made by the Fertiliser Quality Council;
- will pay the annual Spreadmark levy of ($200 + GST);
- allow reasonable access to the appointed Aerial Spreadmark Auditor;

We agree that if Spreadmark Registration is withdrawn or lapses all mention of Spreadmark made in the company publications or on the company vehicles or any other use of the Spreadmark trademark will cease.

……..…… …. ……..……
(Signature) *(Name)*

…… *(Date)*

5 Registers

This section of the Spreadmark Code of Practice contains the following registers:

5.1 Approved Spreading Equipment Testers,

5.2 Collectors Approved for Use with Spreadmark Testing, and

5.3 Spreadmark Type Approved Spreading Equipment.

NOTE:	*The Executive Director will maintain, and make public, a list operators who hold Spreadmark Registration. This list is not included in this Code.*

5.1 Approved spreading equipment testers

Below is a list of people, and the organisations that they are employed by, that are recognised by the Fertiliser Quality Council as Approved Aerial Pattern Testers and are able to carry out fertiliser spreading equipment testing and certification for the Aerial Spreadmark programme.

Jim Laird
Jim Laird Assessment Services
PO Box 671
Masterton
Phone: (0274) 412 659

Garth McMaster
McMaster Engineering Ltd
169 Great North Road
Winton
Phone: (03) 236-7275 or (0274) 334-486

Stuart Hill
McMaster Engineering Ltd
169 Great North Road
Winton
Phone: (03) 236-7275 or (0276) 577-811

Travis Churchill
Spread Test NZ Ltd
222 Loburn – Kowai Road
RD2 Rangiora 7472
Phone (021) 215-4361

Julie Churchill
Spread Test NZ Ltd
222 Loburn – Kowai Road
RD2 Rangiora 7472
Phone (021) 215-4361

5.2 Approved collectors, data collection and reporting for aerial spread pattern testing

5.2.1 Collector and Insert design

The following is a list of collector designs that are approved by the Fertiliser Quality Council for use in aerial pattern testing, together with standardised processing formats.

Organisations wishing to have an additional collector and collector insert designs approved should advise The Executive Director, Fertiliser Quality Council, Federated Farmers of New Zealand, Box 715, Wellington.

and obtain a comparative test report from Dr I. Yule, NZ Centre for Precision Agriculture, Massey University, Palmerston North.

The following is a list of collector and collector insert designs approved by the Fertiliser Quality Council for use in Aerial Spreadmark pattern testing:

- The collector and baffle design of the NZ Groundspread Fertiliser Association. These are available from:

  The Executive Director
  NZ Groundspread Fertilisers Association
  Federated Farmers of New Zealand
  PO Box 414
  Ashburton

- The collector design of NZAAA. These are available from

  The Business Manager
  NZAAA
  PO Box 2096
  Wellington

5.2.2 Data collection and reporting

a) Data Collection - general

Pattern test data for an aircraft distribution system, whether for liquids or solids shall include a graph of the swath pattern from a single pass, a graph of the bout width vs. the CV% for evenness of application and the following information:

- Wind speed and direction at the test site (relative to the flight path or the line of collectors)
- Fertiliser physical properties, including SGN, UI (for liquids this may be expressed as VMD or (Dv0.1 Dv0.5 and Dv0.9)) and Bulk Density.
- Application rate (intended and achieved, kg per ha)
- Flight path (centerline collector)
- Application height (estimated + or – 5m)
- Ground speed (km/hr)
- Collector specification (size, spacing, number)
- Weight of fertiliser per collector (gm)
- Application equipment type – see also Appendix E in Part B of this Code

b) Data collection – application equipment (solids)

Solids Spreader	Data	Report
None	Dimensions of outlet	……..mm long …….. …….mm wide
	Type of outlet (clamshell/louvre/other)	
	Fairings (describe)	
Ram Air	Front (inlet) dimensions	……mm
	Rear (outlet) dimensions	……..mm
	Number of vanes	
Powered (disc)	Disc diameter	……..mm
	Disc open or shrouded	
	Disc height (i.e. vane height)	……mm
	Disc speed	……rpm
	Number and shape of vanes (describe)	
	Feed point onto disc	
	Flow metering device (e.g. orifice plate)	

c) Data collection application equipment (liquids)

Spray System	Data	Report
Nozzles	**Nozzle type -Flood jet, fan, disc/core, other (describe)**	
	Number of nozzles	
	Nozzle orientation (90^{o} = straight down, 180^{o} = straight back)	
	Nozzle spacing (mm) Include diagram for variable spacing	…….mm
Spray Boom	Location (in relation to wing or helicopter skids – describe)	
	Boom pressure	……..kPa
	Boom width/rotor or wing span	……m boom width ……m rotor/wing span

5.2.3 Data collection and reporting

A spread pattern is determined by flying the aircraft over a line of approved collectors, then retrieving and weighing the amount of fertiliser retained in each collector. The data are used to plot a graph of the basic swath pattern from a single pass of the aircraft.

The following conditions must be met when measuring the transverse distribution pattern for an Approved Aerial Pattern Test Certificate. Wind speed and direction are particularly important along with the need to identify the flight path of the aircraft in relation to the line of collectors.

Item	Requirement
Spreading equipment	Clean and sound working condition
Hopper loading	Hopper content to be not less than one quarter full at the conclusion of a pattern test
Application rate	The application rate measured at the nominated BW shall be within 30% of the nominated application rate
Speed over collectors	Typical operating speed
Number of passes over collectors	One per spread pattern test
Wind speed and direction[1]	not greater than 15 km/hr and not more than ± 15^{o} in the direction of travel. Tests can be into or down wind but the ground speed of the aircraft shall be recorded

[1] Note that for cross winds, the collectors at each end of the line shall be empty.

Reporting

Approved Aerial Spreading Equipment Testers will, at the conclusion of the test, produce an Approved Aerial Pattern Test Certificate. An Aerial Pattern Test is approved by the Executive Director, Fertiliser Quality Council or his nominee.

The Certificate must show the data collected (see Section 5.2.2 a] and b]) and include:

- The operators name and aircraft identification
- The Certified Bout Width for each fertiliser tested –see Note below
- A description of the physical characteristics of that fertiliser including product name, bulk density (BD), uniformity index (UI), size guide number (SGN) and a graph of the particle size distribution (see Table E1 in Part B).
- The date of the test and the expiry date of the certificate. The expiry date will be two years after the date of the test.

NOTE:	The Spreadmark Certified Bout Width is the maximum bout width where the CV is 15% or less for nitrogenous fertilisers and 25% or less for non-nitrogenous fertilisers

5.3 Spreadmark type approved spreading equipment

Companies manufacturing aerial spreading equipment and wishing to gain type certification for their equipment should contact The Executive Director, Fertiliser Quality Council, Federated Farmers of New Zealand, Box 715, Wellington.

The protocol for type testing of aerial equipment can be found in this Code. Refer Part 7 of Appendix E.

There are currently no aerial fertilizer spreading equipment types which are recognised by Spreadmark as being able to reproducibly comply with Spreadmark requirements.

PART B The Aerial Spreadmark Code

1. Introduction

This part of the Aerial Spreadmark Code sets out the performance standards for the aerial application of fertiliser

1.1 Scope

This Code describes good practice standards for aerial application of fertiliser. Good practice is sustainable, from the aerial applicators viewpoint, the farmer client's and the regulator's viewpoint. In simple terms, good practice for aerial application is often determined by whether the fertiliser was evenly applied and was at the required application rate. Coefficient of Variation (CV%) is used as the measure of evenness of application. The current minimum acceptable Spreadmark CV% for application equipment testing is a transverse CV% of 15 for fertiliser containing nitrogen and 25 for all other products.

1.2 Sustainability

The principles of sustainability can be applied in a general sense to any operation, including application of fertiliser. In this Code they are applied to the aerial application industry as a whole, which means that they apply to each aerial applicator.

The five sustainability principles, and the outcomes for each are:

- *Production:* the practice achieves the desired (production) goal
- *Security:* the risk that the production goal will not be achieved is managed
- *Economic:* the practice is economically viable
- *Environmental:* any adverse effects on soil, water, air or other resources as a result of the practice are satisfactorily managed
- *Social:* the practice is socially acceptable, i.e. any potential adverse effects on people have been satisfactorily managed

If aerial application of fertiliser does not satisfy each of five broad principles, then it is not sustainable, and changes need to be made. These principles are applicable to the aerial applicator but can also be applied to the regulator or the farmer client.

Some of the principles are more business related, for example the productivity goals set and the financial performance targets, the strategic planning to cope with mechanical failures that lead to the production goal not being achieved, and the fees charged for service provided. Other principles are more quality related, for example the evenness and accuracy of fertiliser placement, minimisation of fertiliser applied directly to water, and the reduction of noise and dust.

This Code deals with the quality related issues, but all five principles are part of sustainability.

1.3 Information needed

This Code deals only with the issues that the aerial operator can influence or has control over. In order to take the required actions, the operator needs specific information for each property where aerial application of fertiliser is being considered. There are four parts to the specification required by the operator in order that good practice may be achieved. They are

- What nutrients are needed?
- What application rate (of fertiliser) is required?
- Where is the fertiliser required (what area and what site)?
- When is the fertiliser required (date and or time of day)?

This information, which would normally come from the client or their agent, is an essential input to good practice for aerial application of fertiliser by air.

1.4 Verification and compliance

Practices that are mandatory for compliance with this Code are indicated by the use of the word “shall”. Recommended practices are indicated by the use of the word “should”.

In order to comply with this Code the operator shall comply with all the actions listed for the various risks. A series of Appendices is also included to provide assistance in managing these risks.

Verification of compliance requires objective evidence to be available.

1.5 Products covered

The Code applies to all fertilisers as defined in the Code of Practice for Fertiliser Use. This includes physical forms ranging from solids, suspensions and liquid, whether applied separately or in combination.

2. Risk management

2.1 Scope

This Code is about good practice for the aerial application of fertiliser.

The approach used is to consider what risk exists, and then the person most able to manage those risks must be identified. That individual will need certain information and may need to take some actions to meet their responsibilities. The information needed and the actions taken will depend on the nature of the risk. Inevitably some record of what happened will be needed, so documentation is important. Finally the individual responsible must be competent to discharge their responsibility satisfactorily.

In summary the approach is:

- Risk
- Responsibility
- Information
- Action
- Documentation
- Competency

The following sections explain the risk management approach in more detail.

2.2 Risks

The main objective with aerial fertiliser application is to apply the specified fertiliser at the specified rate in the required place (and nowhere else), at the required time. The risks associated with not achieving each one of these objectives may differ in different situations with different fertiliser, and the consequences of not achieving the objective will also vary. Good practice requires that a process to manage these risks is active. An active risk management programme means that the risk of not achieving application of fertiliser by air in a sustainable way will have been identified, and strategies developed to manage those risks.

Under the Resource Management Act 1991 (RMA) there is a duty to avoid, remedy or mitigate adverse effects on the environment associated with the discharge of contaminants, which includes fertilisers. Appendix A summarises the relevant parts of the RMA and other rules and legislation that govern the application of fertiliser.

2.3 Responsibility

A clear indication of who has the responsibility to manage the various risks is needed. This may include people other than the aerial operator (see section 3).

Note that the individual who has the responsibility to manage the risk may elect to delegate that responsibility to another individual. In such cases it shall be clear who has the delegated responsibility and there shall be evidence of that delegation.

2.4 Information and action

In order to manage risk, information is needed and actions may need to be taken. For example the risk of fertiliser not being applied accurately may be because the fertiliser has poor flow properties. That can be predicted from flow testing and the actions taken can range from not applying the fertiliser to improving the fertiliser flow properties.

All the information needed to ensure that the risks identified in relation to the application of fertiliser by air shall be available to the aerial operator so that any risks are managed satisfactorily, and any actions required as a result of that information are taken. Note that not all the identified actions may need to be taken – it depends on the risk.

2.5 Documentation

The most practical way of demonstrating that good practice is being used is to provide objective evidence. Objective evidence can be verified. The most common objective evidence is documentation, which could include files or printouts from global positioning systems (GPS) showing tracks flown while the aircraft was applying fertiliser, or it may be a print-out of the spread pattern obtained with the fertiliser and application equipment being used.

Some aspects of fertiliser application will need to be documented and those records held for specified periods of time. The level of objective evidence varies according to the risk. Where risks are low, that is where the consequences of failure are low, then objective evidence of practices used to manage that risk are also likely to be low. The higher the risk, the greater is the need for objective evidence.

Documentation is objective evidence that risks have been managed. Evidence that these risks have been managed shall be available on request.

2.6 Competency

When an individual has the responsibility to manage risk, that individual shall be competent to do so.

The pilot of any aircraft shall hold a current agricultural and chemical rating to apply fertiliser by air. Also, each person who has a responsibility to manage or carry out any part of an operation to apply fertiliser shall be competent do so and evidence of appropriate qualifications or other in-house training shall be available.

Note

CAA Advisory Circular AC 61 – 1.15 provides information on the training syllabus content that is acceptable to the Director for meeting the Civil Aviation Rule requirements for the issue of an Agricultural Rating. This Advisory Circular relates specifically to Civil Aviation Rule Part 61 Subpart O – Agricultural ratings.

3 Transport, storage and disposal

3.1 Scope

The transport, storage and disposal of fertiliser are not normally under the immediate control of the aerial applicator. However these activities can directly affect the aerial application operation, and if good practice is not followed for these activities the operator may have to deal with the consequences of that

Appendix B summarises the CAA Safety Guideline *'Farm Airstrips and Associated Fertiliser Cartage, Storage and Application'* , which describes some of the risks (hazards) associated with the aerial application of fertiliser. The three main risks to be managed are described next.

a) Fertiliser is not free flowing

Risk

- Failure to jettison because of total blockage in the hopper outlet
- Poor spreading because of uneven flow from the aircraft hopper

Responsibility

- Pilot in command (note that responsibility can be delegated but a system that records that delegation shall be maintained)

Information

- Mean particle size and size range (see Appendix C Fertiliser physical properties and aerial application)
- Moisture content of the fertiliser
- Hopper outlet mechanism functioning correctly

Actions

- Cease operations, where the fertiliser to be applied has flow properties that are unacceptable
- Notify the manufacturer in relation to any product issues that may have contributed to unacceptable fertiliser flow properties. Note that verification of this is to be filed with NZAAA (See Appendix B)
- Notify the farmer/airstrip owner in relation to any fertiliser moisture issues from inadequate storage that may have contributed to unacceptable fertiliser flow properties

Documentation

- Incident report to the farmer/airstrip owner or the manufacturer detailing the nature of the problem
- Complete and sign the *'Access, Storage and Strip checklist'* (see Appendix B). This checklist shall be counter signed by the farmer or airstrip owner

Competency

- The pilot shall hold a current pilot agricultural and chemical rating.
- The pilot or whoever has the delegated responsibility shall be trained in procedures to test for fertiliser flow properties

b) Airstrip or operating site unsafe for use

Risk

- Damage to the aircraft
- Injury to the pilot
- Loss of productivity

Responsibility

- Pilot in command

Information

- Length of airstrip or other design limitations (including helipads)
- Airstrip width and surface, including the loading area
- Hazards other than the airstrip or helipad – e.g. wires

(**Note** – refer to Appendix B Airstrips and Operating Sites)

Actions

- Reduce the load carried until the farmer/airstrip owner has remedied the design limitations or carried out the required maintenance
- Cease operations until the farmer/airstrip owner has remedied the design limitations or carried out the required maintenance
- Cease operations until the hazard identification process for wires and other hazards has been reviewed
- Move operations to another operating site (eg helipad) where operating conditions are safe
- Communicate with the farmer/airstrip owner to ensure the requirements needed to make the operating site safe are understood.

Documentation

- Complete and sign the *'Access, Storage and Strip checklist'* (see Appendix B). This checklist shall be counter-signed by the farmer or airstrip owner
- Document the presence of wires and any other hazards for the operating site
- File an incident report where any damage to the aircraft has occurred
- File an accident report to OSH where any injury has occurred

Competency

- The pilot shall hold a current pilot agricultural and chemical rating.
- The pilot or whoever has the delegated responsibility shall be trained in the requirements for a safe operating site.
- The pilot or aerial operator shall ensure that all other parties (e.g. farmer/airstrip owner) have the required information and understand what needs to be done to make the operating site safe

c) Disposal of bags and containers

Risk

- Contamination of waterways from empty liquid fertiliser containers
- Aircraft damage from propeller/rotor strike due to unsecured empty bags

Responsibility

- The operator, who may advise the client of any requirements

Information

- Disposal options for the disposal of empty plastic containers or bags that have contained fertiliser

Action

- Triple rinse any empty plastic containers that have held liquid fertiliser and apply the rinsate to the target area or dispose of safely
- Secure any loose empty fertiliser bags for return to the manufacturer or confirm other safe disposal options

Documentation

- Record in daily flight records the number of bags/containers used and the disposal procedures followed. Where appropriate, provide information to the client confirming that any liquid containers have been triple rinsed.
- For any substances that are require tracking under the HSNO legislation a record of the where and when the disposal of the empty container took place shall be maintained

Competency

- The pilot shall hold a current pilot agricultural and chemical rating.
- The pilot or whoever has the delegated responsibility shall be trained in the requirements for a safe disposal of any fertiliser containers.
- The pilot or aerial operator shall ensure that all other parties (e.g. farmer/airstrip owner) have the required information and understand what needs to be done with any empty containers

4. Application

4.1 Scope

This section covers the application of fertiliser and the practices that shall be followed to ensure that both the regulatory and the client requirements are met. These practices are based on information required by the operator. Figure 1 summarises the information needed by the operator to enable the appropriate actions required to apply fertiliser by aircraft to be taken. Information is required in four areas –

- What fertiliser is to be applied
- What application rate is required
- What is the application site
- When is the application required

Most often the information will come from the farmer, but it may come directly or indirectly from their agent or consultant.

4.2 Regulatory requirements

Regulatory requirements include legislative, such as the Resource Management Act and the requirements found in the relevant Regional Resource Plan (Regional Council), or as part of an industry quality assurance programme. The requirements commonly deal with precision of fertiliser application in relation to specified areas, including waterways. These are off-property effects. In some instances however, regulatory requirements may extend to on-property activities including maximum permissible application rates and specified application times.

4.3 Client requirements

Client requirements normally refer only to on-farm effects, where specifications for application of fertiliser by air are more to do with achieving the specified application rate for the fertiliser(s) to be applied over the required area. When an application rate is specified, an evenness of application specification is also implied, because an uneven application means a significant variation in actual application rate.

It shall be the responsibility of the client to verify that the regulatory requirements relating to the application of fertiliser in the relevant Regional Plan have been identified and taken into account in the application specification provided to operator.

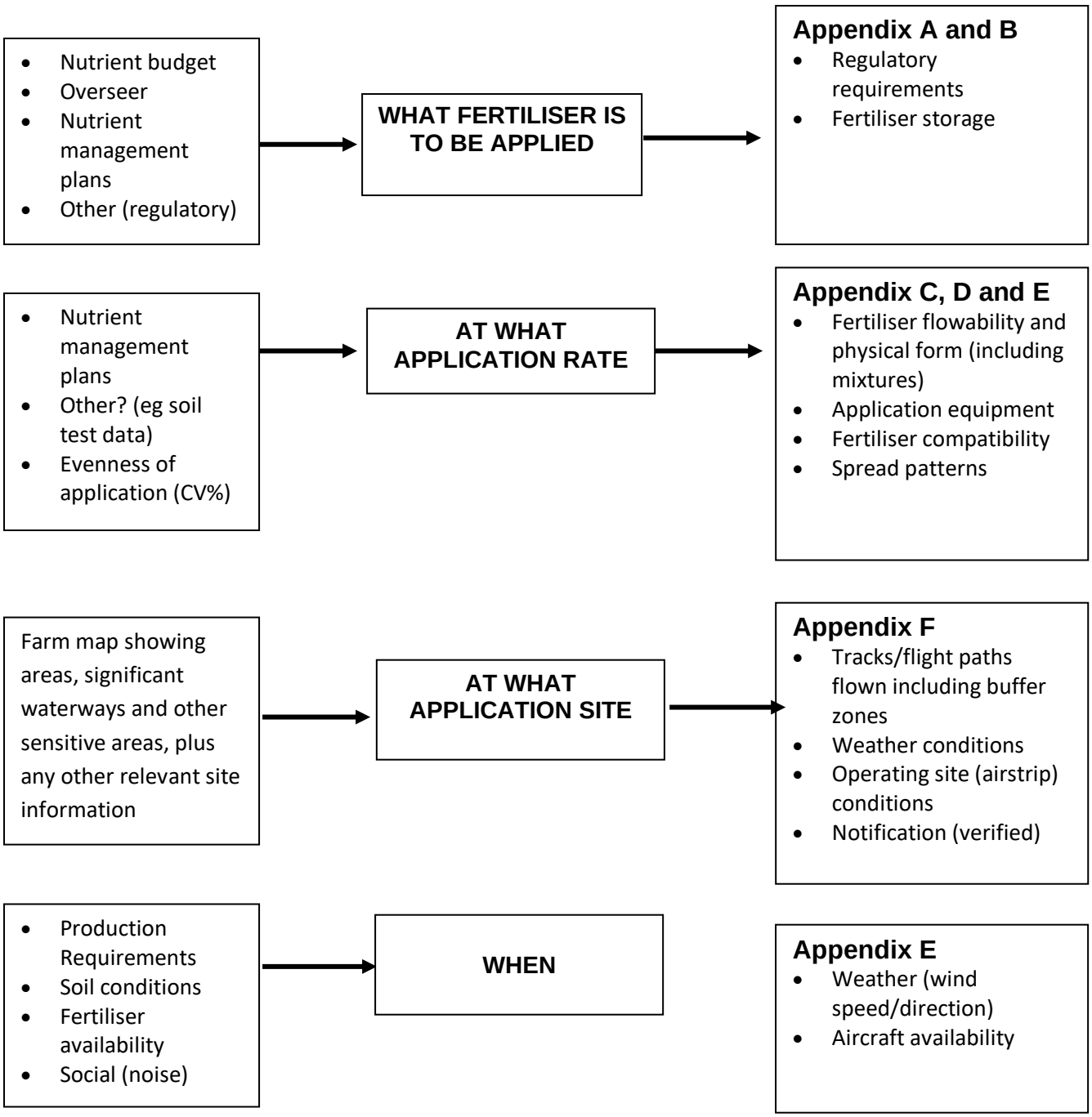
4.4 Operator requirements

It shall be the responsibility of the aerial operator to verify that the regulatory requirements relating to aerial application of fertiliser in the relevant Regional Plan have been identified and taken into account in the application practices followed. The operator shall document the application rate and evenness of application required in the application specification provided to them.

The application specification is made up from information provided by the client or their agent. Figure 1 summarises these information requirements and identifies the Appendices where more detail is provided on why the information is important, how the operator can use the information and what actions might be needed.

Information is needed on each of the four areas shown in the centre column. The boxes on the left indicate the nature of the information required and where it may come from. The boxes on the right provide more detail on what information an operator may need to obtain or verify in order to meet the application specification.

Figure 1: Information requirements for an application of fertiliser by air



In the following section, the risk management approach (Section 2) is applied to each of the four areas identified. The operator shall manage the identified risks by taking the actions identified. In each case the risks given represent the possible consequences of not achieving the objective, which is to apply the specified fertiliser at the correct rate, only on the specified site at the required time. The risks listed refer only to those factors an operator can reasonably be expected to manage or control.

a) Application of the specified fertiliser, including mixtures

Risk

- Client dissatisfaction and complaint
- Breach of regulatory requirements
- Corrosion of components
- Costs of client compensation (lost production)

Responsibility

- Pilot (note that responsibility can be delegated but a system that records that delegation shall be maintained)

Information required

- Specifications of what nutrients (fertilisers) are to be applied, including mixtures. Where appropriate, this shall include a Safety Data Sheet
- Recommended storage life or any special requirements

Action

- Before commencing, confirm with the client the fertiliser application specification, any safety issues (e.g. corrosion) and the application rate and evenness of application requirements

Documentation

- Fertiliser applied (daily flight record and statistical return to CAA)

Competency

- The pilot shall hold a current agricultural rating and a current chemical rating

b) Application at the specified rate

Risk

- Client dissatisfaction and complaint (lost production, uneven spreading)
- Cost overrun (client compensation) from incorrect or unspecified CV% target
- Incompatible fertiliser leading to segregation or adverse reaction of mixtures either in the aircraft hopper or before loading

Responsibility

- Pilot

Information required

- Spread pattern data for the application equipment to be used

- Specification of the application rate (kg per ha or litres per ha) for the fertiliser to be applied
- Specification of the evenness of application (CV%) required
- Confirmation of flowability/consistency of the fertiliser to be applied (solid fertiliser). For suspension fertiliser confirm the specific gravity (weight per volume)

Action

- Check the condition of fertiliser to be applied, (moisture content, flowability, incompatibility for mixtures) and if necessary measure mean particle size (SGN) and size range (Uniformity index, UI)
- Confirm that a spread pattern is available for the application equipment used, and where required, obtain spread pattern data for any new fertiliser to be applied
- Select appropriate spreading system/device
- Check/verify that the aircraft application system has been calibrated (e.g. hopper flow rate, track spacing)

Documentation

- Spread pattern data for the fertiliser being applied shall be available on request
- Application rate recorded (daily flight record)
- Application equipment or method used including spreader type, suspension system, nozzles (liquid)

Competency

- The pilot shall hold a current agricultural rating and a current chemical rating

c) Correct application site

Risk

- Fertiliser applied on the wrong site
- Fertiliser applied in a sensitive area (off site)
- Incorrect/no buffer zone set around sensitive areas (sensitive areas not identified) - a likely regulatory requirement which requires information on particle size of the fertiliser so that set buffer zones can be achieved
- Cost overrun (client compensation) from application to the wrong site
- Noise, dust or other third parties hazards (e.g. power line corrosion)

Responsibility

Pilot

Information required

- Verification of application site – hard copy map or GIS data of the application site and any non-target areas where no fertiliser is to be applied
- Verification that notification of neighbours/third parties has been carried out where required (see Appendix F)
- Particle size (% less than 500 microns diameter)

Action

- Where necessary, set appropriate buffer zones around non-target areas
- Log target areas onto GPS system or otherwise verify the location of the target site
- Confirm that the operating site (airstrip/helipad) available and suitable
- Establish/confirm any operational hazards (e.g. wires, livestock in or near the target area)

Documentation

- Buffer zones set (where required)
- GPS plots for the application site
- The type of fertiliser applied and the rate of application

Competency

- The pilot shall hold a current agricultural rating and a current chemical rating

d) Required application date

Risk

- No aircraft available
- No pilots available
- No ground crew available
- No spreader available (if required)
- Unsuitable weather
- Operating site unsuitable or not available
- Application site unsuitable (soil moisture)
- Noise problems (for the date or the time of application)

Responsibility

- The operator (note that responsibility can be delegated but a system that records that delegation shall be maintained)

Information required

The required or preferred application date

- Weather – particularly wind direction and wind speed
- Aircraft availability
- Equipment availability (including loaders)
- Staff availability (pilots, ground crew)
- Capacity (number of aircraft) to use or time needed to apply the amount of fertiliser specified

Action

- Communicate with client to confirm arrangements (notification)
- Have evidence available, if required on request, that notification has been done and appropriate actions taken to mitigate any adverse effects.

Documentation

- Date of application noted (daily flight record)

- Adverse events, if any, including jettison or off target application and strip report
- Equipment used
- Amount applied – statistical returns to CAA
- Weather conditions (wind speed and direction)
- Tracks flown (GPS data)

Competency

- The pilot shall hold a current agricultural rating and a current chemical rating

5. Product data

The physical form of fertiliser coupled with the required application rate affects the spread that can be achieved – both the swath width and the spread pattern. It also affects the ability to precisely control where the fertiliser goes in relation to the edge of the target area and the need to avoid placing any fertiliser in specified sensitive areas, including water. In some cases, poor flow properties may also directly contribute to incidents and accidents as a result of the failure to jettison when the situation requires it .

5.1 Responsibilities

Operators shall be familiar with the product names used by fertiliser manufacturers so that the specification provided by clients for the fertiliser to be applied can be identified.

a) The operator

It is the operators responsibility to ensure that the application system fitted to the aircraft is fit for purpose and that any fertiliser that is placed in an aircraft hopper, including slung spreader buckets, is also fit for purpose. That means:

- The hopper design and outlet mechanisms are such that no adverse effects on flow rate are caused.
- The physical properties of the fertiliser are such that the fertiliser can be discharged at the required rate, and if necessary, be jettisoned should the situation require it.

b) The fertiliser manufacturer

It is the fertiliser manufacturer's responsibility to ensure that the fertiliser supplied for transport complies with the required specification for physical properties

c) The farmer (client)

It is the farmer's responsibility to ensure that the fertiliser delivered has not deteriorated below specification for physical properties at the time it is to be applied.

5.2 Product information required

All fertilisers applied should be Fertmark registered. Information that should be provided, or available on request includes:

a) Solid fertilisers

- Size guide number, SGN (the mean particle size)
- Uniformity index UI (the particle size range)
- Bulk Density BD (weight per volume)

b) Blends and mixtures

- Physical compatibility of blend components (SGN, UI)
- Chemical compatibility

c) Suspension and liquid fertiliser

- Specific gravity

APPENDIX A: Legislation and the application of fertiliser

1. Introduction

Various regulatory and other industry or quality assurance requirements affect the application of fertiliser. The main legislative requirements are the Resource Management Act 1991 (RMA), the Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM) and the Hazardous Substances and New Organisms Act 1996 (HSNO). Each of these pieces of legislation is about risk management – to the environment (RMA), to trade and primary produce (ACVM) and to the environment, people or animals (HSNO). The Health and Safety in Employment Act 1992 (HSE) is also relevant in relation to safe workplace requirements.

2. Legislation

2.1 The RMA

The principle item of legislation that affects the application of fertiliser is the Resource Management Act 1991 (RMA). Under the RMA:

No person may discharge any contaminant

- into water
- onto or into land if it may result in entering water
- into the air or onto the land

in a manner that contravenes the Regional Plan.

Regional Councils, including unitary authorities prepare resource management policies and plans under the RMA. The plans usually include rules that govern various activities, including the discharge of contaminants. In this context fertilisers are considered contaminants.

Under these rules, which may appear in a water plan, or an air quality plan, fertiliser application may be considered a discretionary activity in which case it will require a resource consent, and there will be conditions attached to that consent. More commonly fertiliser application will be a permitted activity. There will normally still be conditions attached to that status, meaning that the application of fertiliser can be carried out without the need for resource consent provided that the conditions are met.

For all aerial application of fertiliser, operators shall be familiar with the requirements of the relevant resource management plan for the area concerned.

2.2 The Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM)

This legislation covers the requirements for the fertiliser group of agricultural compounds. Fertilisers are broadly defined as substances or products that are used to encourage plant growth but are further classed as either:

- Fertilisers - used to provide nutrients to encourage plant health and growth
- Fertiliser additives – used to adjust the chemical or biological characteristics of soil to facilitate uptake and use of nutrients
- Soil conditioners – used to adjust the physical characteristics of soil

All products that are either fertilisers or fertiliser additives are exempt from registration under the ACVM Regulation 9 as long as the requirements of the ACVM Regulations that cover the import manufacture and trade in fertilisers and fertiliser additives are met. That means the fertiliser must be fit for the purpose specified in the directions for use and be provided with information at the point of sale that including the trade name, nutrient content and modifying pH, details of any precautions to be taken to prevent or manage risk and directions for use. Normally this information will be in the form of a dispatch docket or consignment note.

2.3 The Hazardous Substances and New Organisms Act 1996 (HSNO)

The Minimum Degrees of Hazard Regulations 2001 and Hazardous Substances (Classification) Regulations 2001 determine and describe the hazardous properties of substances. Some fertilisers may be hazardous substances under these regulations, in which case any controls applied under the HSNO regulations must be complied with. The controls may relate to any stage of the life cycle of the substance including manufacture, transport, storage, use or disposal

2.4 Health and Safety in Employment Act 1992 (HSE)

Identifying hazards then eliminating, isolating or minimizing the hazard is a centerpiece of the HSE legislation along with providing a safe workplace. The consequences of poor flow properties of fertiliser leading to the inability to jettison a load from an aircraft in an emergency is one example where this legislation may affect the application of fertiliser.

3. Related Codes of Practice

Other programmes may influence fertiliser application.

3.1 Fertmark

Fertmark is an independently assessed fertiliser quality assurance programme. It provides quality assurance on claimed nutrient content to farmers purchasing fertiliser. Currently 68 products from 13 fertiliser companies operating on 18 sites are now Fertmark registered.

Independent audits are made on the quality assurance standards of Fertmark brand fertiliser. Regular follow-ups are made to ensure this quality control is maintained.

Currently almost all Fertmark-registered fertilisers are manufactured products, and do not yet include blends or mixtures. As the scheme develops, it will be extended to a greater range of products. Fertmark registered manufacturers, importers and suppliers also have an advertising code of conduct, so they should be able to verify the claims they make about the

quality of the products they sell. The bright green Fertmark tick stands for fertiliser quality assurance.

The Code of Practice for the Sale of Fertiliser in New Zealand (the Fertmark Code) is an approved Code under the ACVM Act 1997.

3.2 Fertiliser Users Code of Practice

The Code of Practice for Fertiliser Use is designed to enable individuals to undertake farm nutrient management that is specific to their unique situation within an effective decision making framework.

The Code enables a participatory, non-prescriptive approach that is consistent with the requirements of the Resource Management Act (RMA) which focuses on the effects of the activity rather than the activity itself.

To achieve this the Code uses an internationally recognised, agriculturally based process known as FESLM, Framework for Evaluating Sustainable Land Management. The system allows for the selection of a range of options for fertiliser use, which promotes sustainability and enables users to avoid, remedy or mitigate any adverse environmental effects as required under the RMA.

Options for fertiliser use are based on the following five guiding principles:

- to maintain or enhance production
- to reduce the level of production risk
- to protect natural resources and prevent degradation of soil and water quality
- to be economically viable
- to be socially acceptable

The Code is designed to address two main audiences - regulatory authorities (regional councils) and fertiliser users. Regulatory authorities require a document that is robust and has the legal status to be referred to in Regional Plans, and also provides a high degree of certainty with regard to outcomes.

Farmers on the other hand need a practical document that provides them with the guidance and direction required to deal with issues specific to their situation.

To accommodate these requirements the Code has been developed in three sections:

- Fertiliser Practice
- User Guides
- Fact Sheets

APPENDIX B: Airstrips and operating sites

1. Introduction

Many of the accidents and deaths that have occurred in the aerial application of fertiliser are preventable. While many factors contribute to accidents, they can occur because of the poor condition and siting of topdressing airstrips or because of poor flow of fertiliser from the aircraft hopper. This can be due to the inclusion of foreign matter or objects, excessive moisture, compaction due to fineness of milling or problems with hopper outlet mechanisms.

CAA and OSH have produced a Safety Guideline called 'Farm Airstrips and Associated Fertiliser Cartage Storage and Application' that covers:

- Manufacturers of Fertiliser.
- Transport Operators and Drivers.
- Airstrip owners.
- Farmers (as purchasers of fertiliser)
- Aircraft Operators, Loader drivers and Pilots

The section covering operators, loader drivers and pilots is included next.

2. Hazard Identification – the Operator, Loader Drivers and Pilots

The following text is from the CAA/OSH Safety Guideline

The Hazard:	Lack of Training, information, supervision, and communication.
Controlled by:	Employers of staff, Employees

2.1 Employer: Loader Driver and Pilot (and self-employed People)

Employers of pilots and loader drivers have a duty to ensure that the work assigned can be performed safely and that employees are not harmed. To this end, employers have a duty to provide supervision, training and information relevant to the tasks involved in work being performed.

Management of fundamental issues such as ensuring that the pilot is current on type, correctly trained, is medically fit and has knowledge of hazards and how to avoid them needs to be demonstrable. The same applies to loader drivers. Training and information with regard to specific hazards of the tasks involved is crucial.

Supervision, training and information, includes the following (S12 and S13 of the HSE Act):

- Ensuring that the pilot and the loader driver are conversant with the flow property requirements of the load, and how to test for that.
- Ensuring that the pilot and the loader driver are conversant with the procedure to communicate the result of a flow test to both the farmer, and their own employer, if required.
- Ensuring the pilot is properly licensed and current on aircraft type, has the requisite certificates and is appropriately trained for the task.
- Ensuring that the pilot has the experience and knowledge necessary for the task or is properly supervised commensurate with training and experience.
- Communicating information relevant to hazards such as overhead wires and other hazards, obtained from the farmer.
- Ensuring that the loader/driver is properly licensed and trained to safely carry the necessary functions.

Employers must be aware that they have a duty to take all practicable steps to provide a safe place of work. Self-employed people have a duty to take all practicable steps to keep themselves from harm.

Both operators and pilots must be aware of the requirement under Civil Aviation Rule Part 137 Subpart C – Special Flight Rules, particularly 137.103 (a) (2) which relates to the aircraft jettison capability. This rule is printed below:

137.103 Maximum take-off weight

a) Notwithstanding Part 91 and subject to paragraph (b), a pilot performing, or being trained to perform, an agricultural aircraft operation in an aeroplane must not take-off at a weight greater than the MCTOW prescribed in the aeroplane's flight manual unless:

1. the pilot complies with the procedures listed in Appendix B; and

2. the aeroplane is equipped with a jettison system that, in accordance with D.5, is capable of discharging not less than 80 percent of the aeroplane's maximum hopper load within five seconds of the pilot initiating the jettison action.

b) Where there is a third party risk as defined in Appendix A, the pilot must determine the maximum take-off weight in accordance with 137.107 and 137.109

***Note:** Appendix A of Part 137 defines the third party risk and Appendix B refers to overload weight determination.*

It is a crucial that fertiliser being sown has an inherent capability such that the criterion for jettison is achievable. A material that is not free flowing may inevitably be implicated in hopper discharge problems; therefore, operators and pilots must take all practicable steps to ensure that:

- The jettison system is capable of discharging the agricultural material used within the criteria specified and
- The fertiliser material will remain free flowing after placement into the aircraft hopper.

The employer (operator) must also abide by the conditions of CAA aviation safety reporting requirements under CAA Rules Part 12 and the Serious Harm reporting requirements of S25 of the HSE Act.

2.2 Loader driver

The HSE Act requires employees take all practicable steps to ensure their own safety while at work and to ensure no person in their workplace is harmed as a result of their actions or inaction.

Poor storage of fertiliser can affect the condition of the aircraft loads and the ability to spread the load in a safe manner. Loader drivers can therefore contribute significantly to the safety of the operation by ensuring that fertiliser is free flowing prior to loading it into an aircraft.

Loader drivers are in a good position to make early assessment of the fertiliser for free flowing characteristics and its suitability for spreading, and practicable steps include:

- Checking the flow characteristics of the load and communicating test results to the pilot.
- Checking and agreeing with the pilot as to the suitability of the fertiliser load to be spread.
- Communicating to their employer and to the farmer, any inadequacies of the storage facility that were noted.

The loader driver is responsible for the appropriate use of the loader and load weight/mass measurement mechanisms.

2.3 Pilots

The HSE Act requires self-employed persons (under section 17) and employees (under section 19) to take all practicable steps to ensure their own safety while at work and to ensure that no person is harmed as a result of their actions or inaction while at work. For employees there is a specific duty to use any protective clothing or equipment that is provided for their use.

For pilots these duties mean, for example, abiding by the conditions of the CAA Operating Certificate and Rules governing the role and operation of the aircraft and wearing appropriate safety gear. Other practicable steps may include the following:

- Operating in accordance with the employing company's documented policies and procedures or Standard Operating Procedures (SOPs).
- Assessment of the safety/condition of the runway strip, operating areas and approaches with respect to the aircraft type to be used.
- Assessment of the environmental conditions.
- Checking and agreeing with the loader driver as to the suitability of the condition of the fertiliser to be spread.

- Give an informed positive or negative statement to his employer (if appropriate) and the farmer with regard to carrying out the work, based on the above.

The pilots must report incidents and accidents in accordance with CAA Rules Pt 12 and Serious Harm under the HSE Act 1992.

2.3 Pilot checks prior to commencing a topdressing contract

Agricultural pilots shall demonstrate that the risks of using a particular runway with the aircraft type have been considered in relation to the contract requirements. A checklist is one way of achieving this. The checklist should also be used to note that a briefing has been received from the owner or contractor on the known hazards, particularly with respect to wires, and of both the runway and the topdressing task itself, and that they have checked on the condition of the fertiliser and that it is suitable for the task.

Such a checklist should be incorporated with the job documentation and retained for future reference. Should an area be noted as unsatisfactory, the form could be used to bring the problem to the attention of the farmer for rectification.

Airstrip Risk Checks

Date:	Airfield Owner/ Occupier Name:	
Pilot Name:	Loader Name:	
Aircraft Type:		Aircraft Reg: ZK-
Airstrip Position:		Job Number:

Checks

Item Checked	OK	Not OK	Comments
Airstrip Checks			
Runway approach/takeoff paths safe			
Runway length/slope satisfactory			
Runway width satisfactory			
Runway surface satisfactory			
Braking action satisfactory			
Wind Indicator satisfactory			
Fencing/obstacle/wire clearance satisfactory			
Weather satisfactory for the contract job			
Load Checks			
Aircraft load – adjusted for conditions			
Material flow checks satisfactory			
Job Hazard Briefs			
Runway hazard brief from owner received			
Job hazard brief received from Principal			
Pilot Signature ……			**Date/Time** ……..

Hand to loader/driver for retention and filing on return to home base.

NOTE:	In the event of some items not being OK, a copy of this form shall be filed with the Executive Officer NZAAA, c/- Box 2096, Wellington.

APPENDIX C: Fertiliser physical properties and aerial application

1. Introduction

This appendix describes fertiliser physical properties and how these properties can affect flowability of fertiliser from the aircraft hopper. Information on physical properties should be available for any fertiliser applied. Normal practice would be to obtain this information at the time that spread pattern testing is done so that the spread pattern can be related to the fertiliser used.

2. Fertiliser physical properties

2.1 Solid fertilisers

The most important solid fertiliser physical characteristics are:

- Size Guide Number (SGN) – the mean particle size
- Uniformity Index (UI) – the ratio of small to large particle sizes
- Bulk Density (BD) – affects ballistic properties and can affect the performance of spinning disc spreaders

Ballistic properties of fertiliser are most affected by the particle size and the particle density. Where a spinning disc spreading device is used, bigger, heavier particles can be thrown further and will be less affected by wind. Where no spreader is used, the range of particle sizes is important because of the need to get an even spread pattern, which means an even mass of fertiliser across the swath.

SGN, UI and BD data for any fertiliser should be obtained when spread pattern tests are carried out (see Appendix E). These data are obtained by sieve testing, using a stack of sieves and a sieve shaker, but for convenience and ease of use a sieve box is recommended. A sieve box also allows tests to be done after fertiliser has been delivered and before application. Representative sampling of the bulk fertiliser is vital.

Fertiliser	SGN	BD (t/m3)	UI
Superphosphate	245 – 300	1.03 – 1.28	11
Potash Super	135 – 286		23
Urea	290 – 340	0.7 – 0.8	60
DAP	265 – 335	0.90 – 1.0	55
AS Std	90 – 160	1.02 – 1.10	20
AS granular	265 – 280	1.02 – 1.10	60
Lime	20 - 50	1.2 – 1.4	2

Table C 1 – Typical physical properties for a number of NZ fertilisers

2.2 Changes in the physical properties

The physical properties identified, including SGN, UI, BD, MC% and fertiliser flow properties may change as a result of handling (particle degradation) or exposure to weather. The extent to which these changes might occur can also be measured, for example hygroscopicity (the rate at which MC% changes when exposed to higher humidity). However the biggest factor is sampling error. The sample taken for testing must accurately represent the bulk material if the data are to be reliable and useful.

In the worst case, flowability may decrease to the point that blockages in the aircraft hopper can occur.

The best way to deal with such changes is through constant testing. This may begin with a sample prior to purchase, then at arrival, dispatch from the store and prior to spreading. The test methods therefore need to be simple and easy to use.

2.3 Suspension fertiliser

Solid fertiliser can be ground into fine particle sizes and mixed with water to form a suspension. The fineness of grinding affects the ability to produce and maintain a stable suspension, and the amount of water required to achieve that. A typical suspension would consist of 30% water by weight.

The ability to form suspensions in this way has a number of advantages. However two points to note in relation to the use of suspensions are:

a) It offers the opportunity to mix constituents that may be chemically incompatible, and which may produce reactions in the aircraft hopper. Unless a suspension has been shown to be safe, a sample mixture of the proposed suspension shall be prepared and tested for compatibility and stability before it is used in an aircraft

b) The specific gravity of a suspension may be up to 1.5 or higher. Because the amount placed in an aircraft hopper is often judged by volume, the increased specific gravity means that the aircraft may be grossly overloaded even though the hopper is not full.

Although a suspension behaves like a liquid, specialised equipment is needed to dispense the suspension in flight and achieve reliable starting and stopping of discharge

3. Flow rate

The rate at which fertiliser leaves the hopper on an aircraft depends on the application rate, the aircraft travel speed and the swath width (and hence the track spacing). The actual flow rate required may vary from 300 kg per minute to over 2000 kg per minute.

Good fertiliser “flowability” means the fertiliser will continue to flow at the required discharge rate from the time the hopper is full until it is empty. It also means that flow will recommence immediately the hopper outlet is opened, regardless of the length of time the outlet has been closed and regardless of whether the hopper is full or near empty.

Measuring “flowability” of fertiliser from an aircraft hopper is a complex problem because it involves a number of factors, many of which interact. The factors involved include physical properties of the fertiliser. The main properties are:

- Particle size
- Particle shape
- Range of particle sizes
- Particle hardness
- Moisture content

The way in which these factors interact with different aircraft hopper shapes and wall angles, different outlet designs, the effect of turbulent air at the outlet, and compression of particles at the bottom of the hopper from the weight of particles makes the flow properties difficult to predict. However the following guide can be used.

	Flowability	
Property	**Good**	**Poor**
Particle size (SGN)[1]	High (> 200)	Low (< 50)
Particle size range (UI)[1]	High (> 20)	Low (<10)
Particle shape	Smooth, spherical	Rough, irregular
Particle hardness[2]	Hard	Soft
Moisture content[3]	Low (< 5%)	High (>5%)

Table C2 – Guide to flowability based on fertiliser physical properties

Note: This table is a guide only, providing a general indication of the likely effect on flowability for the various properties.

[1] = see section C2

[2] = particle hardness also includes cases where fertiliser is not mature

[3] = the effects of moisture content can vary considerably. Moisture content alone may not be a reliable indicator of flow

4. Spread patterns

Appendix E describes the information that is collected when a spread pattern is measured. In practice, differences in spread pattern obtained in the field will be dominated by the weather conditions at the time of application (see Appendix D).

As a general rule, fertiliser with good flowability properties will tend to give a consistent spread pattern. If fertiliser with a high SGN and UI is used, the spread pattern in the field will not differ significantly from that obtained under test conditions. Spread patterns for fertiliser with poor flow properties, particularly where the UI is low, will vary according the wind conditions at the time of application.

APPENDIX D: Fertiliser application specifications

1. Introduction

In practice, fertiliser application will seldom if ever be uniform, and there will be departures from the specified application rate. This is especially so for aerial application because of the greater potential impact of weather conditions.

The significance of departures from uniformity in fertiliser application depends on the production system and objectives. The specifications for fertiliser application must be site specific, and may be modified or affected by production, environmental, financial or social factors. The fertiliser application specification may be derived using a range of different methods. These factors are outside the control of the operator and must be considered by the farmer or client; most likely as part of a nutrient management plan.

To be Spreadmark Registered, application equipment must satisfy the performance standard for transverse CV% of 15% for nitrogenous fertilisers and 25% for all other products.

In simple terms the pilot will manage the actual application rate applied in two ways

- Within a specified accuracy for the required application rate, as described by the CV%.
- At an application rate of zero for areas where no fertiliser is to be applied. Such areas may include water bodies, wetlands or other designated non-target areas.

In each case information must be available to the pilot on the application site and the application rate and evenness required. Methods available to the operator to satisfy these two objectives may include firstly the setting of a specified track spacing and control over departures from that specified track and secondly, control over the discharge of fertiliser, both in terms of flow rate along the flight path and the spread pattern.

To satisfy the requirements of this Code, the operator shall document specifications for

a) Application rate (kg/ha) and

b) Evenness of application (CV% or departures above and below the mean application rate)

2. Evenness of application and CV%

The Coefficient of Variation, or CV is a relative measure of evenness of application. To calculate CV%, divide the standard deviation (of the spread pattern achieved) by the mean application rate and express the result as a percentage. The approximate relationship between CV and departures from the mean application rate is shown in Table D1. The relationship is approximate because it depends on the general shape of the spread pattern.

Also, because CV uses the standard deviation it describes the average of the departures around the mean rate. Those departures can be made up of either a small number of large departures or a large number of small departures to get the same CV value.

For example, at a CV of 25%, the rate of application is within 25% of the mean rate over 66% of the target and within 50% of the mean rate over 95% of the area.

	Maximum departure from the mean application rate over different % of target area		
CV%	**66%**	**95%**	**99%**
5	5	10	12
10	10	20	25
15	15	30	40
20	20	40	50
25	25	50	65
30	30	60	80

Table D1 CV and variation from the mean application rate

3. Variation in actual application rate

The actual application rate achieved in the field depends on several factors, which may either increase the variation in actual rate or compensate for errors and reduce the variation.

The factors are:

- Spread pattern
- Track spacing
- Ground speed of the aircraft
- Discharge rate of fertiliser
- Cross wind and application altitude

Some of these factors can be controlled or at least influenced by the pilot, for example track spacing, ground speed, discharge rate and application height. The pilot may also be able to change the spread pattern by using a spreader. The one factor the pilot has no control over is the crosswind. However the effects of a cross wind in relation to the fertiliser being applied are known or can be established, and the wind conditions at the application site can be measured.

Where necessary, operators shall be able to provide evidence to verify the wind conditions at the application site and of the application systems and practices that were followed so that the actual evenness application can be established.

3.1 Swath patterns

A transverse spread pattern shall be available for all aircraft types and spreader combinations. Each spread pattern shall be recorded at a typical or average application rate for the fertiliser to be applied.

The spread or swath pattern from either a fixed wing aircraft or a helicopter, with or without a spreading device will be dominated by:

- Fertiliser particle size
- Crosswind speeds

- Application height

a) No spreader

With higher aircraft ground speeds and rates of application above about 150kg per ha, spreaders are not normally used because the high mass flow rates that must be put through makes the spreader less effective.

Where no spreader device is used on a fixed wing aircraft, and in calm conditions, fertiliser particle size does not influence the distribution pattern. The pattern will tend to be narrow and sharply peaked with an effective width of about 10 to 12 metres and the same pattern will occur almost irrespective of fertiliser type.

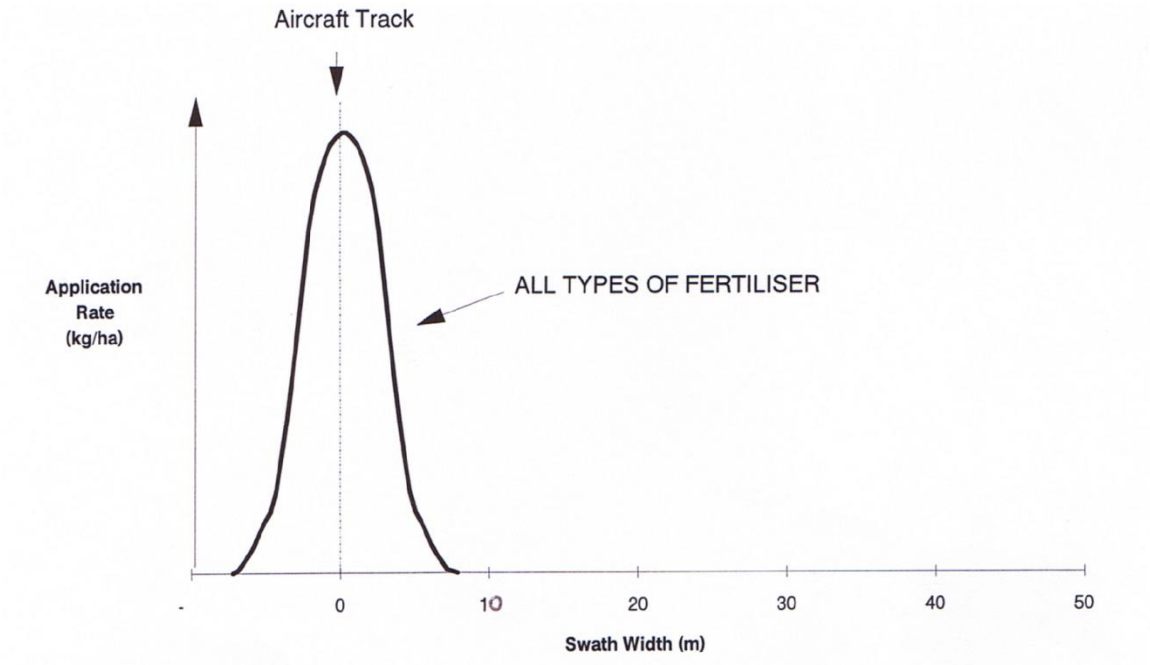


Figure D1 Typical swath pattern under calm conditions – all fertilisers

Where there is a crosswind, small particles will be moved downwind more than large particles. If the fertiliser contains a range of particle sizes, the spread pattern will become skewed. Where all the particles are large the shape of the spread pattern will not change much but the whole swath will move downwind.

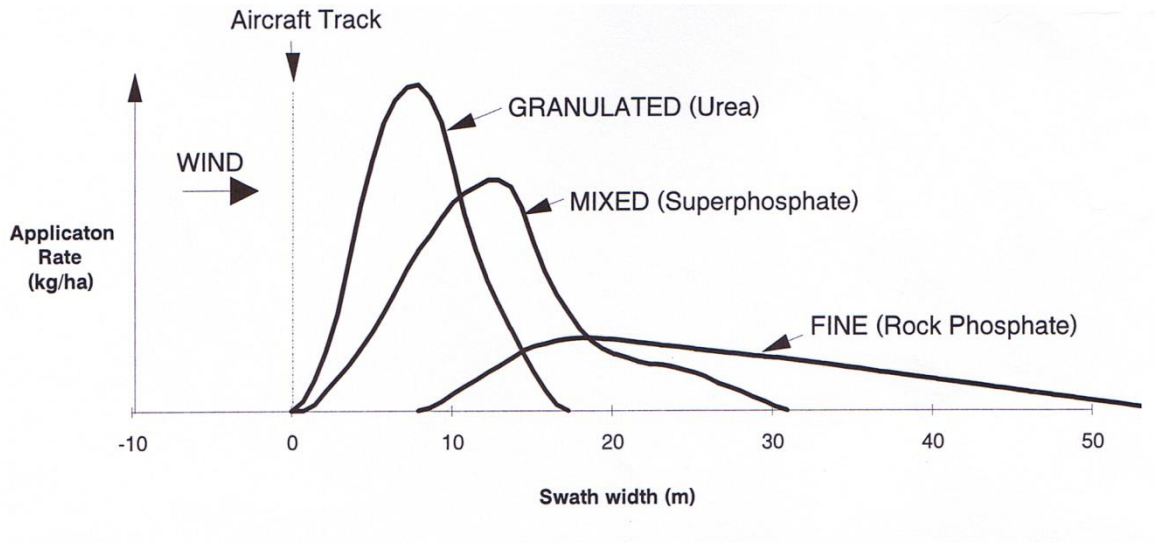


Figure D2 The effect of wind on swath patterns for different fertilisers

b) Spreaders

Spreaders will either be mechanical (e.g. spinning disc) or aerodynamic (e.g. ram air). In either case, they impart energy into the fertiliser particles to propel them transversely in relation to the travel direction. The larger the fertiliser particle the more energy can be imparted and the greater the distance the particle can be moved.

Spreaders will have little effect on particles of less than about 0.5mm diameter.

If particles are all the same size they will have roughly the same energy imparted and will therefore travel a similar distance laterally. Depending on the spreader design this can result in an “M” shaped spread pattern

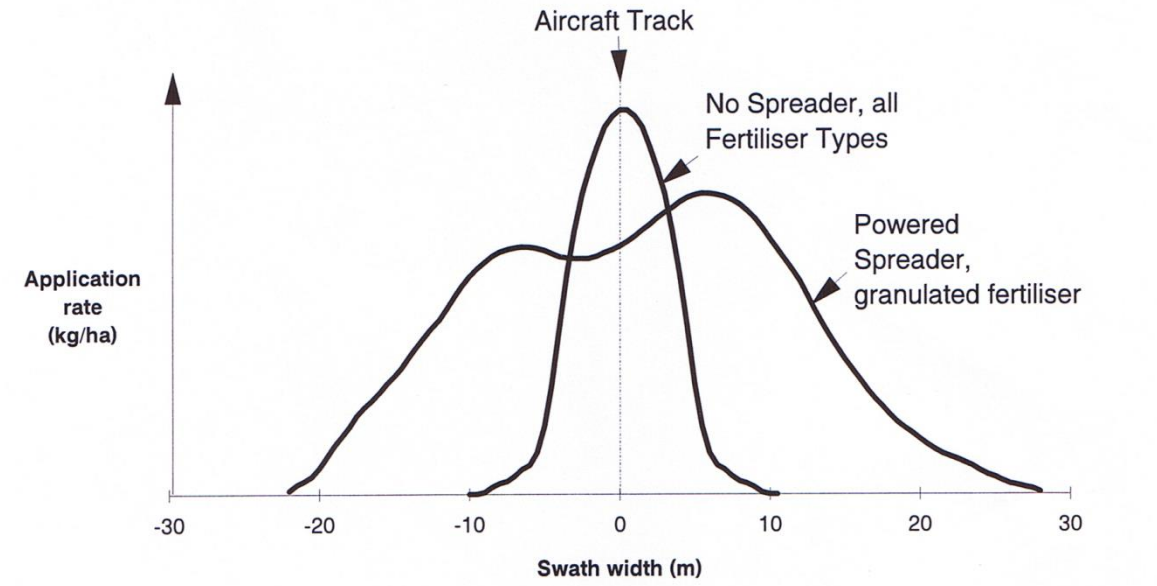


Figure D3 Typical swath patterns from a spreader

For any aerial application, achieving the required evenness of application depends on a number of factors including the spread and an even flow rate from the hopper. Spreaders influence the spread pattern achieved by changing the trajectory of fertiliser particles as they leave the aircraft.

Spread pattern testing is described in Appendix E, where the information that is collected when a spread pattern is measured is set out. Spread pattern tests are normally done under controlled conditions – a flat site, and constant application height with light or low wind speed. In practice the application height will vary because of the terrain, which means the winds that would typically be encountered at the application site will have a significant effect on the actual spread pattern achieved.

Within limits, the effect of any wind at the application site will be to improve the overall evenness of application. However in higher wind speeds it will also be more difficult to confine the fertiliser to the specified application site, and the risk of applying fertiliser in a sensitive area will increase.

In practice, differences in spread patterns obtained in the field, and hence variations in actual application rate, will be dominated by the wind conditions at the time of application. If fertiliser with a high SGN and UI is used the spread pattern in the field will not differ significantly from that obtained under test conditions. As a guide only, fertiliser with good flowability properties will tend to give a consistent spread pattern. See Appendix C. Spread patterns for fertiliser with poor flow properties, particularly where the UI is low, will vary according the wind conditions

3.2 Track spacing

Track spacing is the distance between successive passes of the aircraft. The application rate achieved and the variation in application rate, expressed by CV%, is obtained when the spread pattern is overlapped. Table D1 shows the typical track spacing to achieve a CV% of 25 for a range of fertiliser types and no cross wind. If all the conditions described in section 2 are constant apart from track spacing for an actual fertiliser application in the field, the affect on the evenness of application is indicated as follows;

	Track spacing (m)		
Fertiliser type	**Fixed Wing (FW)**	**FW with powered spreader**	**Helicopter bucket with spinning disc**
Superphosphate	12 (18)	23	34
Granulated (egDAP)	11 (18)	26	35
RPR	12 (40)	12 (40)	13 (40)

Table D2 Track spacing to achieve a CV% of 25

Note

1. The application height is 30m

2. The figures in brackets are the tracks needed to achieve a CV% of 25 when the wind is greater than 8 km/hr

3.3 Ground speed of the aircraft

Variations in ground speed translate directly into variations in application rate. If the speed increases by 10% the application rate achieved decreases by 10% unless compensation is made by increasing the discharge rate for fertiliser at higher speeds, and decreasing it for lower speeds. Higher application speeds reduce the time available to make such changes.

3.4 Discharge rate of the fertiliser

An increase in discharge rate will tend to decrease the spread width obtained, whether a spreader is used or not. Discharge rate can also be affected by poor flow properties of the fertiliser so that the actual amount discharged will vary along the flight path. These two effects of longitudinal variation and the effect on the transverse spread pattern may compensate or they may be cumulative, but the important point is that poor fertiliser flow properties produce unpredictable results.

3.5 Cross wind and application altitude

A crosswind during fertiliser application has little effect on fertiliser that has a high SGN and UI (see Fig D2). However the effect can be significant for fertilisers with low SGN and UI and noticeable for fertiliser with high SGN and low UI.

Application altitude is important only to the extent that higher altitudes mean a longer time for the fertiliser to reach the ground and hence more time to be moved by any cross wind that does exist.

4. Situations where application rate of zero is required

4.1 Areas where zero application rate is required

For various reasons e.g. environmental or social, there may be areas where no fertiliser should be applied. A territorial authority (Regional Council) may designate such areas in a resource management plan. For example the plan might designate significant water bodies where no direct application of fertiliser is permitted. Other areas may be designated for different reasons e.g. organic farmed areas.

Identification of any areas where no fertiliser is to be applied is a basic requirement. As part of the requirement to identify the application site, the farmer/client has the responsibility to establish what areas within or adjacent to that site have been designated as areas where no direct application of fertiliser should be made.

The operator shall be aware of any such designated areas when confirming that application site with the client and adopt practices to ensure that no fertiliser is applied in those areas.

4.2 Strategies for achieving zero application rates

Three operational factors are relevant:

a) Fertiliser ballistic properties (i.e. particle size and density)

b) Orientation of the flight path in relation to the designated zero application rate area (ie directly towards, at an angle, or parallel)

c) Local weather (wind speed and direction)

Fertiliser ballistic properties are largely determined by particle size and density. When a fertiliser particle is released from an aircraft, it is travelling at the same speed as the aircraft but following release the particle rapidly slows because of air resistance and drag. Smaller particles stop more quickly and their fall speed to the ground is also slower. The behaviour of a single particle will be entrained by the mass of other particles around it when released from an aircraft, with the result that the downwind travel distance is likely to increase. The aircraft height is also relevant in terms of the opportunity presented for fertiliser released to travel downwind from the release point. Table D3 distances (m) travelled by particles, released at various heights and travel speeds before reaching the ground

Table D 3 distances (m) travelled by particles, released at various heights and travel speeds before reaching the ground.

50 km/h

Particle size (mm)	Release height (m)		
	15	**30**	**60**
0.5	7	8	10
1.0	10	12	15
2.0	13	17	22
3.0	15	20	26
4.0	17	22	29
5.0	18	23	31

100 km/h

Particle size (mm)	Release height (m)		
	15	**30**	**60**
0.5	8	10	11
1.0	13	15	18
2.0	18	23	27
3.0	22	28	34
4.0	25	31	40
5.0	27	34	44

150 km/h

Particle size (mm)	Release height (m)		
	15	**30**	**60**
0.5	9	11	12
1.0	14	17	20
2.0	21	26	31
3.0	26	32	39
4.0	30	37	46
5.0	34	42	52

200 km/h

Particle size (mm)	Release height (m)		
	15	**30**	**60**
0.5	10	11	13
1.0	16	18	21
2.0	24	28	33
3.0	30	36	43
4.0	35	42	51
5.0	38	47	57

Notes:

1. These are rounded computed values for single particles. The assumptions include

   Air density = 1.229 kg/m3

   Gravity = 10 m/sec2

   Particle density = 2000 kg/m3

2. Where spinning disc spreaders are used, the travel speed must be added to the speed with which the particles leave the spinning disc. As a guide, if the particle velocity from a spinning disc is 35m/sec, which is typical, then a 4 mm particle would travel somewhere between 15 and 20 metres .With the aircraft travelling at 100km/hr a 4 mm particle released at 60 m would travel 40m before hitting the ground. Adding this to say 20 metres gives an estimated 60 metre total distance.

3. The distances fertiliser travels in the field will differ mainly because of the effect of a mass of particles moving together on the drag coefficient.

Where the flight path is directly towards a sensitive area the flow of fertiliser must be stopped in time so that no fertiliser reaches the sensitive area. The minimum dimension or size of a designated area where a zero application rate can be achieved is a largely a function of the travel speed of the aircraft, and the fertiliser ballistic properties. If the designated area is identified on a GIS database and the aircraft GPS system is operating from that GIS

database, that can enable the fertiliser flow to be shut off in time to prevent any fertiliser entering that area. This method may allow smaller margins. Where the pilot does this fertiliser shut off, using visual assessment and judgement, the results will be less reliable with greater margins needed.

4.3 Buffer zones

In practice buffer zones can be set which provide a margin for error in ensuring that no fertiliser enters water directly. Buffer zone distances up to 100 metres may be set, depending on the circumstances. The width of a buffer zone will be a function of the aircraft type used for the application, the spreading mechanism used (if any), the physical properties of the fertiliser and the wind conditions at the site.

APPENDIX E: Spread pattern testing and interpretation for aerial application

1. Introduction

New Zealand has a quality assurance programme for ground based fertiliser application called Spreadmark, which places limits on the variability of evenness of application that are deemed acceptable. The coefficient of variation or (CV%) is obtained from sample trays used in a single transverse test of the spread pattern. The CV is calculated by taking the standard deviation of the overlapped distribution and dividing by the respective mean and expressing as a percentage. A low CV% means more even spreading. The evenness of distribution is affected by the shape of the individual spread pattern and by the accuracy with which the required bout width or track spacing can be maintained

Although an aircraft may be in the correct position, there are a number of environmental factors affecting where the fertiliser lands. Wind clearly has an effect, as does the aircraft air disturbance as it travels at speeds up to 200km per hr (fixed wing). The physical characteristics of the material being spread also have a major bearing on ballistic behaviour of particles and hence the spread pattern.

To be Spreadmark Registered, application equipment must satisfy the performance standard for transverse CV% of 15% for nitrogenous fertilisers and 25% for all other products as indicated by an Approved Aerial Pattern Test Certificate

2. Information required

2.1 Solid Fertiliser

The principle piece of information is the spread pattern achieved. A spread pattern shall be available for every material classed as Fine, Medium or Coarse (Table E1) for every spreader type used. The spread pattern shall be established at one application rate that is typical or average for that used for the fertiliser. Where the same spreader type is fitted to a different aircraft (fixed wing) type then additional spread pattern tests are required.

For helicopters the spread pattern achieved from a given spreader bucket is not normally affected by being used with a different helicopter so no additional pattern testing is required. One exception may be where the ground speeds are significantly higher and hence the required flow rate from the bucket is higher for a given application rate.

The spread pattern shall be displayed showing the centerline and the application rate and evenness of application (CV%) achieved for the selected track spacing.

2.2 Liquids

Again the most important information is the shape of the spread or swath pattern. A swath pattern shall be available for every boom/nozzle configuration used, at an application rate that is typical for the product (fertiliser) being applied. Where the same configuration is used with a different aircraft (fixed wing or helicopter) then additional swath pattern tests are required

3. Collector specifications

Collectors used for spread pattern testing of solids shall comply with the Spreadmark specifications, which are:

- Collector size no less than 500mm x 500mm x 150 mm deep
- Collectors to have suitable anti ricochet systems

Collectors shall be set out in a single line for transverse distribution measurement, at right angles to the flight path. For Approved Aerial Pattern Test Certification, collector spacing shall be 1 metre centre to centre, and the number of collectors used shall be sufficient to ensure that the collectors at each end of the line remain empty.

4. Application equipment type (solids)

4.1 No spreader

Where no spreading attachment is used the dimensions of the hopper outlet when at the setting used for application shall be recorded and the type of outlet shut-off mechanism used (e.g. Easton box, louvre doors) noted. As well the use of hopper outlet fairings in front of or around the hopper outlet should be noted.

4.2 Ram air spreaders

This includes all spreader types where the fertiliser is introduced to the front of the spreader and the entrained air/fertiliser mixture is spread laterally by spreading vanes. The make/model of spreader used shall be recorded (e.g. Transland slimline) along with the following information:

- Dimensions of the front opening
- Dimensions of the rear opening
- Number of vanes

4.3 Powered spreaders

These typically are spinning disc spreaders. Information to be recorded includes:

- Spinning disc diameter
- Disc width (i.e. vertical dimension)
- Number of vanes and vane shape (e.g. straight radial, backwards sloping curved)
- Disc shrouded or open
- Disc speed
- Feed point onto the disc
- The flow rate metering device used (e.g. orifice disc, clamshell)

5. Application equipment type (liquids)

Information to be recorded includes:

- Nozzle type (e.g. flood jet, fan) and position on the boom of each nozzle (in many aircraft configurations the nozzle spacing is not constant)

- Total number of nozzles used.
- The orientation of each nozzle (1800 = straight back and 900 = straight down)
- Boom pressure
- Boom width

6. Aerial spread pattern testing

6.1 Data collected

The information collected for any pattern test of an aircraft distribution system, whether for liquids or solids shall include:

- Wind speed at the test site
- Wind direction (relative to the flight path or the line of collectors)
- Fertiliser physical properties, including SGN, UI (for liquids this may be expressed as VMD or (Dv0.1 Dv0.5 and Dv0.9 which will depend on the nozzle type and pressure) and BD. See 2.1 below
- Application rate (intended and achieved, kg per ha)
- Flight path (centerline collector)
- Application height (estimated + or – 5m)
- Ground speed (km/hr)
- Collector specification (size, spacing, number)
- Weight of fertiliser per collector (gm)
- Application equipment type – see later

a) Solid fertiliser properties

SGN = Size guide number = the mean particle size

UI = Uniformity Index = the relationship of the small particles to large particles in the fertiliser mix. A low UI (e.g. 3) means the fertiliser has a wide range of particle sizes; a large number (e.g. 50) means the particles are very similar in size.

BD = Bulk Density

SGN	UI	Class
<150	<20	Fine
150 – 350	20 – 60	Medium
>350	>50	Coarse

Table E1 SGN and UI classes (solid fertilisers)

b) Liquid fertilisers

For liquids, the important physical properties include:

$D_{v0.1}$ = the diameter of droplets that make up 10% by volume of the spray mix

$D_{v0.5}$ = the diameter of droplets that make up 50% by volume of the spray mix

$D_{v0.9}$ =the diameter of droplets that make up 90% by volume of the spray mix

VMD =volume mean diameter = $D_{v0.5}$

These properties depend on the nozzle type and operating pressure (or rotation speed for rotary nozzles). All this information should be available from the spray nozzle manufacturer.

7. Type testing of spreading equipment

Aerial application equipment may be type tested, which means that subject to meeting the requirements described below, subsequent items of spreading equipment built to that same specification will not need to be tested for spread patterns.

Applications for equipment type approval should be sent to:

The Executive Director
Fertiliser Quality Council
Federated Farmers of New Zealand
Box 715
Wellington

7.1 Principles

a) Aerial application systems that meet the following general criteria can become Spreadmark Type Approved. Spreadmark Type Approved spreaders will:

- be able to consistently achieve satisfactory spreading performance over the range of the fertiliser types (particles sizes) specified by the applicant
- perform satisfactorily over the normal range of application rates for the fertiliser types specified by the applicant
- have longitudinal distribution patterns that are satisfactory over a representative range of fertiliser types and application rates.
- have substantially the same performance characteristics between different units of the same model.
- be provided with suitable operating guidelines to enable the operator to achieve satisfactory spreading with the fertilisers and application rates defined above.

Satisfactory spreading performance means the equipment meets the Spreadmark evenness standards at the range of bout widths for which the spreader is operated at the required application rates for a given fertiliser specification.

b) Type Approval will be subject to a re-approval process.

c) Aerial Spreadmark Approved Equipment Testers who carry out Aerial Spreadmark Type Approval Testing shall not be an employee of the spreader manufacturer or importer.

7.2 Type approval assessment criteria

The criteria used to assess whether a particular fertiliser spreader model used in aerial application should be Spreadmark Type Approved are described below. Data from other pattern testing may be accepted as sufficient evidence for type approval.

a) Spreading performance envelope of the type

The aim is to ensure that satisfactory spreader performance can be achieved over an appropriate range of fertilisers and application rates and that spreaders have reasonably stable operating characteristics over small variations in fertiliser characteristics. In order to do this one spreader unit will be tested as follows:

- The evenness of distribution will be tested with fine, medium and coarse fertiliser types, representing the particle size ranges (SGN and UI) that the spreader may need to spread (see Table E1)
- The effect of application rate on the evenness of distribution will be tested by transverse distribution measurements at the minimum, typical and maximum application rate for each product.
- Longitudinal variation may be measured with fine medium and coarse products at their mean application rates.

It may not be necessary to test all fertiliser products at all rates. Products may be grouped and one product used as a representative product once it has been established that their spreading performance is the same. If however, differences appear between similar products, more intensive testing will be done to define the extent of the difference and where it occurs. The actual amount of testing will be determined by the need to have enough information to decide whether the spreader performance is satisfactory over the appropriate range of fertilisers and application rates and whether or not the spreader has reasonably stable operating characteristics over small (normal) variations in fertiliser characteristics.

Testing for type approval for aerial application systems will also take into account the fact that the effect of wind on the spread pattern achieved may dominate particularly where fertilisers of low SGN and/or low UI are applied.

The manufacturer/importer may self-impose limits to the testing of the spreader model. Examples of this could be where upper limits to the application rate (flow rate) are set. Any such limits will be recorded and reported on the type test certificate and on the published list of Approved Aerial Spreading Equipment.

All tests will be carried out in accordance with the procedures set out in Appendix E and the data collection and reporting procedures of this Code

b) Reproducibility of the type

A number of units of the same model may be tested to identify whether different units of the same model of spreader have substantially the same performance characteristics. These tests will be carried out at critical points identified during the testing of the type performance envelope (e.g. at low application rates with difficult to spread products).

At least two units will need to be evaluated to check reproducibility between machines and the number of transverse distribution measurements made will normally be six per unit. Spreadmark or other pattern test data may also be used as reproducibility evidence. In order to be type approved the shape of the swath pattern under the same test parameters, will need to be substantially the same.

Reproducibility testing may be carried out at different times and places to the type performance envelope testing described in a) above. Reasonable care will be taken to use fertiliser products with the same or very similar SGN and UI values to those used for spreader performance envelope testing. It may be necessary to retain product between type tests or reconstitute product by particle size to ensure that products of the same SGN and UI are used for type testing.

c) Documentation

In order to be Spreadmark Type Approved, spreading equipment will be provided with a suitable manual describing performance characteristics and adjustments. The information in the operator's manual must be consistent with the information found from the spreader performance testing.

d) Standard design

Manufacturers or importers wishing to apply for type approval shall define the spreader model that is being type approved, and make a commitment to advise of changes to the spreader design.

The design shall be defined on a set of drawings showing the critical dimensions of the spreading equipment. These drawings may be used to check that the design of the approved models remains the same.

8. Reporting

Approved Aerial Spreading Equipment Testers will, at the conclusion of the test, produce an Approved Aerial Pattern Test Certificate

The Certificate must show the data collected (see Section 5.2.3 Part a]), and include:

- The operators name and aircraft identification
- A description of the spreading equipment used (see Appendix E5)
- The Certified Bout Width for each fertiliser tested –see Note below
- A description of the physical characteristics of that fertiliser. The description to include: product name, bulk density (BD), uniformity index (UI), size guide number (SGN) and a graph of the particle size distribution. (see Table E1)
- The date of the test and the expiry date of the certificate. The expiry date will be two years after the date of the test.

NOTE:	The Spreadmark Certified Bout Width is the maximum bout width where the CV is 15% or less for nitrogenous fertilisers and 25% or less for non-nitrogenous fertilisers

APPENDIX F:Site mapping and application verification

1. Introduction

Identification of the fertiliser application site is important for two main reasons:

- To ensure that the client contract is satisfied
- To enable any sensitive areas or other hazards to be identified and any risk management strategies to be developed and applied

There are both planning (before the task) and verification (after the task) aspects to consider. The particular circumstances for each application task may influence what is required. Relevant information includes

- The fertiliser to be applied (e.g. N, P)
- The nutrient status of the pasture/crop
- Local site conditions and the existence/proximity of sensitive areas
- Client demand (industry QA or production related)

This Appendix describes methods of site mapping and application verification that can be used and what factors are important with respect to buffer zone distances.

2. The application site

Fertiliser shall be applied only to the nominated site at the required evenness and application rate (kg/ha). The application site shall be appropriately identified. Options include (in order of acceptability as objective evidence):

- Verbal description from the client
- Hand drawn farm map, with site confirmed with the client by the operator
- Aerial photograph / overlay of application site
- Application site logged using GPS at or before the application date, with the site boundaries confirmed
- GIS coordinates (digital map) of application site available before application, with data entered into GPS

The method used to identify the application site may depend on the sensitivity of the situation and may include:

- Fertiliser types to be applied (N,P)
- Nutrient status of the application site
- Crop yield response (e.g. pasture and grazed animal; intensive cropping)
- Sensitivity of the receiving environment e.g. proximity of sensitive areas and waterways

Identification of the application site means that the areas where no fertiliser is to be applied are also identified.

Where such zero application areas are identified within 300 metres of an application site, the method used to identify the application site shall be verifiable (auditable).

3. Application verification

Verification of the fertiliser application task carried out may be required. Information required may include:

- Location of the application site
- Date of application
- Fertiliser applied (e.g., N, P K S) including trace elements and other additives
- Application rate (kg/ha)

Methods to verify application include:

- Verbal, with documentation where appropriate (e.g. diary note)
- Written daily flight logs
- GPS records

Where the application has been carried out within a distance of 300m from an identified sensitive area, then verifiable or auditable information of the application shall be available on request. The information shall include tracks flown and weather conditions (wind speed and direction) at the application site.