AGROWPLOW®

SOIL CARE SYSTEMS INTERNATIONAL PTY. LTD. A.B.N. 29 075 828 947

Agrowdrill
Operator's Manual

AD 100 Series Drill
AD 300 Series Drill
AD 500 Series Drill
AD 700 Series Drill
AD 900 Series Drill
JPC 2000 Series Drill

Agrowplow
Agrowplow Pty Ltd

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‘Prosperity Through Soil Care’

Disclaimer

Every effort has been made to ensure that the information in this manual was accurate and up to date at the time of printing. Agrowplow Pty Ltd reserves the right to make subsequent changes to the machine or this manual, where necessary, without notification.

Agrowplow Pty Ltd will not be responsible for any damage or consequential loss arising out of misinterpretation or failure to follow recommended procedures. Nor will it be liable for any damage caused by or arising out of modification or misuse of its product.

The owner has a responsibility to protect himself and others by observing all safety information and by ensuring all operators are well acquainted with the safety information, trained in the correct use of the machine and applying safe work practices.

The Owner's Manual

Your new Agrowdrill will give long and efficient service if given normal care and operated properly.

This owner's manual is provided so that you can become thoroughly familiar with the design of the machine and to obtain information on correct operation, adjustment and maintenance. Only people well acquainted with these guidelines should be allowed to use this machine.

A separate illustrated parts section has been provided so that if any parts are required your dealer will be able to supply them by reference to part numbers.

Right and left hand references in this manual are determined by standing behind the machine and facing in the direction of travel.

The manual is considered as part of your machine and must remain with the machine when it is sold.

Delivery

On delivery of your new Agrowdrill please check that the machine is not damaged. In cases of shipping damage, please ask your dealer to arrange for the appropriate claim to be lodged immediately.

Assemble any parts supplied loose and inspect your machine with the aid of this manual to familiarise yourself with its features. If you have any queries ask your dealer straight away.

The machine is covered by our 12 month warranty on faulty parts, subject to normal use. Record below the serial number of your machine and keep it in a secure place to help trace the machine and assist us when you order parts.

Model:_____

Serial Number: _____

Authorised Agrowplow Dealer: _____

_____

_____

Agrowplow – Company Profile

Agrowplow Pty Ltd, trading as Agrowplow, is an innovative, soil conscious company committed to developing "Soil Care" products for improved, sustainable agriculture.

The founders of Agrowplow had the foresight to see that farmers needed to improve their practices - to improve soil structure, increase humus and allow more water to infiltrate and store in the soil - if farming was to be sustainable.

The first Agrowplow was designed and built in 1977 to improve soil structure, increase humus levels and increase water infiltration and storage deep into the soil.

Today the company's range of Agrowplows and Agrowdrills are widely accepted by farmers and agricultural researchers for their unique capabilities. The term "Agrowplow" has become a "farming concept" rather than just another implement.

The company's range of specialised Agrowplows, Agrowdrills and other products are designed and manufactured under strict code of sustainable agricultural mechanisation, and promoted under the slogan:

"Prosperity Through Soil Care"

The company's research and development division develops world leading technology for Agrowplow which has resulted in a well earned reputation of turning market "Ideas" into reality.

Development is undertaken with the professional guidance of fully qualified design engineers with the use of 3D CAD/CAM that supports the complete design to manufacture process. All designs are manufactured to the highest standards of quality control.

Agrowplow has large factory area (3500 square metres) with extensive fabrication equipment. Experienced and qualified personnel form an extensive resource in all areas.

Agrowplow - building soil care products for improved, sustainable agriculture.

The Hazard Management Policy

Our management accepts it has a Duty of care to employees, customers and the public to identify, assess and control safety hazards and risks.

It is the goal of **Agrowplow Pty Ltd** trading as **Agrowplow** to provide farm machinery and plant that complies with the relevant Occupation Health and Safety legislation and Australian Standards.

We intend to fulfill these responsibilities, so far as it is practicable, through the application of the HazCheck Management System.

This will guide and inform our efforts to:

- Consistently review, communicate, implement and maintain the HazCheck System;
- Provide sufficient training and information to employees and customers to allow the safe use of products, services and machinery;
- Identify and control hazards and related risks in the products we manufacture;
- Inform customers of the hazards and risk controls necessary for the safe operation of the products they purchase;
- Support our hazard management practices through the safe keeping of appropriate records;
- Continually review and improve the effectiveness of the HazCheck System.

To ensure the effectiveness of this Policy we encourage staff, customers and others to report all health and safety hazards and risks. We also invite any suggestions that may lead to an improvement in our control of risks.

Phil Avery – General Manager

Wade Smith – Engineering & Production Manager

July 2007
Date

Completing Safe Use Instruction (SUI) Reports

The use of the SUI Report is mandatory. This Report must be completed as part of the sales process of every machine. Each completed SUI Report must detail:

1. The intended purpose of the machine;
2. The safety controls that have been used to reduce or eliminate identified hazards;
3. A warning of the existence of hazards remaining in the machine and an explanation as to why the hazard remains and what further safety controls are required.
4. Limitations to the use and application of the machine or plant resulting from any remaining hazards as recorded on the SUI Report.
5. Further operator training that may be required.

Special Note:
Dealers are responsible by law to determine that machines are suitable and properly equipped for the application they know or should reasonably have known the machine will be used for. This implies that a supplier must enquire what the machine is to be used for, and a further review of safety controls must be carried out, in view of the specific application the machine to this intended purpose.

At the time and point of delivery the salesperson must present the SUI Report to the purchaser as a record of the installation process. This should be the result of a face to face installation.

Once the intended purpose is confirmed, use each item of the SUI as the record of instruction given to the purchaser including:

- Safety controls that minimise the hazards present in the machine;
- Safe operating procedures for the proper use of the machine;
- Limitations to the use of the machine according to an intended application that prevents a safety hazard arising;
- Any additional training the operator may require to use the machine safely

The purchaser should sign the completed SUI as evidence that information and training has been provided and that the purchaser now has the responsibility to train all other operators. Although it is the responsibility of the purchaser to ensure all other operators are trained, it is wise to record the names of all people to whom training was provided during the machine installation.

The original SUI must be completed and signed and returned to Agrowplow with the Warranty Registration Form for Warranty to be valid.

The Yellow Copy must be retained by the dealer for their records.

The Pink Copy must be retained by the purchaser for their records.

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Safe Use Instructions (SUI) Report

Stock Number _____

Final Inspection Checklist Reference: _____

Intended Application _____

Attachments to be used: _____

Operators handbook supplied: ☐

Hazards machinery decal: ☐

The following items have been explained:

- ☐ Identification/Operation of controls
- ☐ Starting & stoping instructions
- ☐ Safe Transport / Locks
- ☐ Operating procedure

Hazards requiring special care when operating machine

- ☐ Cutters / Blades
- ☐ 3 PL / Attachments / PTO
- ☐ Hydraulic penetration
- ☐ Other _____
- ☐ Crush / Impact points
- ☐ Gloves

Personal protective equipment required:

- ☐ Ear protection
- ☐ Overalls
- ☐ Respirator / Cab Filter
- ☐ Other _____
- ☐ Eye protection
- ☐ Gloves

Servicing Requirements:

- ☐ Daily Startup Checks
- ☐ Cleaning
- ☐ Bolt / Stud Re-tensioning
- ☐ Periodic Servicing
- ☐ Warranty Provisions / Conditions

Important safety controls:

The location and proper use of the following items have been explained

- ☐ All safety guards
- ☐ Safety Props / locks
- ☐ Load / Speed / Slope Limits
- ☐ Other _____
- ☐ Decals (Review all)
- ☐ Shut down / Lower Hydraulics
- ☐ Tyre Pressure

Care is required when operating under the following conditions:

- ☐ High loads
- ☐ Soft / Slipper ground
- ☐ Bystanders / Assistants
- ☐ Other _____
- ☐ Steep Slopes

Persons to whom training was provided

- •
- •
- •

Further training required:

- ☐ _____

Legend: ☑ Information Given ⊟ Not Applicable ☒ Remaining Uncontrolled Hazards

Risk controls for high risks include: Operate and service strictly according to operators handbook.

Likely improper use includes: Do not operate without guards or by pass guards. Do not exceed specific limits.

Remaining uncontrolled hazards / limitations to use:

Machine Make: _____ **Date:** _____

Serial Number: _____ **Model:** _____

Dealership Name: _____ **Invoice #:** _____

Address: _____

Dealer's Representative: _____ **Phone:** _____

Purchaser's or Agent's Declaration

have been instructed in, and understand the hazards, the safe operating instructions and safety controls applicable to this machine including the need for further training. I understand and accept my responsibility to train any operator to follow these safety measures.

Purchaser's Name: _____ **Purchaser's Signature:** _____

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RISK ASSESSMENT

AGROWDRILL RANGE

RISK ASSESSMENT	Rate the severity & likelihood of any potential or existing hazards present within the machine			
RISK SEVERITY	4 = Possible fatality	3 = Major injury	2 = Minor injury	1 = Negligible injury
LIKELIHOOD OF OCCURRENCE	4 = Very likely	3 = Likely	2 = Unlikely	1 = Very unlikely
FREQUENCY	If the exposure to a hazard is very frequent eg continuous, compared to daily, weekly, monthly etc, this exposure should be reflected in increased likelihood of occurrence.			
Add the Risk Severity to the likelihood of Occurrence to calculate the Risk Assessment Rating				

HAZARD TYPE			CAUSE OF HAZARD		RISK CONTROL
REF	**Is there a potential for injury or illness or illness due to …**	**Yes / No**	**If YES, what is the cause or source of the hazard …**	**RISK ASSESS RATING**	**Determine and apply appropriate risk controls after considering Hierarchy of Risk Control**
H1	**ENTANGLEMENT** Entanglement, drawing in, pinching or trapping.	YES	Rotating shafts. Moving chains or belts. Rotating augers & similar mechanisms for moving seed fertiliser.	3 + 3 = 6 3 + 3 = 6 3 + 2 = 5	Fit safety guards. Fit decal. Generally guarded by hopper structure unless lid opened. Fit decal
H2	**CRUSHING OR IMPACT** Crushing or impact during operation.	YES	Raising or lowering Coulter Bars Working under raised machines	3 + 2 = 5	Fit decal. Fit safety stops when working under machine
H3	**STRIKING** An object striking the operator or another person.	YES	Material Discharge Spring loaded tynes	2 + 3 = 5	Fit decal.
H4	**CUTTING** A cutting, stabbing, puncturing or shearing injury.	YES	Sharp edges on structures & mechanisms	2 + 2 = 4	Remove sharp edges from any areas which may be inadvertly contacted during operation. Other guarding generally impractical without affecting function. Fit decal.
H5	**SLIPPING** slipping, tripping or falling	YES	Steps, handrails & Work Platforms. General condition of larger machines where operator may stand on the unit during service or adjustment	2 + 2 = 4 1 + 1 = 2	Securely fitted with non skid treads. 3 points of contact for access Ensure no loose or hanging hoses or similar items that could cause a trip or fall
H6	**EXPOSURE** Exposure to vibration, heat, radiation, friction or abrasion	YES	Heat from Hydraulic Motors (if fitted) No other specific hazards	1 + 2 = 3	Motors guarded. Fit decal. Ensure machine attached to a safe tractor.
H7	**NOISE** Excessive noise	YES	No other specific hazards		Ensure machine attached to a safe tractor.
H8	**FLUID** Hydraulic fluid penetration	YES	Coupling & uncoupling hydraulic quick release fittings	3 + 1 = 4	Hydraulic system in good condition. Correct fittings & correct pressure rating for hoses. Fit decal.
H9	**HAZARDOUS SUBSTANCES** Hazardous or dangerous substances or suffocation.	NO		0	
H10	**MANUAL HANDLING** Manual handling or ergonomic conditions causing physical injury.	YES	Incorrect use of controls (where applicable)	3 + 2 = 5	Ensure controls marked or decal fitted showing purpose of controls.
H11	**EXPLOSION** An explosion	Yes	Over inflation of tyre.	3 + 1 = 4	Fit Decal.
H12	**ELECTROCUTION** Electrocution or electrical burning	Yes	Contact with low overhead electrical cables (eg folding sections or cultivators etc)	4 + 2 = 6	Fit decal

Warranty Policy

Agrowplow Pty Ltd trading as Agrowplow warrants to its Authorised Dealer, who in turn, warrants to the original purchaser (Owner) that each new product, part or accessory will be free from defects in material and workmanship for twelve (12) months after delivery and installation by an Authorised Agrowplow Dealer, according to the conditions outlined.

This warranty does not cover damages resulting from abuse, accidents, alterations, normal wear or failure to maintain or use the Agrowplow product with due care.

During this warranty period, the Authorised Agrowplow Dealer shall repair or replace, at Agrowplow's option, without charge for parts and labour any part of the Agrowplow product which fails during normal use and operation because of defects in material or workmanship.

The Owner must provide the Authorised Dealer with written notice of the defect within 14 days of its occurrence, and allow reasonable time for replacement or repair.

Agrowplow (at its option) may request failed parts to be returned to the factory. Freight costs associated with retuning parts will be the responsibility of the owner.

Any travel of a service technician and/or transportation of the Agrowplow product to the Authorised Servicing Dealer for warranty work is the responsibility of the Owner.

This warranty is in lieu of all other warranties (except those of title), expressed or implied, and there are no warranties of merchantability or fitness for the particular purpose. In no event shall the Authorised selling Dealer or Agrowplow be liable for downtime expenses, loss of machine use, loss of crops, loss of profits, injury or damage arising from accident, direct or indirect loss, or other incidental, consequential or special damages.

Conditions of Warranty

1. The Warranty is **not transferable** to any third party or subsequent purchaser.

2. The Warranty Registration Form **must be filled in and returned to** Agrowplow by the Dealer within seven (7) days of delivery and installation of the unit. By signing the Warranty Registration Form, the owner acknowledges that he is responsible for the safe operation of the product, and that he undertakes to fully train any person that might operate the product. Only when the Warranty Registration is **completed and returned**, can Agrowplow fulfill all warranty obligations.

3. Components and conditions <u>not covered by warranty</u> include:

- **Abuse**
  Failure resulting from neglect, improper operation, lack of required maintenance or continued use of machine after the discovery of a defect which results in greater damage to the unit.

- **Environmental Conditions and Application**
  Deteriorated or failed components such as hydraulic hoses, seals, valves or connections damaged by corrosive materials, dirt, sand, excessive heat or moisture. Warranty determination for these types of failures will be made by Agrowplow only after inspection of failed components.

- **Normal Wear**
  Normal wear and consumable items such as oils and lubricants, nuts, bolts, washers, grease caps, spanners, jacks, bearing housings, axles, poppet valves or seal kits for hydraulic cylinders, seals, points, discs, axles, tyres, machine adjustment and periodic service. These are considered to be normal wear items and are not warranted.

- **Maintenance**
  Component failure caused by non performance of schedule maintenance such as correct lubrication and maintenance, tightening or replacement of bolts, nuts, fittings, shields and covers.

- **Damage**
  Damage or machine failure caused by carelessness, accidents, improper operation, inappropriate transportation or storage of the machine, parts or attachments.

- **Alterations**
  Any unauthorised alteration, modification, attachments or unauthorised repairs to the Agrowplow product, parts or attachments. Written approval must be obtained from Agrowplow for any such items to maintain warranty.

- **Replacement Parts & Service Work**
  The Labour or expenses involved in any of the following replacements or service tasks is the responsibility of the owner:
  1. Replacement of faulty tynes.
  2. Soil opener replacement.
  3. Metering roller adjustment or replacement.
  4. Any bearing replacement.
  5. Adjustments (refer to manual).
  6. Drive shaft adjustment or replacement.
  7. Periodic service work

  Agrowplow and its Dealers are not responsible or liable for any such expenses.

- **Clean-up Time**
  Agrowplow does not pay for cleaning the products, parts, accessories or work area before or after the warranty repair. Clean-up time is affected primarily by the application or conditions in which the unit is operated and maintained. Since clean-up time can be so variable, cleaning time should be considered a customer expense.

- **Transportation & Insurance Costs**
  Warranty does not cover transportation or insurance costs for its products or other equipment needing repair or replacement of warranted components. Nor does it cover any freight or insurance costs in obtaining new parts or returning old parts to Agrowplow for inspection purposes.

- **Travel Time**
  Travel time required for warranty repairs is the responsibility of the Owner.

- **Diagnostic Time**
  Warranty does not cover time required to diagnose a warranty problem. Diagnostic time is affected greatly by the training and expertise of the technician employed to do the job. With proper training of service personnel, diagnostic time should be at a minimum. Agrowplow expects that Dealers will assign a well trained and proficient technician to handle warranty repairs.

- **Non – Genuine Parts**
  Use of parts other than Agrowplow parts for repair of warranted parts will automatically negate any warranty. Warranted components must be replaced with genuine Agrowplow repair parts.

- **Unauthorised Repairs**
  Repairs by an unauthorised agent will automatically forfeit any warranty. Warranty repairs must be carried out by an Authorised Agrowplow Dealer only, and only after Agrowplow's authorisation has been obtained.

4. Special Warranty Considerations apply in respect to the following:

(a) **Tyres:** Tyres are covered by the tyre manufacture's warranty. Claims for tyre fault must follow Agrowplow's normal claim procedures.

(b) **Contractors:** Owners who undertake contract work with their Agrowplow product line are **limited to a 90 day warranty period.**

Privacy Statement

Your privacy is important to Agrowplow Pty Ltd trading as Agrowplow (referred to herein as Agrowplow). We understand that you should have control over what happens to your personal information. This privacy statement informs you about the way Agrowplow handles your information.

The information that you provide us on the Warranty Registration Form will be collected by one of our dealers. This information will be passed on to Agrowplow for the administration of your warranty.

Agrowplow may also use this information to provide you with a number of services that are directly related to the enjoyment and operation of your Agrowplow product. We may also use your personal information in the following circumstances:

1. To inform you of Agrowplow products and offers
2. To advise you of issues relating to your Agrowplow product

There may be special offers and information that all become available to you now that you are a valued customer of Agrowplow. In order to keep you informed Agrowplow may use the personal details provided to us in your Warranty Registration Form to mail or electronically communicate the relevant information.

In using your personal information this way Agrowplow may be required to make disclosure to its suppliers, marketing firms or parts suppliers. All such disclosures take place with stringent safeguards to ensure the security of your personal information.

Agrowplow may use your personal details for market research purposes. This may involve disclosing your personal information to our research firms for the compilation of statistics. All disclosure takes place with stringent safeguards to ensure the security of your personal information.

If you wish to access personal information that we have about you, you may make a request in writing.

All correspondence should be directed to:

The Privacy Compliance Officer
Agrowplow Pty Ltd
PO Box 270
WELLINGTON NSW 2820

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1.0 Safety

Agricultural machinery presents an operator with hazards associated with setting up, on and off road transport, tillage and seeding applications, as well as machine service and maintenance. The operator must be aware of these hazards.

The dealer will explain the capabilities, safe application, service requirements and restrictions of the machine and demonstrate the safe operation of the machine according to Soil Care Systems International instructions. The dealer can also identify unsafe modifications or use of unapproved attachments.

The following publications provide information on the safe use and maintenance of the machine and attachments:

- The operator's manual delivered with the machine gives operating information as well as routine maintenance and service procedures. It is a part of the machine and must stay with the machine if it is sold. Replacement operator's manuals can be ordered from your Agrowplow Dealer.
- The machine has decals that instruct on safe operation and care.

1.1 Shared Responsibility For Safety

1.1.1 Why is farm safety important?

Farming is dangerous. Farms have many conditions that create dangerous situations including increasing use of machines and chemicals, confined spaces, live animals, constantly changing weather conditions, very young and very old people and continual financial pressure to get crops in and harvest off on time. As any combination of theses factors can become lethal, control of occupational health and safety risks has become an essential farm management competency.

Taking risks with the lives of family members or employees is not something that should ever be contemplated!

Farm accidents are often workplace accidents of a different kind. While any workplace accident is a tragedy, a farm accident is often a family disaster where a breadwinner, grandparent, child or other family member is injured or killed. At times the tragedy is made worse by the fact that another family member may have caused the accident and is charged with an offence under occupational health and safety legislation.

Considering that the likelihood of an accident can be significantly reduced by people being more safety conscious, safety should be a topic of frequent

discussion among family members and farm employees. Children also need to be trained to recognise hazards and to never use machinery as a plaything, as they too can play a role to remind others to never take safety risks. The loss of fun that kids might otherwise have on machinery is nothing compared to the grief of harm done to a child.

1.1.2 Four Big Reasons Why Safety Is Important

- Accidents Hurt
- Accidents Cost
- Accidents Involve Others
- Accidents Can Be Avoided

1.1.3 How to Create Safety Awareness

The Safety slogan – 'Think it, Talk it, Work it', summarises what we all must do to make workplaces that are without risk to the extent that is reasonably practicable. Assuming that the chain of responsibility is working as it should, machinery will be properly guarded, safety switches fitted and proper information given by way of Operator Handbooks, decals, verbal instruction and so on. But even if all these controls are used, it is still always up to each person to use the machine or do a task, being aware of the risks and using a machine properly and safely, according to the information they have been given.

Risk awareness and proper use of a machine is the result of an employer having been given relevant information, taking safety seriously, and ensuring that each operator of a machine is properly trained and supervised.

1.1.4 Consultation

Providing information is a good beginning. Each employee must than be free to further discuss safety related matters and ask for further assistance from your employer, Health and Safety Representative, or workplace OH&S Authorities if required. Consultation is always best if it is done cooperatively, as part of the way business is normally done, at smoko discussions or at more formal meetings depending on the topic and your business situation.

Ultimately, we are only safe at work when everyone who is responsible for safety has played their part and the employer, supervisor and the person using a hazardous machine "thinks it, talks it and works it". Safe working conditions are the result of a safety culture in which everyone participates, where it would be unacceptable to behave any other way.

1.1.5 Hazard Identification

A Hazard is the potential to cause harm to a person. Where you are now there may be hundreds of hazards. Some hazards have so little potential for harm, due to their likelihood, that we can disregard them. Other hazards, because of the real and likely potential for serious harm, must not only be identified, but also controlled so as to eliminate or reduce the potential for harm to a person.

1.2 Safe Operation

This section offers general guidelines for the safe operation of machinery. It does not replace local, state or federal safety regulations.

Agrowplow Pty Ltd has made every effort to highlight all risks to personnel or property. Owners and operators have a responsibility to exercise care and safe work practices at all times in the vicinity of the machine. Owners are advised to keep up to date on safety issues and to communicate these to all users of the machine. If you have safety concerns specifically related to this machine, contact your dealer immediately.

1.2.1 Operator Safety

Read this manual carefully before operating new equipment. Learn how to use this machine safely. Be thoroughly familiar with the controls and the proper use of the equipment before using it.

Take careful note of all safety instructions both in this manual and on the machine itself. Failure to comply with instructions could result in personal injury and / or damage to the machine. Replace missing or damaged safety decals on the machine and ensure that these remain clearly visible.

It is the owner's responsibility to ensure that anyone who operates, adjusts, lubricates, maintains, cleans or uses the machine in any way has had suitable instruction and is familiar with the information in this manual. Operators and other users of the machine should be aware of potential hazards and operating limitations.

1.2.2 Have Training with Actual Operation

- Operator training must consist of a demonstration and verbal instruction. This training is given by your dealer when the machine is delivered.

- New operators must start in an area without bystanders and use all the controls until they can operate the machine safely under all conditions of the work area.

1.2.3 Know the Work Conditions

- Operators must know any prohibited uses or work areas. They need to know about excessive slopes and rough terrain.
- Operators must know the local road transport regulations, and understand the dangers and requirements of transporting wide and heavy equipment.
- Always wear protective clothing when servicing the machine.
- For operators to be qualified, they must not use drugs or alcoholic drinks that impair their alertness or coordination while working. Operators who are taking prescription drugs must get medical advice to determine if they can safely operate a machine.

1.3 Warning Decals

Safety Warning Decals are a means of communication the presence of hazards and appropriate risk controls to machinery operators.

- Do not remove any safety instruction decals.
- Ensure that any safety decals are clear and visible. Clean and replace as necessary.

1.3.1 Hazardous Machinery

Misuse or incorrect operation on any machine could cause serious injury or death to either the operator or bystanders. It is important to always fully read the Operator's Manual and understand all operating and safety procedures before using the machine. If you have any queries relating to safety or the operation of any machine contact your Agrowplow dealer immediately.

All guards and safety devices must be kept on the machine and maintained in a functional condition. If necessary to remove guards or safety devices for maintenance they must be replaced before commencing operation.

Sound the horn before starting the machine and before moving off to alert bystanders of your intentions. Bystanders must also be well clear of the machine before operating.

Figure 1.1: Hazardous Machinery Decal

If the machine is to be left unattended the hydraulics must be lowed and the engine stopped. This will prevent accidental operation of the machine.

1.3.2 Bystanders

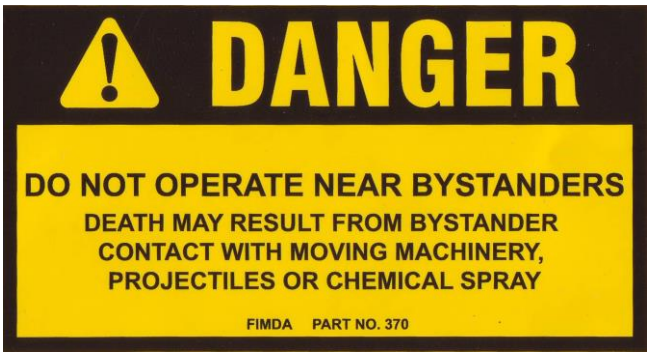


Figure 1.2: Do Not Operate Near Bystanders Decal

Do not operate any agricultural machinery near bystanders. Serious injury or death to bystanders could occur in they come in contact with projectiles, chemical spray, fertiliser and/or grain dust and moving machinery.

Sound the horn before starting the machine and before moving off to alert bystanders of your intentions. Make sure bystanders are well clear of the machine before operating.

1.3.3 Machinery Safety Guards

Figure 1.3: Rotating or Moving Machinery Decal

Safety hazards related to exposed drive belts, pulleys, chains, sprockets and other mechanisms must be clearly identified and properly guarded. Some hazardous mechanisms like tynes and coulter discs cannot carry out their intended function if they are guarded and must, therefore, be controlled by an alternative means. Guards must be fixed in place with bolts, locks or fasteners that require a tool or key to remove them.

Always wear personal protective equipment (PPE) including overalls whilst operating the machine. Loose items of clothing, jewellery (including watches), or long hair could all become entangled in rotating or moving parts causing serious injury or death.

Keep clothing and body extremities well clear of pinch points while the machine is operating. Keep well clear of moving parts at all times. These include drive chains, sprockets, shafts, wheels, discs, pivot points, etc. Guards are provided with the machine for safety reasons where practical without compromising machine performance. Ensure these are always fitted during operation.

1.3.4 Hydraulic Fluid Penetration

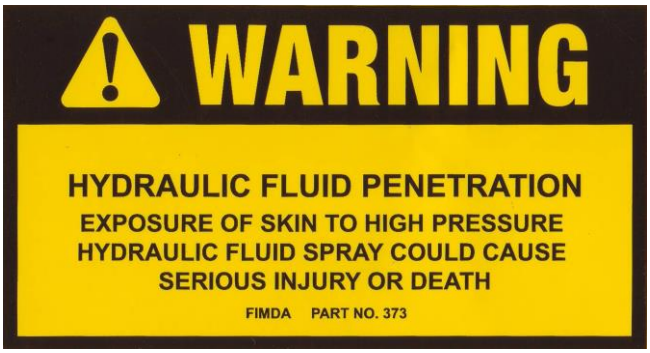


Figure 1.4: Hydraulic Fluid penetration Decal

A hydraulic fluid leak can, under high pressure, penetrate a human body.

Appropriate risk controls must be established to safe guard against hydraulic fluid penetration. All hydraulic machinery should be inspected regularly. Worn hoses and faulty connections, valves or cylinders, must be repaired or replaced.

Operators should be warned that, in some cases, residual pressure can remain in a hydraulic system after it is shut down. In these situations the cause of the residual pressure needs to be identified and controlled to avoid the possibility of a high pressure hydraulic fluid leak or the unintended operation or movement of the machine or attachment.

Relieve the pressure before disconnecting any hydraulic or other lines. Make all repairs and tighten all fittings before re-connection to pressurised fluid. Keep your hands and body away from any pinholes or high pressure jets. Search for leaks with a piece of cardboard instead of using your hand directly.

Avoid any contact with fluids leaking under pressure, because the fluids can penetrate the skin surface. Any fluid which penetrates the skin will need to be removed immediately by a medical expert. Seek specialist advice on this type of injury.

To eliminate the risk of serious injury or death:

- Repair or replace all possible causes of leaking hydraulic fluid, including:
  - Faulty valves, cylinders and components;
  - Worn hoses and fittings.
- Work Methods & Procedures Required
  - Train operators to shut down pressure pumps or pressure sources before coupling or uncoupling hydraulic connectors.
  - Never use bare hands to check hoses for leaks.
  - Use a piece of paper to detail a high pressure spray.
- Use Personal Protective Equipment

Instruct operators to wear protective equipment, including safety glasses, if there is a high likelihood of a high pressure hydraulic leak.

1.3.5 Hot Components

Figure 1.5: Heat Source Decal

During operation hydraulic components such as motors, pumps and valve blocks can become quite warm. Do not touch these components until they have cooled down otherwise serious injury such as burns could result.

1.3.6 Three Point Linkage

Figure 1.6: Three Point Linkage Decal

The three point linkage on a tractor creates numerous pinch and crush points that could cause serious injury or death. Keep well clear of this area when the engine is running.

Shut the engine off for all attachment, unattachment and maintenance in this region.

1.3.7 Service Access

Figure 1.7: Do Not Climb On This Machine Decal

Using incorrect access points could result in serious injury or death as a result of slipping and / or falling. Agricultural machinery contains many sharp edges and points. Some of these can and should be guarded whilst other section cannot be guarded without compromising the working function of the machine.

Always use access platforms and access ladders to carry out maintenance or refilling. If maintenance is required on parts of the machine not serviced by an access platform always use a ladder or some other form of access device.

Do not ride or allow passengers on the machine. Under no circumstances are passengers to be permitted on the machine while it is in operation or being transported. Any platforms and/or steps are provided solely for the purpose of preparing the machine for use.

1.3.8 Handle Agricultural Chemicals Safely

All farm chemicals including fertilisers should be stored, used, handled and disposed of safely and in accordance with the manufacturer's recommendations. Read the product label before using, noting any warnings or special cautions, including any protective clothing or equipment that may be required.

Do not eat or smoke while handling chemicals, fertilizers or coated seeds. Always wash your hands and face before you eat, drink or use the toilet.

Store chemicals, fertilizers and coated seeds out of reach of children and pets, and away from food and animal feeds. Any symptoms of illness during or after using chemicals should be treated according to the manufacturer's recommendations. If severe, call a physician or get the patient to hospital immediately. Keep the container and/or label for reference.

Figure 1.8: Chemical Hazard Decal

1.4 Ergonomic Safety

1.4.1 Personal Protective Equipment

Employers must provide a safe workplace for their employees.

Employers are responsible to ensure the Personal Protective Equipment (PPE) is available for use in situations where it makes a practical contribution to controlling hazards and safety risks.

Employers must also ensure that PPE is in good condition and is properly used by employees.

1.4.2 Working At Heights

Where work is required at heights where a fall of more than two (2) meters is possible, operators must be aware of hazards caused by:

- Unstable, sloping or slippery surfaces;
- Proximity to unguarded edges;
- Other non-fall hazards.

Risks must be controlled by the most practicable of the following means:

- Do the task at ground level;
- Use suitable equipment that provides a solid elevated working surface;
- Use fall prevention system (safety harness)

Ladders are the least preferred means of working at heights and should only be used when there is no viable alternative such as:

- Stairs;
- Cherry picker;
- Portable steps;
- Forklift with appropriate platform;
- Scaffold.

Emergency procedures including first aid must be available.

A safety harness must also be used where required by the nature of the task.

Where employees must work at height in situations including servicing of machines proper equipment, such as a ladder and proper training in its use and emergency procedures must be provided.

In other situations where employees must often or always work at height a proper scaffold or mobile platform must be provided which provides a solid working surface. Other potential hazards that may cause falls, such as fatigue from using a spray gun and exposure to paint fumes must be minimised.

1.4.3 Controlling Noise

Excessive noise levels can cause permanent hearing impairment. The incidence of hearing impairment increases as the exposure to noise increases. Noise levels are cumulative and increase with each extra noise.

Noise can be reduced by eliminating sounds. Isolate noisy operations by making sure that they are carried out away from other people.

Provide sound reducing equipment such as a cab on a tractor. Avoid using noisy equipment if possible.

Use warning signs to remind people to wear hearing protection and reduce noise. Have staff that work in noisy environment undergo an annual hearing check.

Always wear earplugs, or similar devices, when carrying out noisy activities.

1.4.4 Manual Handling

Manual handling injuries relate to a range of conditions including:

- Muscle sprains and strains;
- Back injury;
- Soft tissue injury;
- Hernias;
- Chronic pain.

Some of these injuries are known as repetitive strain injury (RSI) or Occupational overuse Syndrome (OOS) but all are generally known as Musculoskeletal Disorder (MSD) resulting from manual handling.

All work activities must have manual handling hazards identified, risks assessed and controlled. Some tasks have a very high risk of MSD evident from an assessment of the task, or reports of previous injuries. Assessment should include a review of:

- Postures;
- Movements / distances moved;
- Forces and type of loads;
- Duration and frequency of activity;
- Environmental factors including vibration / heat / cold.

A suitable checklist is available from WorkCover to ensure your assessment is systematic and facilitates consultation with employees.

Where practicable, tasks causing MSD must be eliminated or the risk reduced by altering the machine or process, to something less risky according to the hierarchy of control such as:

- Eliminating the task;
- Substituting the task with another less risky task;
- Using mechanical aids;
- Improved work layout / seating;
- Improved work systems including job rotation or rest periods;
- Providing training;
- Using personal protective equipment.

Implement and review controls to ensure they are properly used and effective.

As MSD is a complex subject with significant risks that are not immediately obvious, it is suggested a high degree of employee consultation is used and professional assistance is sought if you are unsure of the best approach.

Typical examples of MSD injuries in automotive workshops include:

- Bending over mudguards for long periods;
- Working with your hands above your head for long periods;
- Apply high force to levers, spanners, etc for long periods;
- Lifting heavy weights such as tyne assemblies.

Use good mechanical handling equipment, such as hoists, jacks and wheel lifters as much as possible.

Review all tasks where employees work in unusual postures for long periods, or have to exert great effort, and develop improved job methods to reduce MSD injuries.

When MSD injuries are reported, risk assessments must be reviewed and all hazards identified and risks controlled.

1.5 Maintenance

1.5.1 Practice Safe Maintenance

Keep the machine in safe working condition. Routine maintenance and regular servicing will help reduce risks and prolong the life of the machine. General Maintenance Accidents occur most frequently during servicing and repair. The following general rules must be followed when maintaining or working with machinery:

- All operating and maintenance manuals must be read before and referred to while using or servicing any piece of equipment.
- Turn off all machinery power sources and isolate the machine before making adjustments, doing lubrication, repairs or any other maintenance on the machine.
- Ensure that the machine hydraulics are disconnected from the power source.
- Wear gloves when handling components with cutting edges, such as any ground cutting components.
- Beware of hazards created by springs under tension or compression when dismantling or maintaining the machine.
- It is recommended that you clean the machine before commencing maintenance.
- When machinery is fitted with hydraulics, do not rely on the hydraulics to support the machine. During maintenance or while making adjustments under the machine, always lock the hydraulics and support the machine securely. Place blocks or other stable supports under elevated parts before working on these.

- Extreme caution should be used when clearing coulters, tynes or soil openers. These may be very sharp and cause serious injury.
- Use due care when adjusting or maintaining any aspect of the Agrowdrill. Failure to do so may result in serious injury.

1.5.2 Electrical Maintenance

Disconnect the electrical supply from the tractor before doing any electrical maintenance. Welding With electronic equipment in modern tractors and on machinery it is advisable to disconnect the machine from the tractor or at least disconnect the alternator and battery before attempting any welding.

1.6 Transporting the Machine

Ensure that all linkage pins and security clips are fitted correctly. With trailing machines tow with the drawbar only as this is the only safe towing point on the machine. Always check that bystanders are clear before starting and moving the tractor and the machine. Plan safe routes of travel, and be aware of power lines and other roadside hazards. Take particular care when towing implements on hillsides.

Do not ride or allow passengers on the machine. This machine is not designed to carry passengers and therefore no riders are permitted at any time.

Please consult your local transport authority regarding the use of ‘Oversize’ signs, escort vehicles and lighting equipment when transporting agricultural machines on public roads.

When transporting the machine:

- A speed of 20 km/h must not be exceeded. Transporting at greater speeds will result in loss of implement control and cause serious damage or injury.
- Do not transport the Agrowdrill without the tractor drawbar being in a locked position. Transporting without the drawbar locked will result in loss of implement control and serious damage or injury.
- Do not transport an Agrowdrill with a vehicle of less gross mass than that of the Agrowdrill being towed. Transporting with a smaller lead vehicle will result in loss of implement control and cause serious damage or injury.
- Make sure the Agrowdrill does not exceed the unbraked towing capacity of the lead vehicle.
- Do not pull trailed Agrowdrills from any point other than from the tractor drawbar. Pulling from a point other than the designated tractor drawbar can result in tractor instability and cause serious damage or injury.

- Do not operate outside daylight hours unless lights are fitted and clearly visible. This also applies when visibility is limited eg in foggy conditions. Please consult your local road transport authority.
- Avoid holes, ditches and obstructions which may cause the machine to tip over, especially on hillsides.
- Never drive near the edge of a gully or steep embankment as it might cave in.
- Slow down for hillsides, rough ground and sharp turns.

2.0 Soil Care System of Farming

The origins of Agrowplow began with observation and concern about devastating effects of conventional cultivation on Australian soils.

Today, Agrowplow remains focused and dedicated to the development of innovative farming practices and equipment to improve and protect our nation's greatest asset - the soil!

2.1 Soil Degradation

Traditional cultivation and sowing techniques, which require soil to be ploughed and cultivated before sowing, have caused erosion by wind and rain and severe break down of soil structure. Continual passes of the tractor and deterioration of soil structure have also formed compacted layers below the soil surface.

These soil damaging factors combine to seriously limit plant growth and yields, and erode our precious asset. In the case of compacted layers water absorption is prevented and root growth is restricted, prohibiting the plants access to nutrients.

Helpful soil microbes and earthworms are reduced or eliminated because poor soil structure causes pastures to become water-logged quicker, dry out faster, and often make tillage operations almost impossible.

Traditional cultivating practices are always aimed at controlling weed growth and preparing a fine "seedbed". Unfortunately these practices destroy soil humus, expose soil particles to erosion, compact the soil, restrict moisture infiltration, reduce root growth and lower plant yields.

In order to maximize farming profits while still protecting the environment these problems must be overcome.

The "Soil Care System" approach to farming is different because it promotes the health of both "seed-bed" and "root bed" in a sustainable way - working with nature rather than against it.

New farming techniques are evolving together with new equipment to give simple, logical compatible answers.

2.2 The Solution

Agrowplowing or non-inversion tillage as well as direct drilling provide positive answers to sustaining soils for highly productive farming. The Agrowplow Soil Care System of Farming encompasses these techniques.

The Soil Care System of Farming has been developed to provide farmers with better returns from their crops and stock. It advocates no tillage or minimum tillage because of moisture losses and soil degradation brought about by each cultivation. These methods can be used in a variety of ways to suit each soil and seasonal condition for creating healthier, sustainable root bed and seed bed environments.

The unique range of specially developed Agrowplows and Agrowdrills are machines which will allow you to obtain the best advantages of non-inversion tillage, direct drilling and minimum tillage practices - for crop and pasture establishment in conservation farming systems.

2.2.1 Agrowplowing or non-inversion tillage

Non-inversion tillage is lifting and shattering hard soil pans without soil inversion. The task is accomplished with minimum soil surface disturbance ensuring that precious top soil is left on the surface and minimal moisture is lost to the atmosphere.

Top soil is not mixed with less fertile subsoils or less fertile subsoils mixed with fertile top soil. The topsoil remains virtually undisturbed and is less susceptible to wind and water erosion than conventionally cultivated soils.

The patented design of the Agrowplow shank prepares and renovates the root zone of the soil without inversion.

This unique ability of root bed renovation improves water infiltration, humus levels, soil structure and sustainable productivity. Root development is enhanced by an unrestrictive soil environment.

2.2.2 Direct Drilling

No-Till or direct-drilling is the term given to establishing crops and pastures with out any prior tillage. Control and reduction of vegetation and weeds is achieved by either chemicals or livestock or both.

Non-inversion tillage and direct drilling go hand-in-hand. Direct drilling promotes the benefits of Agrowplowing reducing risk of erosion and prolonging the effect of deep ripping through less soil traffic. This leads to reduced compaction and enhanced root growth encouraging healthier and deeper soils.

2.3 Soil Compaction

Soil compaction is a form of soil degradation. It strangles the life out of soil and severely impacts on yields. Yield losses of up to 40% are not uncommon. In extreme cases yields can be reduced by up to 80% and severe erosion can occur.

2.3.1 Causes of Soil Compaction

Soil compaction is caused by normal farming activities including using tractors, implements, headers, vehicles, cultivation, livestock and irrigation.

The weight of vehicles and livestock compress the soil. Cultivation breaks down soil aggregates, soil structure, porosity and humus. The worst damage occurs in wet soils, with high stocking rates, frequent vehicle traffic and intensive cultivation. Any activity which reduces the porosity or bulk of your soil is causing soil compaction.

Compacted soil becomes denser leading to decreased porosity of the soil. This causes reduced:

- Water infiltration
- Humus levels
- Soil aeration
- Worm activity
- Microbe activity
- Water retention
- Root growth
- Crop yields

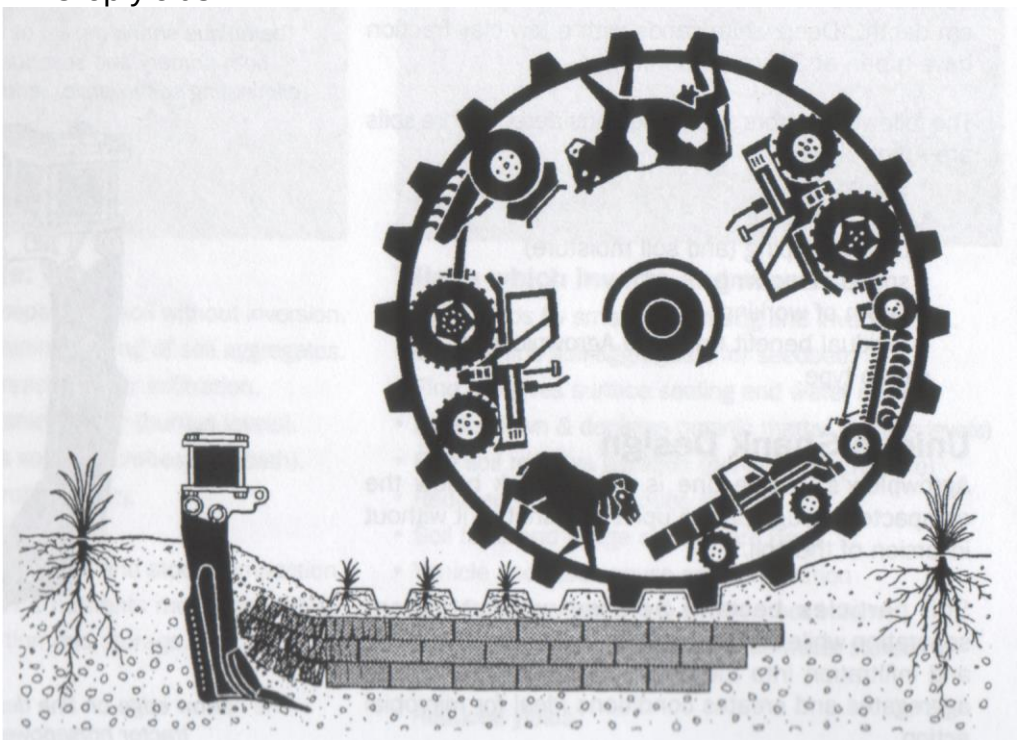


Figure 2.1: Everyday farming activities cause compaction

2.3.2 How is Soil Compaction Rectified?

Step 1
Break up compacted soils, hard pans, clay pans, tillage pans and impenetrable barriers with an Agrowplow.

Step 2
Re-establish plants with strong, deep root systems to rebuild and hold the soil structure, bulk and porosity in a healthier state - preferably using direct drilling or minimum tillage techniques.

Step 3
Use farming practices which minimise soil cultivation, soil inversion and traffic in wet soils.

2.4 Advantages of Agrowplowing

Agrowplows are used for both primary and secondary tillage. They work without soil inversion and therefore minimise moisture loss. The narrow edge on tine design substantially reduces tractor horsepower requirements.

The low angle digging tool and narrow shank of the Agrowplow ensures that the previous crops root systems are fully retained in the soil. This improves structure, adding humus, increasing water infiltration and holding moisture whilst allowing greater utilization of nitrogen created by legume Rhizobium bacteria.

The Agrowplow can be successfully applied in most situations. It has been used extensively in the farming of cereal, cotton, sugar, vegetables, vineyards and orchards under both dry land and irrigation farming methods.

Agrowplowing is particularly effective in pasture renovation and the control of water run-off, allowing infiltration and storage within the soil. Wind erosion is reduced and salinisation problems can be reduced.

Hardpans and barriers, created by fine particles moving downwards into the coarse soil structures creating an almost impenetrable layer, can be eliminated.

It should be noted that hard pans can be re-established quickly unless tractor traffic is reduced. Normal cultivation requires many more passes of a tractor than direct drilling.

Measurements from many soil types indicate that the depth of the traffic compaction layer varies according to soil type. Generally, the lower the clay content of the soil, the deeper the hard pan formation.

The following factors should be considered before soils are Agrowplowed:

- Soil type
- Soil Moisture
- Shank spacing
- Time of working
- Speed of working
- Depth of working
- Crop type.

2.4.1 Unique Shank Design

The unique Agrowplow shank is set to work below the compacted plough pan to uplift and shatter it without inversion of the soil. Soil particles become aerated without violent separation while allowing greater moisture infiltration into the seed bed. This minimizes fine soil aggregates and creates conditions ideal for microbial action. Crop roots are then free to pursue moisture and nutrients deep in the soil. Crop rotation and the planting of deep rooted species also assists in developing and maintaining a healthy root bed.

The Agrowplow has been engineered to operate in a wide range of soil conditions whether they be black, heavy soils or the light, sandy, abrasive types. Soil type does not affect successful Agrowplowing or non-inversion tillage.

2.4.2 Compare the Differences

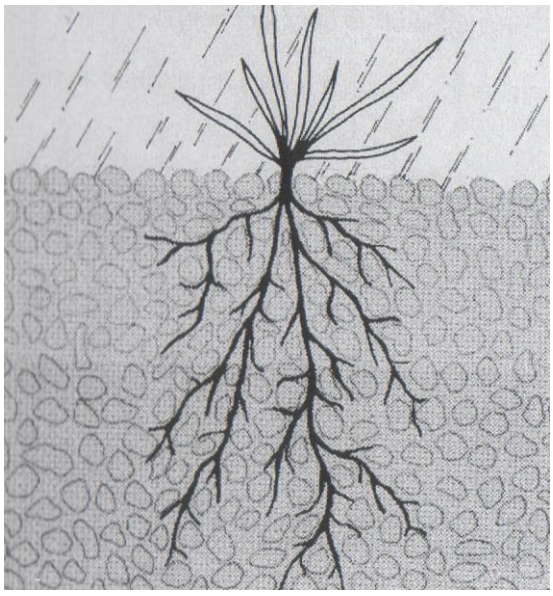


Figure 2.2: Root growth with non-inversion tillage

Non Inversion Tillage:

- Kills weeds by lifting & separating soil without inversion.
- Creates root bed with minimal fining of soil aggregates.
- Soil decompaction increases water infiltration.
- Retains and builds organic matter (humus levels).
- Aerates the soil (allows soil & microbes to breath).
- Increased worm & microbe activity.
- Agrowplow eradicates hard pans.
- Agrowplow decompacts vehicle and stock compaction.
- Unrestricted root growth & nutrients more accessible.
- Increased water infiltration and storage.
- Erosion control.
- Increased yields.
- Sustainable Soil Care Farming

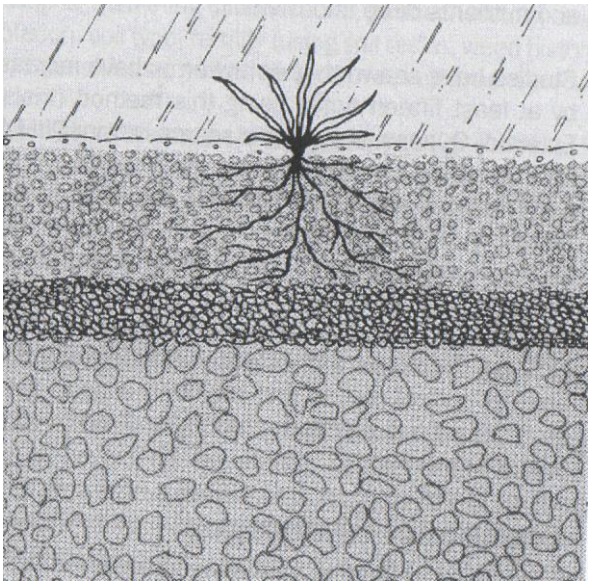


Figure 2.3: Root growth under conventional tillage practices

Tillage which inverts and mixes soil:

- Kills weeds by smashing, mixing and inverting soil.
- Creates fine soil aggregates for seedbed.
- Fine soil gives surface sealing and water run-off.
- Breaks down & depletes organic matter (humus levels)
- Fine soil reduces aeration (denser soil structure)
- Reduced worm & microbe activity
- Soil fines and tillage create hard pans
- Vehicle and stock cause soil compaction
- Restricted root growth & smaller root volume
- Restricted water penetration, less water stored
- Increased erosion
- Reduced yields
- More soil disturbance and degradation - unsustainable

2.5 Benefits of Direct Drilling

Direct drilling prevents the soil from being exposed to wind and water erosion and the effect of reduced traffic minimises soil compaction. Zero cultivation avoids degradation of soil structure.

The primary reason for cultivation is to kill vegetation that consumes moisture from the soil. This can now be achieved by alternative methods.

A big advantage of direct drilling is that it allows soils to improve and become more friable with time. As increased organic matter is retained and broken down, it is combined with the soil as humus. Soil structure is improved by this organic matter, making it more porous for better aeration and water infiltration.

The reduction of soil compaction (due to less traffic and soil degradation) allows full moisture retention to be achieved. The plant can then use the soils full potential of stored moisture, and can pursue water and nutrients deep into the soil.

Studies have shown that earthworms level have increased by using this method. Soil microbes are also returned to the soil and these beneficial organisms aerate the soil. This further helps to break down organic matter and make nutrients available.

Utilising chemicals and livestock, modern farming is able to control weeds and maintain a good ground cover. Erosion is therefore reduced and evaporation is kept to a minimum.

As the cost of farming continues to rise over the next decade any increase in margins is an advantage to farmers. Compared to conventional cultivation, direct-drilling will save time and money, and also reduce replacement expenditure on plant and equipment.

Look at the advantages enjoyed by farmers who have adopted direct-drill and minimum-tillage techniques:

- Improved soils
- Reduction of capital costs by up to 40%.
- Greater length of grazing time (between two and four months), allowing carrying capacity to be lifted in mixed enterprises.
- Flexibility in cropping programs.
- Yields superior to conventional cultivation.
- Reduced labour requirements - less time is spent on the tractor.
- More control over timing of sowing and related activities.
- Reduced costs of production.

2.6 Features of the Agrowdrill

The Agrowdrill is the most robust, versatile direct drill available in Australia. It maximises seeding versatility for pasture renovation, summer crops, cereals and legumes – from specialised direct drilling to traditional farming applications.

The Agrowdrill range is are designed to meet a wide range of grazier and mixed farmer needs in cropping and pasture applications. Each machine is capable of doing a number of jobs which enables the capital investment on machinery to be minimized. Agrowdrills can be used in a range of one pass direct drilling and conventional cropping practices, and can handle most seed and fertiliser types.

There are a number of crucial features and options of the Agrowdrill which allow it to perform well in tough conditions. These include:

- Extremely rugged construction with plenty of frame weight to penetrate the soil.
- Flexi Coil spring release tyne with a high breakaway force capabilities. Two versions are available – 350lb and 550lb.
- Very strong coil tynes with a high breakaway force which maintain the crucial digging angle and position of the soil opener.
- The use of inverted “T” (Baker Boots) soil openers.
- Strong coulter design.
- Wide variety of soil openers to suit varying soil conditions.

2.7 Advantages of the Baker Boot

The following outlines essential differences between the Baker Boot, disc seeder and conventional tynes and openers used for direct drilling.

2.7.1 The Baker Boot

The action of the Baker Boot is quite different to the other openers used in direct drilling. The Baker Boot opener is capable of producing the most ideal environment for maximum seed germination and plant establishment, especially in drying soil conditions.

There is little smearing or compacting of the soil as the opener passes through the soil. Therefore the tiny roots of emerging young seedlings easily enter the soft earth and quickly support the plant. In drying conditions, the germination and plant growth obtained from direct drilling with the Baker Boot is radically superior to other openers.

The Baker Boot has no moving parts and the very narrow profile gives lower draft requirements, easier penetration and less wear.

The use of coulters minimises soil disturbance and improves trash handling.

2.7.2 Disc Openers

Single disc soil openers use only one disc, which is dished, mounted at an angle to the direction of travel.

The twin disc simply has 2 discs which form a “V” shaped slot. It does not have a vertical disc at the front to help slice through surface trash.

The triple disc uses a single disc at the front to cut through the trash and soil and 2 more discs behind, making a “V” shaped slot in the soil. The seed and fertiliser are dropped into slot.

The action of a disc slices the soil and moves it to one side. The seed is then dropped in the furrow or open groove created by the disc. The seed is covered by soil falling back into the furrow or often left in the open.

Some of the disadvantages of disc openers are as follows:

- Poor penetration in hard soil conditions.
- Unable to slice through very heavy surface trash.
- Often leave little or no soil cover over the seed.
- Can dry the soil out by bringing moist soil to the surface.
- Can smear the sides of the furrow in wet conditions.
- Many moving parts.
- Easily blocked up with mud.
- Cannot handle rocky conditions.
- Do not always put the seed into loose soil.

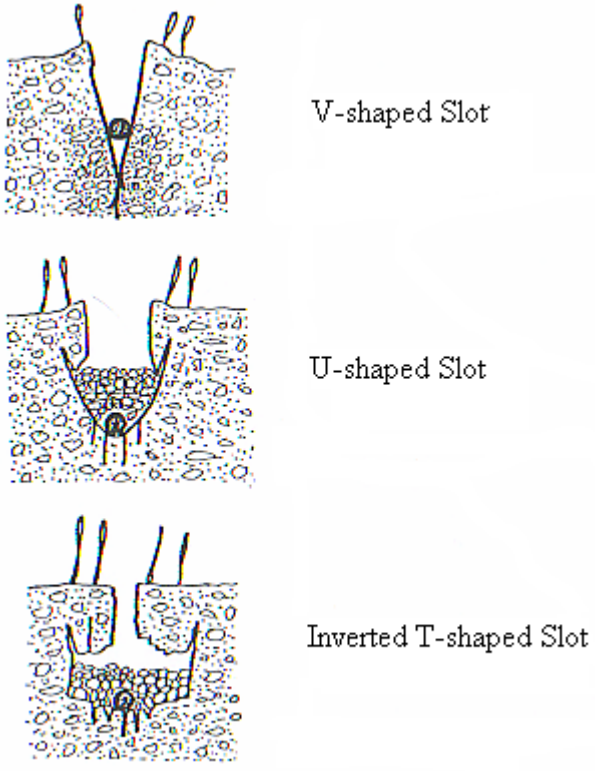


Figure 2.4: Seed placement in different furrow types

2.7.3 Conventional Tynes

Conventional tyne seeders mainly use a cultivating point which operates at a shallow angle to the soil. The action of the tyne and the digging tool tends to lift the soil and throw it to both sides leaving a U-shaped slot.

Few conventional seeders are fitted with coulters and consequently have difficulty handling the large amounts of surface trash often encountered when direct drilling. The action of the tyne tends to drag trash along with it.

The disadvantages of conventional tynes are as follows:

- Poor trash handling ability.
- Dry the soil with a wide furrow, exposing moist soil.
- Often have poor accuracy placing the seed. Seed may end up near the surface, not in contact with moisture.
- Have higher draft requirements due to the width of the digging point and the aggressive action of moving the soil up and to the side.
- The digging tools often have a high wear rate.
- The need for prior cultivation can damage soil structure.

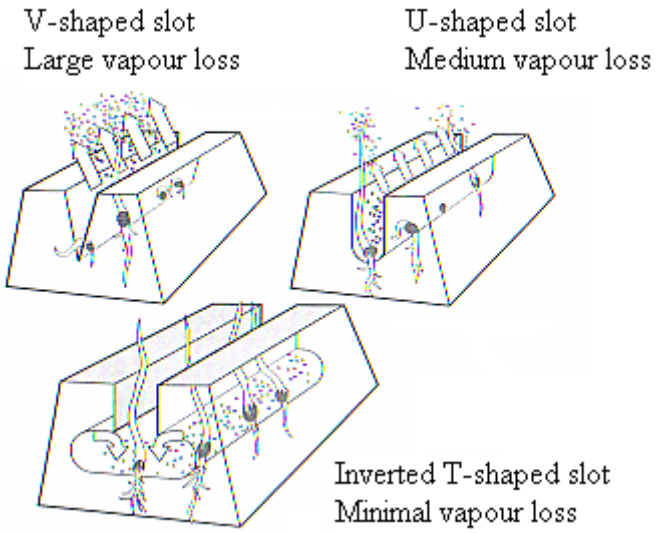


Figure 2.5: Moisture loss in different slot types

2.8 Planning to Direct Drill

Planning is the key to direct drilling and reduced tillage techniques. Planning must take into account gross margins, marketing (if applicable), paddock history, crop rotation, soil type, fertility (using soil tests), weed history and densities as well as long term development plans. Flexibility of operation is also essential.

2.8.1 Weed Control

Good weed control is essential for successful establishment of a new crop or pasture.

Weed control is one of the main reasons for traditional cultivation practices - the ground-engaging tool physically cuts and tears the roots of unwanted plants from the soil.

Direct drilling calls for a different approach. Some of the alternatives available for weed control include:

- Heavy grazing
- Spraying with herbicides
- Slashing
- A combination of the above

2.8.2 Timing

Timeliness of the seeding operation is critical for good germination, growth and best yield results.

There are two main aspects of timeliness you must consider:

- Always check the optimum seeding date for your district and seed on time.
- Ensure the best use of available moisture after rain by seeding while the soil is moist.

2.8.3 Seed

Use only good quality certified seed. Certified seed is guaranteed to meet a minimum standard germination percentage and to be free of weed seeds and impurities. Use the recommended seeding rate.

Your seed supplier or your local advisory officer can tell you how many kilograms per hectare (kg/Ha) you should sow. Adequate plant population will also help your establishing crop or pasture compete with weeds.

Be sure to inoculate legume seed with the correct strain of Rhizobia bacteria. Failure to inoculate could lead to a poor pasture stand. Talk to your seed supplier about inoculation and ask them to supply the inoculant.

Your seed supplier will also be able to advise about chemical protection of your seed for insect attack and various soil borne diseases.

2.8.4 Seed Placement

Accurate seed placement is crucial for successful germination. Seed should always be covered and in contact with moist soil (see Figure 2.6). Seeding depth varies with species and is generally related to seed size.

Small seeds generally need to be placed shallow. The Agrowdrill is capable of placing seed accurately at any depth from a few millimetres down to 75mm (3”). Ask your seed supplier or advisory officer how deep you should be sowing and adjust the Agrowdrill accordingly.

The Agrowdrill can be set up to seed at various row spacings. Sowing row spacing, if coulters are not fitted, can be virtually infinite.

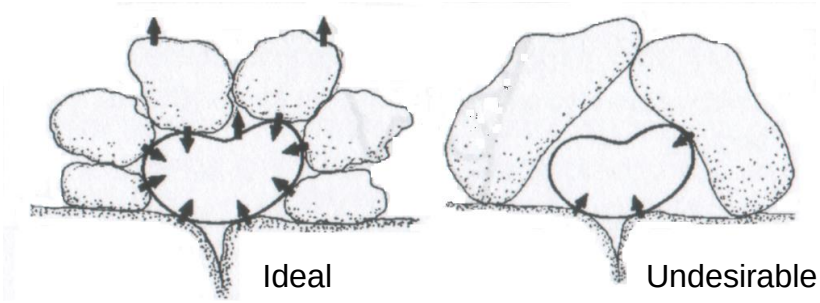


Figure 2.6: Seed to soil contact.

2.8.5 Ensure Adequate Plant Nutrition

Most soils are low in fertility and need to have nutrients added to boost pasture and crop growth. Young plants especially need good nutrition.

The need for fertiliser can be assessed in a number of ways:

- Paddock history.
- The vigour of existing vegetation.
- Chemical soil tests.
- Trial plots.

Advice on fertiliser requirements can be sought from government advisory officers, agricultural consultants or fertiliser companies.

Fertilisers are available in many different forms and can be applied in many different ways. The Agrowdrill can “band” artificial fertilisers close to the seed and provide nutrition where it is most need.

2.9 The Job’s Not Finished at Seeding!

Careful preparation and seeding of a crop or pasture are only the first steps in the management process. There is a great deal of careful management practises needed after the Agrowdrill has given your seed the best chance of establishment.

2.9.1 Weed control

Effective weed control can be the difference between a profit and disaster. Good weed control before seeding will ensure emerging seedlings have a good start and an even better finish.

Certified seed, adequate fertility, correct seeding rates and placement of seed will put the odds in your favour for good germination and emergence.

The management practices after emergence however are just as important. Inspect your crop or pasture regularly for weed growth. If weeds become a problem you have a number of options open to you:

- Use a selective herbicide to kill weeds.
- Strategic grazing or slashing can help reduce weed growth.
- Applying fertiliser may help in some situations.
- Cutting hay can remove weeds.

2.9.2 Insect Pest Control

Insect pests can seriously damage emerging or established crops and pastures. During your regular inspection you should also be on the lookout for insects. Consideration of the following points will help prevent or eliminate insects:

- Grow species or varieties that are resistant to the common pests in your area.
- Use treated seed.
- Spray only if absolutely necessary.

Note: Information on chemical control of weeds and insects should be available from government advisory officers, agricultural consultants, chemical resellers or spraying contractors.

2.9.3 Use of Fertiliser

Maintaining good nutrition is important for sustained production

All crops and pastures can benefit, in some situations, from additional fertiliser after seeding. Fertiliser can be added in many forms.

2.9.4 Grazing Management

New pastures can usually only stand light grazing in the first season. Perennial crops can also be grazed.

The following are some important points to remember:

- Graze only when plants cannot be pulled out
- Graze heavily for short periods to remove weeds.
- Some species need to set seed each year, so allow this to take place.
- Allow plenty of time for the pasture to recover after grazing.

3.0 Specifications

3.1 AD 100 Series Agrowdrill

Model		**10R**	**18R**	**22R**
Number of Sowing Rows		10	18	22
Tyne Spacing		175mm	150mm	
Working Width		1.75m	2.7m	3.3m
Hopper Capacity	Front	200L	335L	430L
	Rear	200L	335L	430L
Wheel Equipment		235 / 75 R15		
Transport Width		1.88m	2.97m	3.51m
Number of Toolbars		3		
Toolbar Spacing		450mm		
Undercarriage		STD Coil Tine		
Drawbar Power	hp	40 - 60	60 - 80	75 - 95
	kW	30 - 45	45 - 60	55 - 70
Linkage Type	Standard	Trailing with Hydraulic Lift		
	Optional	Cat II Three Point Linkage		

Safety Features	Wide Platform Full Length Hand Rail Chain Guards Ground Level Adjustment of all Settings

Frame Features	RHS 100 x 100 x 6mm Toolbars Fully Welded Frame Mounted Toolbox Rear Tow Hitch

Hopper Features	Dual Compartments Twin Distributor Metering System Individual Lids 38mm Seed Cups and Hose

Optional Equipment	Double Shooting Spring Release Coulter Gang - Trailing Only Baffles Hydraulic Couplings for Rear Tow

3.2 AD 300 Series Agrowdrill

Model		18R	22R
Number of Sowing Rows	Standard	18	22
	Maximum	22	26
Tyne Spacing	Standard	175mm	
	Optional	150mm - 305mm	
Working Width	Standard	3.2m	3.9m
Hopper Capacity	Front	570L	720L
	Rear	470L	595L
Wheels		10.5 x 20 Lugged Tyres	
Transport Width		3.6m	4.35m
Number of Toolbars		3	
Toolbar Spacing		750mm	
Undercarriage	Standard	STD Coil Tyne	
	Optional	732 Coil Tyne OEM Tynes	
Drawbar Power	hp	80 - 100	100 - 130
	kW	60 - 75	75 - 100
Linkage Type		Trailing - Heavy Duty 'Tight Turn' Pull	

Safety Features	Wide Platform Full Length Hand Rail Chain Guards Ground Level Adjustment of All Settings

Hopper Features	Individual Compartments Twin Distributor Metering System 38mm Seed Cups and Hose

Options	Hydraulic Drive - Farmscan Bolt-On Extension Stubs Double Shooting Rear Tow Hitch Rear Tow Hitch with Hydraulics Small Seeds Box - See Below

Small Seeds Box Option			
SSB Hopper Capacity	Front	145L	185L
	Rear	130L	170L
SSB Hopper Features		Twin Compartment Single Distributor Metering System 32mm Seed Cups and Hose	

3.3 AD 500 Series Agrowdrill

Model		18R	22R
Number of Sowing Rows	Standard	18	22
	Maximum	22	26
Tyne Spacing	Standard	175mm	
	Optional	150mm	
Working Width	Standard	3.15m	3.85m
Hopper Capacity	Front	560L	715L
	Rear	465L	590L
Wheels		12.4 x 28 Lugged Tyres	
Transport Width		4.2m	4.9m
Number of Toolbars		3	
Toolbar Spacing		510mm	
Undercarriage	Standard	STD Coil Tyne	
	Optional	732 Coil Tyne	
Coulters		14" Heavy Duty Spring Release Hydraulic Lift	
Drawbar Power	hp	80 - 100	100 - 130
	kW	60 - 75	75 - 100
Linkage Type		Trailing - Heavy Duty 'Tight Turn' Pull	

Safety Features	Wide Platform Full Length Hand Rail Chain Guards Ground Level Adjustment of all Settings

Hopper Features	Front Platform Individual Compartments Twin Distributor Metering System 38mm Seed Cups and Hose

Options	Hydraulic Drive - Farmscan Bolt On Extension Stubs Double Shooting Capability Mounted Flexi Roller Rear Tow Hitch Rear Tow Hitch with Hydraulic Couplings

3.4 AD 700 Series Agrowdrill

Model		18R	22R
Number of Sowing Rows	Standard	18	22
	Maximum	22	26
Tyne Spacing	Standard	175mm	
	Optional	150mm to 305mm	
Working Width	Standard	3.15m	3.85m
Hopper Capacity	Front	570L	720L
	Rear	470L	595L
Wheels		12.4 x 28 Lugged Tyres	
Transport Width		4.1m	4.9m
Number of Toolbars		4	
Toolbar Spacing		510mm	
Undercarriage	Standard	STD Coil Tine	
	Optional	732 Coil Tine OEM Assemblies	
Drawbar Power	hp	80 - 100	100 - 130
	kW	60 - 75	75 - 100
Linkage Type		Trailing - Heavy Duty 'Tight Turn' Pull	

Safety Features	Wide Platform Full Length Hand Rail Chain Guards Ground Level Adjustment of all Settings

Hopper Features	Individual Compartments Twin Distributor Metering System 38mm Seed Cups and Hose

Options	Hydraulic Drive - Farmscan Mounted Flexi Roller Bolt On Extension Stubs Double Shooting Capability Small Seeds Box - See Below Rear Tow Hitch Rear Tow Hitch with Hydraulic Couplings

Small Seeds Box Option			
SSB Hopper Capacity	Front	145L	185L
	Rear	130L	170L
SSB Hopper Features		Twin Compartment Single Distributor Metering System 32mm Seed Cups and Hose	

3.5 AD 900 Series Agrowdrill

Model		**22R**	**27R**
Number of Sowing Rows	Standard	22	27
	Maximum	26	34
Tyne Spacing	Standard	175mm	
	Optional	150mm - 305mm	
Working Width	Standard	3.85m	4.725m
Hopper Capacity	Bin 1	635 Litres	785 Litres
	Bin 2	805 Litres	1000 Litres
	Bin 3	610 Litres	760 Litres
Wheels		16.9 x 28 Lug Tyres	
Transport Width		5.3m	6.2m
Number of Toolbars		4	
Toolbar Spacing		510mm	
Undercarriage	Standard	STD Coil Tyne	
	Optional	732 Coil, OEM Tynes, V -Slice	
Drawbar Power	hp	100 - 130	130 - 160
	kW	75 - 95	95 - 120
Linkage Type		Trailing	

Safety Features	Wide Platform Full Length Hand Rail Chain Guards Ground Level Adjustment of all Settings

Hopper Features	Individual Compartments Twin Distributor Metering System 38mm Seed Cups and Hose Double or Triple Shoot Capability

Options	Hydraulic Drive - Farmscan Front & Rear Bolt On Extension Stubs Mounted Flexi Roller Flood Light Kit Rear Tow Hitch Rear Tow Hitch with Hydraulic Couplings

3.6 JPC 2000 Series Agrowdrill

Model		20R	24R	28R	32R
Number of Sowing Rows	Standard	20	24	28	32
	Maximum	24	28	34	38
Tyne Spacing	Standard	175mm			
	Optional	140mm - 305mm			
Working Width	Standard	3.5m	4.2m	4.9m	5.6m
Hopper Capacity	Bin 1	530L	615L	740L	825L
	Bin 2	480L	555L	670L	750L
	Bin 3	480L	555L	670L	750L
	Bin 4	530L	615L	740L	825L
Wheel Equipment		18.4 x 34 Lugged Tyres			
Wheel Centres		4.6m	5.2m	6.0m	6.7m
Transport Width		5.1m	5.7m	6.5m	7.2m
Number of Toolbars		5			
Toolbar Spacing		510mm			
Undercarriage	Standard	732 Coil Tine			
	Optional	STD Coil Tyne OEM Tynes			
Drawbar Power	hp	90 - 110	100 - 130	120 - 150	140 - 180
	kW	65 - 85	75 - 100	90 - 110	105 - 135
Linkage Type		Trailing			

Safety Features	Wide Platform Full Length Hand Rail Chain Guards

Hopper Features	Individual Compartments Twin Distributor Metering System 38mm Seed Cups and Hose

Optional Equipment	Hydraulic Drive Bolt On Extension Stubs Front Mounted Platform Flood Light Kit Baffles Rear Tow Hitch Rear Tow Hitch with Hydraulic Couplings

4.0 Farmscan 1100 Hectaremeter

The electronic Farmscan 1100 Hectaremeter is designed to fit virtually any farm tractor. It displays and records area sown and displays working speed (km/h).

Figure 4.1: Hectaremeter and Mounting Bracket

4.1 Installation Procedure

1. **Mount the Hectaremeter in the tractor cab.**
   Mount the control unit in a convenient location in the cab using the bracket and securing knobs supplied. The unit is not waterproof and therefore must be installed in a tractor cab. It must be protected against moisture. Warranty will not cover moisture damage.

2. **Connect and secure the cable from the Hectaremeter to the shaft sensor.**
   The cable should be secured with cable ties along the A-frame, away from any risk of damage such as lubricants and moving parts. Dust caps should be plugged together when the cable is in use to ensure dust caps stay clean. Make sure dust caps are fitted when the cable is not being used.

3. Power Connection.

Do not connect power until all other installation is complete.

The power cable must be connected DIRECTLY to the 12V DC vehicle battery terminals. DO NOT join power cable with any other electrical equipment or the vehicle chassis, as this may cause interference.

Use cable ties to secure power cable away from risk of damage.

Connection to battery terminals must be clean and tight.

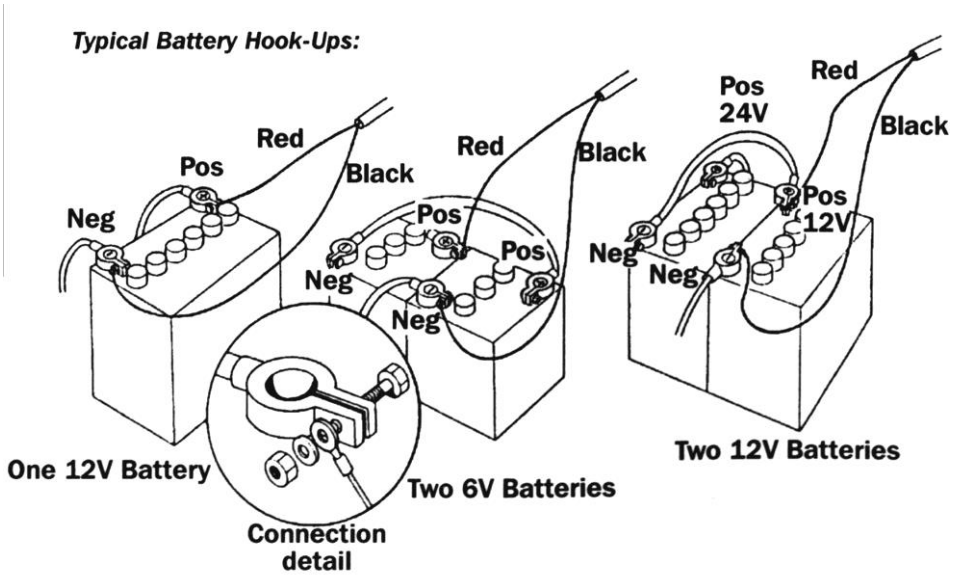


Figure 4.2: Hectaremeter battery connection

Warning: Disconnect power cable from battery when arc welding on machinery as damage to the unit will result.

4.2 Hectaremeter Shaft Sensor Installation

The Agrowdrill comes with the Hectaremeter shaft sensor already installed. In the event of replacement or relocation the following points must be considered.

- The magnet, fitted to the shaft, must sweep past the sensor once per rotation with a clearance of 3-5mm. Do not use substitute magnets.
- Clamp the shaft magnet around a shaft or lock collar that is driven by a ground wheel. The clamp is adjustable from 19mm up to 38mm diameter. The magnet can be transferred to a larger clamp if required.
- The sensor and the magnet must face end to end.

- Do not remove the sensor from the aluminium bracket, as damage to the sensor will result.

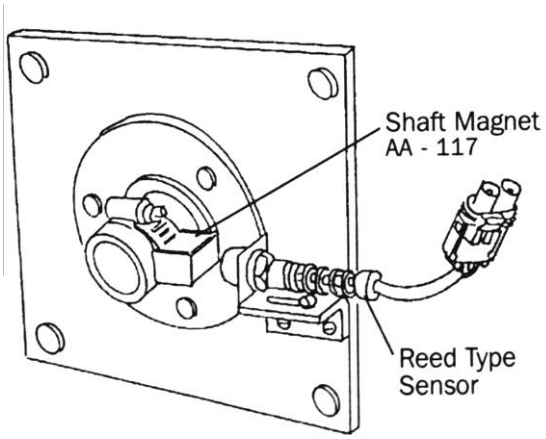


Figure 4.3: Shaft Sensor Installation

- As the sensor is not affected by moisture or mud the main precaution is to protect the sensor and cable from physical damage. As a precaution keep the sensor cable away from aerial leads, engine kill switch cables or wires to electronic clutches and solenoid valves. Use the cable ties provided to secure the sensor cable.

4.3 Operation of the Hectaremeter

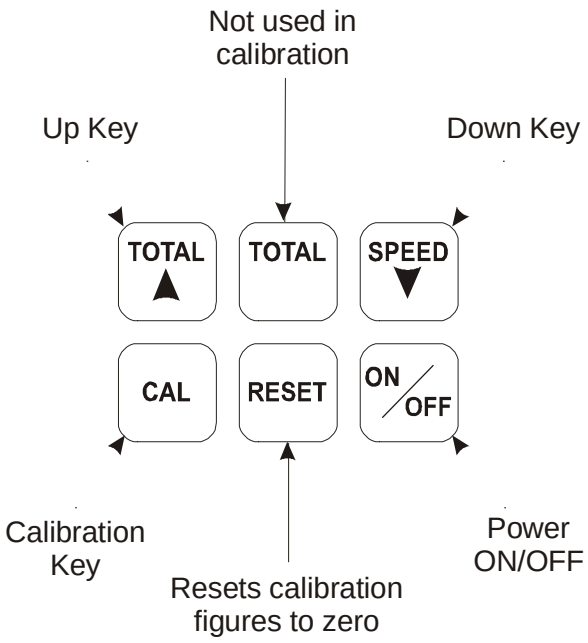


Figure 6.1: Farmscan 1100 Hectaremeter calibration keys

ON/OFF KEY:

The ON/OFF key turns the Hectaremeter power ON or OFF. Whenever the Hectaremeter is turned ON the TOTAL hectares will be displayed first. From this point you can select any other key.

TRIP KEY:

The TRIP key displays the TRIP hectares and works just like the trip meter in your car. You can reset the TRIP hectares for each paddock or load without losing the TOTAL hectares.

Maximum TRIP reading is 999.9 hectares.
Resolution is 00.00 to 99.99 then 100.1 to 999.9 hectares.

RESET KEY:

Use the RESET key to set the TOTAL or TRIP hectares back to zero. After selecting either TOTAL or TRIP hectares, hold the RESET key down for approximately 3 seconds to clear the displayed figure back to zero.

SPEED KEY:

The SPEED key displays the working SPEED (km/h) at any time whilst travelling.

MEMORY:

Both the TOTAL and TRIP area readings are automatically stored in permanent memory - every 6 minutes of operation or when the unit is switched OFF using the ON/OFF key. The last 6 minutes of operating data will be lost if the power is interrupted at the source without first switching the unit off using the ON/OFF key.

FLASHING DECIMAL POINT:

The decimal point on the display will flash for each pulse the meter receives from the shaft sensor to indicate that the unit is working.

4.4 Calibrating the Hectaremeter

Before you can use your Agrowdrill the Hectaremeter must be calibrated and the metering rates must be checked for both seed and fertiliser.

Warning: If the Hectaremeter and metering system calibration is not carried out carefully then any data obtained will be unreliable.

The Hectaremeter must be calibrated to suit the width and distance the Agrowdrill travels per pulse from the shaft sensor.

The width and distance calibration factors are permanently stored in the memory whenever the ‘CAL’ routine is completed, as outlined below.

Important: If the calibration factors are corrupted due to outside interference, the readout will display ‘HELP’ to show that the calibration factors must be checked.

For ease of calibration both the width (Sowing Width) and Distance (Pulse Distance) calibration factors for a range of Agrowdrill configurations are supplied in Section 6.

Follow the steps below to enter the calibration factors:

1. Switch the Hectaremeter on.

2. Press the ‘CAL’ key to display H1 (the distance calibration factor).

3. Use the up and down arrow keys to set the distance calibration factor to the Pulse Distance (in millimetres) as shown on the calibration chart for your model Agrowdrill. See Section 6.

4. Press the ‘CAL’ key again to confirm the previous setting and display H2 (the width calibration factor).

5. Use the up and down keys to set the width calibration factor to the width (in metres). For standard configurations this distance can be obtained from Section 6 or simply measure the distance from outside tyne to outside tyne and add one row spacing.

6. Press the ‘CAL’ key again to confirm the width setting, store them in memory and exit the calibration cycle. The Hectaremeter is now calibrated.

4.5 Hectaremeter Maintenance

4.5.1 Hectaremeter Sensor and Cable

Check the function of the Hectaremeter sensor and cable by the following procedure:

1. Switch the Hectaremeter on.
2. Check that the H1 and H2 calibration factors are entered correctly.
3. Press SPEED key. Display should read 0.0.
4. Disconnect sensor from cable, at the sensor itself.
5. Use a pair of long nose pliers and intermittently short the pins of the connecting plug on the cable together. The speed readout should show random numbers. If the speed readout responds, reconnect sensor.
6. If no response, reconnect sensor and repeat test at tractor breakaway plug (if used). If at this point the speed responds, then the cable between the breakaway plug and the sensor is faulty and will need replacing.

7. If still no response at the tractor breakaway plug repeat the test directly into the Hectaremeter unit itself.
8. If no response is registered at this point return the Hectaremeter unit to the nearest Farmscan dealer or authorised service agent.

4.5.2 Reed Type Sensor

If the Hectaremeter is malfunctioning the reed type sensor can be checked using the following procedure:

1. Disconnect cable from sensor.
2. Rotate the shaft so that the magnet is as close as possible to the sensor.
3. Measure the resistance of the sensor using a multimeter. It should be a short circuit (ie the multimeter shows infinity).
4. Rotate the shaft so that the magnet is as far away as possible from the sensor.
5. Measure the resistance of the sensor using a multimeter. It should be an open circuit (ie the multimeter shows zero).

4.5.3 Sensor Cable

Check the function of the sensor cable using the following procedure:

1. Disconnect Hectaremeter and Sensor from sensor cable.
2. Place a sturdy wire link across the two terminals at the Hectaremeter end of the cable.
3. Measure the resistance across the two terminals at the sensor end using a multimeter. It should be a short circuit.
4. If it is short circuit, check that any breakaway connections are clean and connect firmly. If loose use a small object to close the female connection slightly.
5. Physically inspect cable for damage as it may have been crushed or cut.

4.6 Troubleshooting the Hectaremeter

Please see Section 9.4 for troubleshooting instructions.

5.0 Operating Instructions

5.1 Hitching and Levelling

The Agrowdrill should be matched to the tractor size to maximise performance and efficiency. A mismatched tractor and implement will be inefficient and cost money, as well as being unsafe.

5.1.1 Three Point Linkage Models – AD 100 Only

The three-point linkage lift capacity of the tractor will generally determine the required tractor size. Check the tractor's operator's manual for details.

It is essential that the tractor be front weighted when using the Agrowdrill. The Agrowdrill is very heavy when the hoppers are filled and will transfer weight off the front wheels. This can be very dangerous in hilly areas and when travelling at speed on the road. Consult the tractor's operator's manual for recommendations.

The Agrowdrill must be level while operating. The hitching and levelling procedure is as follows:

1. Attach and level the Agrowdrill laterally (side to side) using the screw adjustable linkage arm.

2. Set both depth wheels evenly at the desired working depth and tighten the locking collar or retaining bolt firmly.

3. Set the fore-aft level using the tractors adjustable top link. The front and rear depth must be equal.

4. Start working at the desired depth and observe the level of the machine from both the side and the rear.

5. Readjust and repeat the above procedure if necessary.

6. Retighten the locking collar on the top link after completing adjustments.

It is very important that the Agrowdrill be levelled correctly to achieve good results. As a final check, dig to the bottom of the furrow at two or three points across the working width of the machine and check the seeding depth. Ensure that the front and rear tynes are seeding at the same depth.

Three point linkage stabiliser bars must be used at all times particularly if coulters are being used. Adjust the stabilisers to bring the Agrowdrill directly behind the tractor, allowing only slight side-to-side movement.

The tractor's three-point linkage system should be operated in the 'float' mode allowing the Agrowdrill to be supported by the depth wheels and to follow the ground contours. Consult the tractor operator's manual for details.

5.1.2 Hitching

The hitching procedure is as follows:

1. Pin the tractor drawbar into the central position.

2. Attach the Agrowdrill to the drawbar and set the adjustable levelling tube so that the machine is approximately level.

   Warning: Ensure the drawbar pin is locked into position so that it cannot work itself out when the machine is in operation or transit. Failure to do this may result in serious injury or death.

3. Attach the hydraulic coupling to your tractor remote outlet, taking care to clean away any dirt.

   The working depth of a trailing Agrowdrill is controlled by the hydraulic rams attached to the wheel assemblies. These are operated by the remote hydraulic system.

   On some tractors it is necessary to set the hydraulic system to operate in the "single acting" or "bypass". Consult the tractor operator's manual.

4. Connect the levelling tube to the top hitch lugs.

5. Disengage the jack stand and adjust the hitch level to suit the drawbar height of the tractor. When level, ensure the levelling tube is locked using the locknut.

5.1.3 Hydraulic Lift Circuit

The procedure to connect and prime the hydraulic lift circuit is as follows:

1. Ensure both the tractor remotes and the hose couplings are clean and then connect to the tractor.

2. Loosen the hydraulic connector on the input line of the right hand wheel lift cylinder (see figure 5.1). This should be done to allow air to escape while the hydraulics are being primed.

Figure 5.1: Right Hand Wheel Lift Cylinder

3. Slowly pressurise the hydraulics until oil appears at the loosened connection on the right hand cylinder.

   Note: Stand well clear of the loosened connection as oil under pressure can spray wildly outwards. It is a good idea to place a hessian bag or similar material over the connection to minimise oil movement.

4. Retighten the connection as soon as oil appears.

5. Continue to prime the hydraulic lift circuit until the right hand cylinder is fully extended. Hold the hydraulics open for a further 15 to 20 seconds to allow air to clear from the circuit.

6. Fully raise and lower the machine several times to expel any residual air trapped in the circuit.

The lift circuit is now fully primed and the Agrowdrill can now be moved.

5.1.4 Coulter Hydraulic Lift Circuit – AD 500 Only

The procedure to connect and prime the coulter hydraulic lift circuit is as follows:

1. Ensure both the tractor remotes and the hose couplings are clean and then connect to the tractor.

2. Disconnect cylinder from coulter bar and allow bar to lower to ground. This allows the cylinders to extend during priming without twisting the bar and damaging the slides.

3. Loosen the hydraulic connector on the input line of the right hand coulter lift cylinder (see figure 5.2). This should be done to allow air to escape while the hydraulics are being primed.

Figure 5.2: Right Hand Coulter Lift Cylinder

4. Slowly pressurise the hydraulics until oil appears at the loosened connection on the right hand cylinder.

5. **Note:** Stand well clear of the loosened connection as oil under pressure can spray wildly outwards. It is a good idea to place a hessian bag or similar material over the connection to minimise oil movement.

6. Retighten the connection as soon as oil appears.

7. Continue to prime the hydraulic lift circuit until the right hand cylinder is fully extended. Hold the hydraulics open for a further 15 to 20 seconds to allow air to clear from the circuit.

8. Reconnect coulter bar to hydraulic cylinders.

9. Fully raise and lower the machine several times to expel any residual air trapped in the circuit.

The coulter lift circuit is now fully primed.

5.1.5 Levelling

The Agrowdrill must be level while operating. The levelling procedure is as follows:

1. Start working at the desired depth and observe the machine from both the side and the rear.

2. Adjust the levelling tube so that the machine is level from front to rear.

3. Retighten the locking collar on the levelling tube when adjustments are completed.

It is very important that the Agrowdrill be levelled correctly to achieve good results. As a final check, dig to the bottom of the furrow at two or three points across the working width of the machine and check the seeding depth. Ensure that the front and rear tynes are seeding at the same depth.

5.1.6 Hitching Conversion – AD 100 Only

The Agrowdrill can be operated as either a trailed or three-point linkage machine. A trailing Agrowdrill can be converted to three-point linkage by removing the A-frame and levelling tube and attaching the tractor directly to the tow lugs on the main frame. The remote hydraulics can still be used to adjust seeding depth providing the three point linkage is operating in the ‘float’ mode.

A three-point linkage machine can be converted to a trailing machine by fitting:

- The trailing drawbar assembly.
- The trailing hydraulic kit including cylinders, hoses and couplings.

5.2 Seeding Depth

Seeding depth will vary depending on the species being sown. Generally speaking, small seeded species should be sown shallower. Larger seeded species will emerge if sown deeper.

The following are important guidelines:

- Seeding deeper than recommended will drastically reduce the chances of good germination and emergence.
- In hot, dry conditions the topsoil will tend to dry out rapidly and lead to poor germination.
- In wet, cool conditions the topsoil will remain moist and shallow placed seed will germinate effectively.

Consult a seed reseller or Advisory Officer for a recommendation regarding seeding depth if unsure.

5.3 Row Spacing

The row spacing of the Agrowdrill is infinitely variable unless coulters are fitted. The only restriction will be the number of outlets on the hopper.

In some conditions it may be advantageous to seed in 127mm rows eg Irrigated Lucerne or Ryegrass. Other crops or pastures may require a wider spacing eg Sorghum at 350mm.

Consult a seed reseller or Advisory Officer for a recommendation regarding row spacing if unsure.

5.4 Coulter Settings

The soil openers must be adjusted to run exactly behind the coulter whilst the machine is operating. If the opener is running off line of the coulter the soil will not be sliced in the correct position leading to trash build up and a greater soil disturbance.

To adjust the spacing of the soil openers:

1. Position the Agrowdrill with the tynes and coulters resting on a hard surface such as a cement floor.
2. Observe coulters and tynes noting any misalignments.
3. Lift the Agrowdrill and secure using the ram safety stoppers.
4. Loosen the frame clamp retaining bolts on the opener assemblies.
5. Adjust so the soil openers align with the coulter blades.
6. Retighten all retaining bolts.

7. Lower the Agrowdrill and recheck alignment.
8. Repeat and adjust if necessary.
9. Recheck and tighten frame clamp bolts after 30 minutes of operation.

The Agrowdrill can be equipped with either plain or fluted coulters. Key factors to consider when choosing the type of coulter are:

- **Plain Coulters**
  - Used where best appearance of the finished job is required.
  - Used in harder soil where maximum penetration is required.
  - Lower wear rate than fluted coulters

- **Fluted Coulters**
  - Perform better in very heavy trash conditions.
  - Cause less smearing in clay type soils.
  - More aggressive soil surface disturbance.

5.5 Operating Speed

The Agrowdrill will produce the best results if operated between 4 and 8 km/h. Optimum speed will vary with the soil type, vegetative cover and root matter present.

Operating at higher speeds will increase soil surface disturbance, reduce penetration and seriously reduce the accuracy of seed and fertiliser placement. High speeds will also increase wear on the openers.

5.6 Hopper Selection

The metering system in all hoppers is identical meaning seed or fertiliser can be used in any hopper. In deciding which hopper to use it may be necessary to take into account and blending or banding options that may be used.

The following points must be considered when deciding which hopper to use:

- For a majority of seeding jobs a greater quantity of fertiliser than seed will be required. On all models except the AD 100 Series Agrowdrill the front hopper has a larger capacity and therefore will give a greater efficiency. The AD 100 Series Agrowdrill has equal sized hoppers.
- Depth placement and / or blending requirements.
- Fertiliser is generally denser than seed. Putting fertiliser in the front hopper will bring the Agrowdrill's centre of gravity forward. This is a big advantage on three point linkage machines.

For hopper capacities refer to the specification in Section 3.0.

6.0 Calibration Instructions

6.1 Adjusting the Seed and Fertiliser Rates

Adjusting the seed and fertiliser rates on the Agrowdrill is very simple as it only involves three components:

- Gearbox.
- Restrictors applied to the fluted rollers.
- Adjustable gates under the fluted rollers.

All three may need to be adjusted.

6.1.1 Gearbox Adjustments

The unique gearbox of the Agrowdrill allows adjustment of seed and fertiliser rates over a wide range by simply adjusting one lever for each.

The levers are on the left hand side of the machine. The lever closest to the front of the machine adjusts the front hopper.

To adjust the rates simply rotate the handle in an anticlockwise direction to loosen and slide the lever up or down the scale as required - an increase in number indicates an increase in speed. Once at the necessary position rotate the handle in a clockwise direction to lock the lever in place.

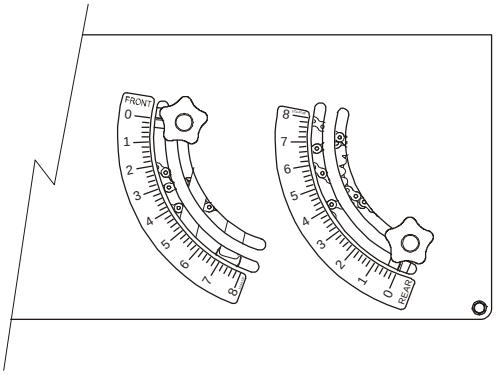


Figure 6.1: Gearbox settings

6.1.2 Restrictors

The fluted rollers (identical for both seed and fertiliser) have a coarse side and a fine side.

This design allows both large and small seeds to be accurately metered. The Agrowdrill can handle a wide range of seed sizes with the minimal adjustment of fitting or removing restrictors.

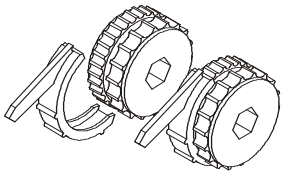


Figure 6.2: Fluted rollers and restrictors

Recommended Restrictor and Gate Settings are as follows:

Seed	Gate Setting		Restrictors Fitted
	RH End	Underneath	
Lupins	1	3	No
Barley	0.6	2	2 of 4
Oats	0.8	3	No
Wheat	0.6	2	2 of 4
Canola	0.2	1	3 of 4
Sub Clover	0.2	1	3 of 4
Lucerne	0.2	1	3 of 4
Ryegrass	0.2	1	2 of 4
Single Super	0.8	3	No
DAP	0.6	2	No
Urea	0.6	2	No

Table 6.1: Recommended restrictor and gate settings

To reposition Restrictors:

1. Grasp the rear arm of the restrictor and gently twist the arm sideways to release it from under the adjustable stopper and remove.

2. Reinsert the restrictor into the new position (see figure 6.5) or leave out as required.

6.1.3 Gate Settings

Depending on the model of Agrowdrill, the gate adjustment levers are located on either the right hand end of the Agrowdrill or in the centre of the machine underneath the hopper.

The gate settings are based on seed size. **Do not** adjust the gate settings to increase the application rate.

Adjust gate settings as follows:

1. Check the gate setting recommendation for the seed or fertiliser being used (refer to table 6.1).

2. Loosen the Knob (rotate in an anticlockwise direction) slide the lever up or down the scale as required. Once at the necessary position lock the lever in place (rotate the knob in a clockwise direction).

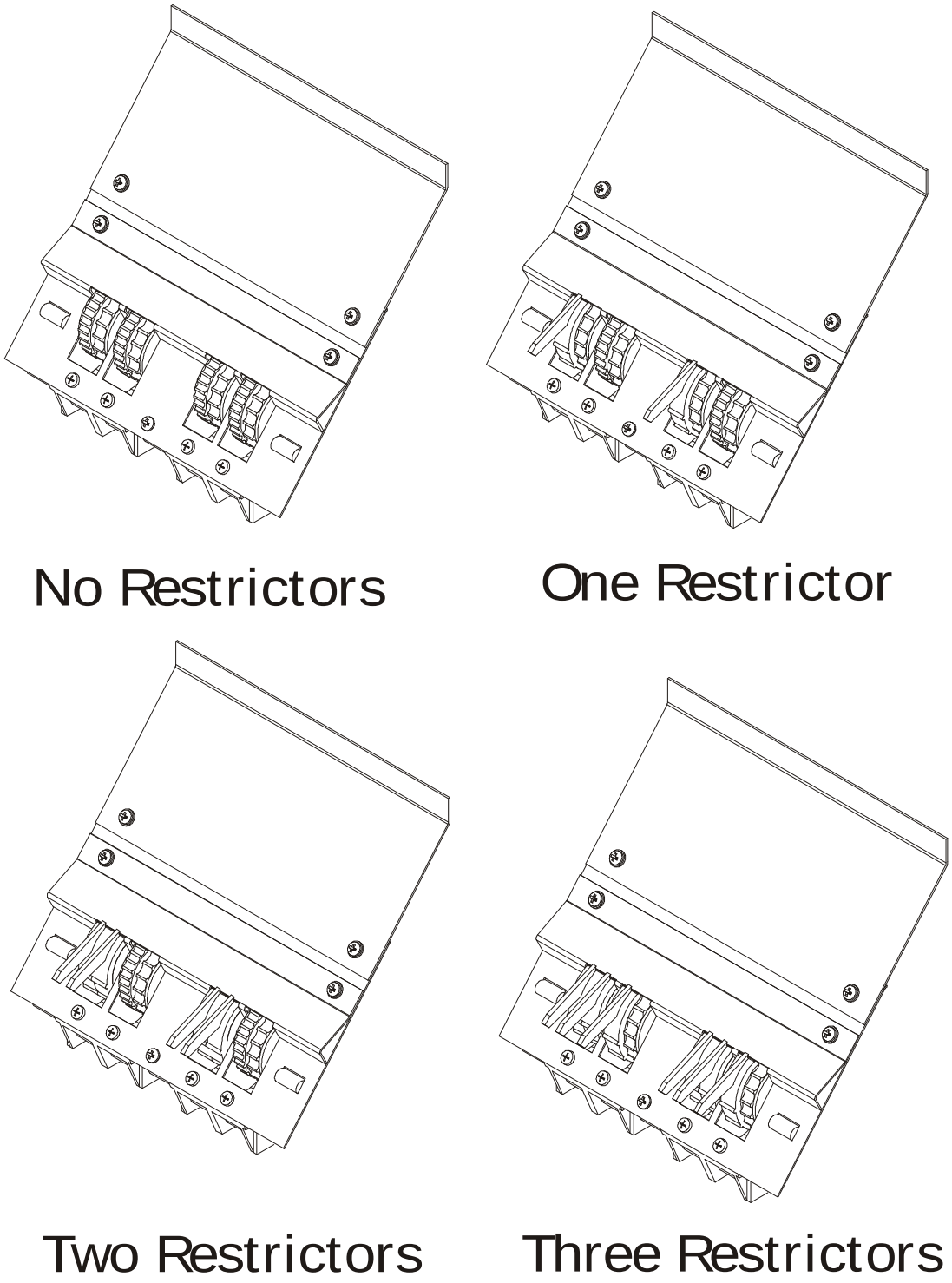


Figure 6.3: Restrictor positioning

6.2 Method for Checking Metering Rates

Our recommended static methods of checking metering rates use:

- An accurate set of electronic scales (accurate to at least 2 grams) most electronic kitchen scales will suffice.
- A small amount of seed and/or fertiliser.
- The use of five seeding rows to test each sample.
- Small containers to collect the seed and/or fertiliser.

6.2.1 Calibration Procedure

1. Fit restrictors and adjust gate setting according to Table 6.1.
2. Set the quadrant lever on the approximate setting as indicated in the rate charts in Section 10.0.
3. Position containers to collect from five (5) hoses.
4. Turn the crank handle the equivalent of 1/50th hectare.
5. Weigh the total amount of product collected from the five (5) hoses.
6. Use the following formula:

kg / Ha = Weight Collected x Number of rows on Drill / 100

Alter the gearbox quadrant setting up or down as required and repeat the procedure until the desired seeding rate is required.

6.3 Calibration Tables

The following tables provide the standard data needed to calibrate the Agrowdrill. For non standard configurations or configurations not listed in these table please follow the procedure in Section 6.4.

6.3.1 AD 100 Series Agrowdrill

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
16	150	2.400	1145	5	72.75	0.160
18	150	2.700	1145	5	64.75	0.180
20	150	3.000	1145	5	58.25	0.200
22	150	3.300	1145	5	53.00	0.220
13	175	2.275	1145	5	76.75	0.130
16	175	2.800	1145	5	62.25	0.160
18	175	3.150	1145	5	55.50	0.180
20	175	3.500	1145	5	50.00	0.200

Table 6.2: AD 100 Series Calibration Data

6.3.2 AD 300 Series Agrowdrill

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
20	150	3.000	969	5	68.75	0.200
22	150	3.300	969	5	62.50	0.220
26	150	3.900	969	5	53.00	0.260
18	175	3.150	969	5	65.50	0.180
20	175	3.500	969	5	59.00	0.200
22	175	3.850	969	5	53.50	0.220
24	175	4.200	969	5	49.00	0.240
14	200	2.800	969	5	73.75	0.140
16	200	3.200	969	5	64.50	0.160
18	200	3.600	969	5	57.25	0.180
20	200	4.000	969	5	51.50	0.200
14	225	3.150	969	5	65.50	0.140
16	225	3.600	969	5	57.25	0.160
18	225	4.050	969	5	51.00	0.180
12	250	3.000	969	5	68.75	0.120
14	250	3.500	969	5	59.00	0.140
16	250	4.000	969	5	51.50	0.160
10	305	3.050	969	5	67.75	0.100
12	305	3.660	969	5	56.25	0.120
14	305	4.270	969	5	48.25	0.140

Table 6.3: AD 300 Series Agrowdrill Calibration Data

6.3.3 AD 500 Series Agrowdrill

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
20	150	3.000	1177	5	56.50	0.200
22	150	3.300	1177	5	51.50	0.220
26	150	3.900	1177	5	43.50	0.260
18	175	3.150	1177	5	54.00	0.180
20	175	3.500	1177	5	48.50	0.200
22	175	3.850	1177	5	44.00	0.220
24	175	4.200	1177	5	40.50	0.240

Table 6.4: AD 500 Series Agrowdrill Calibration Data

6.3.4 AD 700 Series Agrowdrill

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
20	150	3.000	1177	5	56.50	0.200
22	150	3.300	1177	5	51.50	0.220
26	150	3.900	1177	5	43.50	0.260
18	175	3.150	1177	5	54.00	0.180
20	175	3.500	1177	5	48.50	0.200
22	175	3.850	1177	5	44.00	0.220
24	175	4.200	1177	5	40.50	0.240
14	200	2.800	1177	5	60.75	0.140
16	200	3.200	1177	5	53.00	0.160
18	200	3.600	1177	5	47.25	0.180
20	200	4.000	1177	5	42.50	0.200
14	225	3.150	1177	5	54.00	0.140
16	225	3.600	1177	5	47.25	0.160
18	225	4.050	1177	5	42.00	0.180
12	250	3.000	1177	5	56.50	0.120
14	250	3.500	1177	5	48.50	0.140
16	250	4.000	1177	5	42.50	0.160
10	305	3.050	1177	5	55.75	0.100
12	305	3.660	1177	5	46.50	0.120
14	305	4.270	1177	5	39.75	0.140

Table 6.5: AD 700 Series Agrowdrill Calibration Data

6.3.5 AD 900 Series Agrowdrill

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
26	150	3.900	1351	5	38.00	0.260
31	150	4.650	1351	5	31.75	0.310
33	150	4.950	1351	5	30.00	0.330
22	175	3.850	1351	5	38.50	0.220
24	175	4.200	1351	5	35.25	0.240
26	175	4.550	1351	5	32.50	0.260
27	175	4.725	1351	5	31.25	0.270
29	175	5.075	1351	5	29.25	0.290
31	175	5.425	1351	5	27.25	0.310
18	200	3.600	1351	5	41.00	0.180
20	200	4.000	1351	5	37.00	0.200
22	200	4.400	1351	5	33.75	0.220
23	200	4.600	1351	5	32.25	0.230
25	200	5.000	1351	5	29.50	0.250
27	200	5.400	1351	5	27.50	0.270
16	225	3.600	1351	5	41.00	0.160
18	225	4.050	1351	5	36.50	0.180
20	225	4.500	1351	5	33.00	0.200
21	225	4.725	1351	5	31.25	0.210
23	225	5.175	1351	5	28.50	0.230
25	225	5.625	1351	5	26.25	0.250
16	250	4.000	1351	5	37.00	0.160
18	250	4.500	1351	5	33.00	0.180
19	250	4.750	1351	5	31.25	0.190
21	250	5.250	1351	5	28.25	0.210
12	305	3.660	1351	5	40.50	0.120
14	305	4.270	1351	5	34.75	0.140
15	305	4.575	1351	5	32.25	0.150
16	305	4.880	1351	5	30.25	0.160
17	305	5.185	1351	5	28.50	0.170
19	305	5.795	1351	5	25.50	0.190

Table 6.6: AD 900 Series Agrowdrill Calibration Data

6.3.6 JPC 2000 Series Agrowdrill

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
24	150	3.600	2557	5	21.75	0.240
28	150	4.200	2557	5	18.50	0.280
34	150	5.100	2557	5	15.25	0.340
38	150	5.700	2557	5	13.75	0.380
20	175	3.500	2557	5	22.25	0.200
22	175	3.850	2557	5	20.25	0.220
24	175	4.200	2557	5	18.50	0.240
26	175	4.550	2557	5	17.25	0.260
28	175	4.900	2557	5	16.00	0.280
30	175	5.250	2557	5	15.00	0.300
32	175	5.600	2557	5	14.00	0.320
34	175	5.950	2557	5	13.25	0.340
36	175	6.300	2557	5	12.50	0.360
18	200	3.600	2557	5	21.75	0.180
20	200	4.000	2557	5	19.50	0.200
22	200	4.400	2557	5	17.75	0.220
24	200	4.800	2557	5	16.25	0.240
26	200	5.200	2557	5	15.00	0.260
28	200	5.600	2557	5	14.00	0.280
30	200	6.000	2557	5	13.00	0.300
32	200	6.400	2557	5	12.25	0.320
16	225	3.600	2557	5	21.75	0.160
18	225	4.050	2557	5	19.25	0.180
20	225	4.500	2557	5	17.50	0.200
22	225	4.950	2557	5	15.75	0.220
24	225	5.400	2557	5	14.50	0.240
26	225	5.850	2557	5	13.25	0.260
28	225	6.300	2557	5	12.50	0.280
14	250	3.500	2557	5	22.25	0.140
16	250	4.000	2557	5	19.50	0.160
18	250	4.500	2557	5	17.50	0.180
20	250	5.000	2557	5	15.75	0.200
22	250	5.500	2557	5	14.25	0.220
24	250	6.000	2557	5	13.00	0.240
26	250	6.500	2557	5	12.00	0.260

Table 6.7A: JPC 2000 Series Agrowdrill Calibration Data

Number of Sowing Rows	Row Spacing mm	Sowing Width m H2	FarmScan Pulse Distance H1	Collect From Number of Hoses	Number of Crank Handle Turns	Total Weight Multiply By kg / Ha
12	305	3.660	2557	5	21.25	0.120
14	305	4.270	2557	5	18.25	0.140
16	305	4.880	2557	5	16.00	0.160
18	305	5.490	2557	5	14.25	0.180
20	305	6.100	2557	5	12.75	0.200
22	305	6.710	2557	5	11.75	0.220

Table 6.7B: JPC 2000 Series Agrowdrill Calibration Data

6.4 Non Standard Machine Settings

For machines with configurations or tyre sizes not listed in the calibration tables the following procedure will need to be followed:

1. **Establish the working width of your drill.**
   - 1.1 Measure the row spacing in metres.
   - 1.2 Multiply this figure by the number of rows on your machine.

2. **Determine the rolling circumference of your drive wheel.**
   - 2.1 Ensure the tyre is inflated to recommended pressure.
   - 2.2 Lift the machine into transport position.
   - 2.3 Mark the tyre at contact point with the ground.
   - 2.4 Place a peg or marker at this same location.
   - 2.5 Tow the machine for x number of wheel revolutions. The greater the number of revolutions used the more accurate the calculation.
   - 2.6 Measure the distance travelled (in metres) and divide by x to obtain the rolling circumference.

   A list of tyre sizes with their respective rolling circumferences is presented in Table 6.8. These rolling circumferences are based on the tyre manufacturers recommended pressures.

Tyre Size	Rolling Circumference
235 / 75 R15	2.356
10.5 x 20	3.0
12.4 x 28	3.644
16.9 x 28	4.181
18.4 x 34	5.01

Table 6.8: Wheel Rolling Circumference

3. **Calculate the number of wheel revolutions per Hectare.**

3.1 $$\text{Wheel Revs/Ha} = \frac{10000}{\textit{Wheel Circ.} \times \textit{Working Width}}$$

4. **Calculate idle shaft revolutions per Hectare.**

4.1 This is the Wheel Revs/Ha (see 3.1) multiplied by the idle shaft ratio for your drill. See Table 6.9

Agrowdrill Series	Idle Shaft Ratio
AD 100	2.05
AD 300	3.095
AD 500	3.095
AD 700	3.095
AD 900	3.095
JPC 2000	1.96

Table 6.9: Agrowdrill Range Idle Shaft Ratio

5. **Hectare meter settings.**

5.1 **H1** -

5.2 **H2** - Working Width

A Worked Example:

A 22 Run AD 100 Series Agrowdrill with 22 tynes at 150mm spacing:

Working width = Number of tynes x Row spacing
= 22 x 0.150
= 3.3m

Wheel circumference = From Table 6.1
= 2.356m

Wheel Revs / Ha = 10000 / (Working Width x Wheel Circumference)
= 10000 / (2.356 x 3.3)
= 1286.21

Idle shaft revs / Ha = Wheel Revs per Ha x Idle Shaft Ratio (Table 6.2)
= 1286.21 x 2.05
= 2636.72

Idle shaft revs per 1/50th Ha = 2636.72 / 50
= 52.73

6.5 Plotting Calibration Charts

This procedure will allow for the plotting of calibration charts for seeds or fertilisers not listed or for the modification of existing charts.

1. Set the varibox adjusting lever to the maximum setting and carry out the calibration procedure as outlined in the Section 6.2.1 above.
2. Select a blank chart (or draw a new one) suitable to the seeding rate achieved.
3. Find the point on the x-axis (bottom) that corresponds to the achieved seeding rate.
4. Mark a point on the maximum quadrant setting line that corresponds to the achieved seeding rate.
5. Draw a straight line from this point to the bottom left hand corner (0,0).

This line indicates the approximate amount of seed or fertiliser rate at any given quadrant setting.

7.0 Operating Tips

7.1 After the First Round

The following is a list of points that should be checked after the first pass or round of a paddock:

1. Ensure both the seed and fertiliser drives are rotating.
   Note: Problems in this area can be avoided with adequate maintenance and checking the rotation of the drives before commencing.
2. Check that the seed and fertiliser are running evenly through all rows.
3. Ensure that the bottoms of the delivery tubes are not blocking up with wet soil. If this occurs the soil should be allowed to dry before continuing.
4. Check the soil openers for any loose bolts.
5. Check the rotation of coulters.
6. Check the machine for any loose bolts.
7. Check the alignment of the coulters and the openers.
8. Retension all tyne and coulter clamps.

7.2 Gradual Slowing of Fertiliser Flow

This often happens when using fertilisers such as single super that have a high percentage of fine powder. The powder generally builds up at the bottom of the fertiliser hopper and slows the flow rate. This may also occur with lime-coated seeds, as the lime is prone to flaking off.

To avoid this problem, occasionally run the fertiliser hopper to a low level and clear away any powder build up manually by opening the gate settings to the widest setting. Only do this while the machine is stationary.

7.3 Seizing of the Metering System

This can easily happen when using highly soluble and corrosive fertilisers such as urea. Such fertilisers will ‘cake’ rapidly in moist conditions and may seize the fluted rollers.

This can be avoided by never leaving the Agrowdrill filled with fertiliser or seed in moist conditions.

7.4 Checking the Rotation of the Drives

The rotation of the seed and fertiliser metering mechanism can be easily checked by 'ratcheting' the Varibox adjustment levers. Simply loosen the knurled knobs and move the lever backwards and forwards a number of times. This will rotate the drives allowing the following to be done:

- Check if the metering system is seized with 'caked' fertiliser.
- Free small blockages caused by 'caked' fertiliser. If the 'caking' is severe the hopper may need to be cleaned out manually.
- Check for blockages in the fluted rollers, delivery tubes or soil openers.
- The quantity of seed and fertiliser under each opener should be observed to ensure equal metering of seed and fertiliser across the width of the machine.

7.5 Cleaning Seed and Fertiliser Hoppers

Thorough cleaning of the seed and fertiliser hopper is very important for a number of reasons including:

- Fertiliser left in the hopper will cause corrosion of the metal parts of the Agrowdrill.
- If you are changing to a different seed all the previous seed must be removed to prevent contamination.
- Seed left in the Agrowdrill will attract mice, rats and insects.

The following is the procedure for cleaning:

1. Try to have as little seed or fertiliser as possible remaining after finishing the seeding.
2. Scrape all the remaining seed or fertiliser to one side and scoop into bags or buckets. Sweep the bottoms of the hoppers clean with a broom.
3. Remove all restrictors and open the gates under the fluted rollers. For end of season cleaning remove verandahs to allow easier cleaning.
4. Use an air compressor or water hose to blow or wash out any remaining seed or fertiliser. A vacuum cleaner used to suck out remaining seed or fertiliser also works well.
5. Close the gates under the fluted rollers and reinstall the restrictors into the desired location. Replace the verandahs.
6. Clean away any seed or fertiliser that may have spilled onto the frame of the Agrowdrill.

Note: If the Agrowdrill is washed with water allow the hoppers to dry out thoroughly by placing the Agrowdrill in the sun with the hopper lids open.

When the Agrowdrill is clean and dry, apply a light coating of diesel to the insides of the hoppers to prevent any corrosion from fertiliser.

8.0 Lubrication and Maintenance

The Agrowdrill is an extremely robust and durable machine and will give many years of service with simple routine maintenance.

8.1 Pre-Operation Check

Check the following points before operation:

- Check all nuts and bolts are tight.
- Check tyne spacings are correct.
- Check all sowing hoses and tubes are unblocked and correctly positioned.
- Check all grub screws are tight.
- Check metering shafts are easily turned using the crank handle provided. The shafts should not be jammed or hard to turn.
- Check the Hectaremeter is installed correctly and functioning properly.

8.2 Daily Service

Before starting work each day the Agrowdrill should be carefully checked for the following:

- Loose soil opener mounting bolts. Tighten as necessary.
- Excessively worn soil openers. Replace as necessary.
- Bent or blocked down tubes. In rough or stony conditions down tube mounting brackets may bend. Straighten if possible or replace.
- Excessively worn coulters. Replace as necessary.
- Quick visual check of entire machine.

8.3 Lubrication

The lubrication schedule for the Agrowdrill is as follows:

Item	Action	Interval
Drive Chains	Apply Oil	20 Working Hours
Wheel Arm Pivots	Grease	100 Working Hours
Wheel Axle Bearings	Grease	Annually
Chains	Wash and Grease	200 Working Hours
Varibox	Check Oil	200 Working Hours
Varibox	Change Oil	3 Years
Coulter Pivots	Grease	20 Working Hours
Coulter Axles	Grease	Annually

8.4 Replacing Soil Openers

You should replace soil openers when they wear past the tungsten tip or lose their point. Blunt tips or worn heels will reduce the digging efficiency and seed placement accuracy of the Agrowdrill.

The procedure for changing soil openers is as follows:

1. Place the Agrowdrill on a hard surface and lift to the highest position and secure using the ram safety stoppers.
2. Turn the tractor off.
3. Remove retaining bolts that attach the opener to the shank. Depending on the type of opener there may be one or two bolts.
4. Remove worn opener and any damaged bolts.
5. Install new openers and any bolts and tighten bolts firmly.

8.5 Coulter Replacement

Coulter replacement procedure is as follows:

1. Place the Agrowdrill on a hard surface. Lift to the highest position and secure using the ram safety stoppers.
2. Turn the tractor off.
3. Remove retaining bolts.
4. Replace worn coulters.
5. Replace and tighten retaining bolts.

8.6 Downtube Assembly

Use the following procedure to service the down tube assembly:

1. Remove the rubber boot from the retaining lugs on the fluted roller housing.
2. Twist the bottom of the flexible tube off the seeding boot and remove the downtube assembly.
3. Screw out the flexible tube.
4. Replace the rubber boot or flexible tube as required. Ensure the new flexible hose is of similar length.

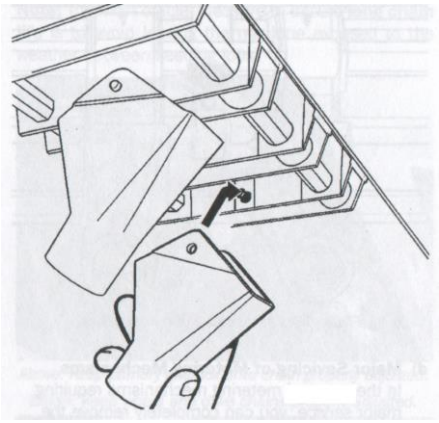


Figure 8.1: Removing outlet cups

8.7 Replacing Adjustable Gates

The adjustable gates are controlled by a hexagonal rod connected to the adjustment lever. Use the following procedure to replace worn or broken gates:

1. Remove the drive chain cover plate from the left side of the hopper.
2. Loosen the bolt that retains the gate adjustment lever.
3. Slide the hexagonal shaft out and remove worn or broken gates as required.
4. Slide the shaft back in assembling and replacing the gates as necessary.
5. Tighten the bolt that retains the gate adjustment lever.
6. Replace the drive chain cover plate.

8.8 Servicing the Fluted Rollers

The fluted rollers are driven by hexagonal shafts through the drive chains and sprockets on the left side of the Agrowdrill. These shafts are supported by self-aligning ball bearings adjacent to the sprockets and by glass filled nylon bushes mounted between every third outlet.

8.8.1 Drive Sprocket Bearings

1. Remove the drive chain cover.
2. Remove the drive chain.
3. Remove the grub screws that retain the drive sprocket and slide the sprocket off the end of the shaft.
4. Loosen the grub screw retaining the bearing locking collar and rotate the collar to release the bearing.
5. Remove the two retaining bolts from the bearing housing and slide the bearing off the end of the shaft.
6. Replace the bearing and reinstall, reversing the above procedure.

8.8.2 Fluted Rollers

1. Remove the drive chain cover and drive chain.
2. Remove the two mounting bolts from the self-aligning bearing.
3. Pull the drive shaft out. In most cases it won't be necessary to remove the shaft completely. Only slide the hexagonal shaft far enough to reach the worn or damaged rollers.
4. Replace rollers as necessary and reverse the above procedure to reassemble.

8.8.3 Drive Shaft Mounting Bushes

The Agrowdrill is fitted with glass filled nylon bushes between every third row. These bushes require no lubrication, are extremely wear resistant and should last the life of the machine.

Use the following procedure if service is needed:

1. Remove the fluted roller shaft as outlined in the above section.
2. Remove the retaining bolt from the worn or damaged bush and replace the bush.
3. Reinstall the drive shaft.

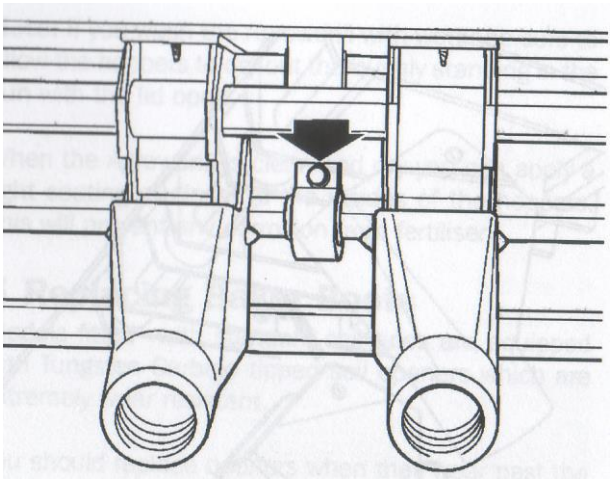


Figure 8.2: Drive shaft mounting bushes

8.9 Major Servicing of the Metering Mechanism

In the event of the metering mechanism requiring major servicing the bottom of the hoppers can be completely removed.

1. Remove the down tube assemblies and fluted roller drive sprockets and bearing assembly as outlined in previous sections.
2. Remove all restrictors.

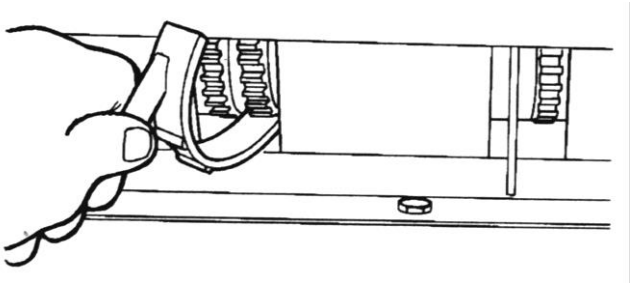


Figure 8.3: Removing and installing restrictors

3. Remove the retaining bolt from the front and rear of each fluted roller assembly and lower the entire metering mechanism from the bottom of the hoppers.
4. Installation procedure is the reverse of the above. The ends of the metering assembly will need to be resealed with a quality silicone sealant.

8.10 Servicing the Gearboxes

The Agrowdrill varibox gearbox requires no maintenance apart from an annual oil level check and an oil change every three years.

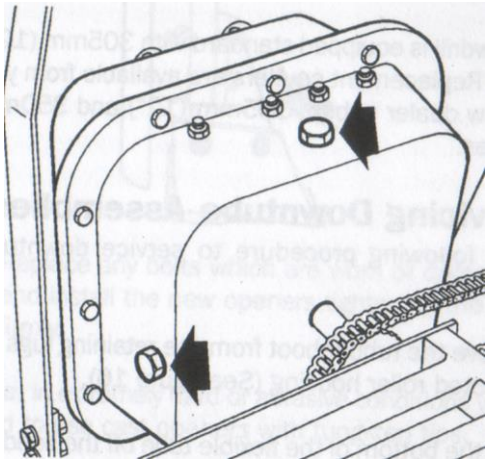


Figure 8.4: Varibox oil level and filler plugs

8.11 Drive Chain Adjustments

Chain tensioners are provided in the drive wheel arm, the chain to the gearbox and the chains to the metering mechanism. All chains should be adjusted until there is between 5mm and 10mm deflection of the chain with a light hand pressure applied. The longer the chain the greater the chain deflection that is allowed.

All drive chains are fitted with nylon tensioners. The procedure to adjust for chain wear is as follows:

1. Loosen the retaining bolt in the tensioner.
2. Move the tensioner up or down until the desired chain tension is achieved.
3. Retighten retaining bolt.
4. If the chain tension is still insufficient a link may need to be added or removed from the chain.

8.12 Drive Chain Maintenance

The drive chains will benefit from some form of lubrication. The two recommended methods are:

- Oil chains regularly during seeding using a quality chain oil.
- Remove the drive chains annually and store them in a pot of quality chain oil.

Note: The most crucial measure to ensure long chain life is to avoid leaving the Agrowdrill exposed to the weather between seeding jobs.

8.13 End of Season Storage

To ensure a long and trouble free working life please take the following steps when storing the Agrowdrill for long periods.

- Clean out the hoppers thoroughly according to the procedure outlined in section 7.5.
- Shed the Agrowdrill for protection against the weather.
- Ensure chains are properly oiled and covered before storage or remove chains and store them in an oil bath.
- Ensure all grease nipples are thoroughly greased before storage. By excluding air and moisture from inside the bearings the chance of corrosion will be minimised. For best results grease the bearings while they are still warm from the last working.

SIMPLE ROUTINE MAINTENANCE WILL PROLONG THE LIFE OF THE AGROWDRILL

9.0 Troubleshooting Guide

9.1 Undercarriage

The Problem	Possible Cause	Possible Solution
Poor penetration	Soil is too dry	Wait for rain or irrigate
	Worn soil openers	Replace soil openers
	Insufficient weight	Keep hoppers full
		Fill tyres with water
		Remove coulters
	Machine not level	Adjust levelling tube to suit
High soil opener wear	Soil is too dry	Wait for rain or irrigate
	Highly abrasive soil	Use tungsten tipped points
	Machine not level	Adjust levelling tube to suit
Tynes ‘laying back’	The soil is too dry and hard	Wait for rain or irrigate
	Machine not level	Adjust levelling tube to suit
	Working too fast	Slow to a suitable speed
Too much surface disturbance	Not working deep enough	Adjust deeper
	Working too fast	Slow to a suitable speed
	Coulters not cutting cleanly	Sharpen the existing coulters
		Fit new coulters
	Opener not aligned with coulter	Adjust alignment
Too deep on one side	Incorrect depth setting	Adjust depth stoppers evenly
	Low depth wheel pressure on one side	Inflate to recommended pressures
	Low tractor tyre pressure	Inflate as recommended in tractor manual

The Problem	Possible Cause	Possible Solution
Coulter ‘bulldozing’ soil	Coulter worn out	Replace coulter
	Seized bearing	Replace coulter bearing
Machine blocking up with trash	Too much trash	Graze heavily before seeding
		Slash paddock
		Control weeds before seeding
		Fit Coulters
	Wet Conditions	Allow soil and trash to dry
	Coulters not cutting properly	Sharpen or fit new or fluted coulters
	Tynes too close	Adjust spacing to wider setting
	Misalignment of tynes	Adjust tyne spacing to correct alignment
		Replace any bent or twisted tynes
Blocked downtubes or seeding boots	Mud build up	Clean blockage and wait for drier conditions
	Insect or rodent nests	Remove downtube and clean
		Prevent mice or insect infestations
	Kinked downtube	Repair or replace
		Avoid conditions where tubes may be damaged

Notes:

9.2 Metering System

The Problem	Possible Cause	Possible Solution
Falling fertiliser rate	Powder build up in hopper	See ‘Operating Tips’ section
	Caking	See ‘Operating Tips’ section
Incorrect metering rates	Different sample than that used to calibrate	Recalibrate
	Faulty scales	Check scales
Some rows not metering	Blocked roller	Clean out hopper and unblock
	Stripped roller	Replace roller
	Fertiliser clods in hopper	Clear blockages
Some rows metering too quickly	Restrictor cap missing	Clean out hoppers and check location of restrictors
	Broken adjustable gate	Replace gate
Self feeding seed or fertiliser	Gate settings too wide	Close up gate setting
	Restrictor caps not in place	Clean out hopper and check location of restrictor caps
	Damaged gate	Replace gate
Failure to meter seed or fertiliser	Sprockets loose on shaft	Tighten or replace grub screw on sprockets
	Gearbox broken	Replace gearbox
	Chain dismounted	Check alignment
		Check condition of chain
	Broken drive chains	Replace chain

The Problem	Possible Cause	Possible Solution
Broken Chain	Chain misalignment	Realign chain
	Worn chain	Replace chain
	Incorrect chain tension	Re-tension chain
	Seized shafts	Grease bearings
		Clean metering system
		Remove spilled fertiliser

Notes:

9.3 Hydraulic System

The Problem	Possible Cause	Possible Solution
Uneven lift	Hydraulics not primed	Prime hydraulic system
Poor lift response	Air in hydraulic hose	Bleed air from system
	Low oil level in tractor	Add oil according to tractor operation manual

Notes:

9.4 Farmscan 1100 Hectaremeter

The Problem	Probable Cause / Remedy
No response from ON/OFF switch	Check that power cable connections at battery are clean and tight
	Measure voltage from power cable at monitor connection point. It should be between 12 – 13.8 V DC
	If voltage ok and unit fails, return to nearest Farmscan dealer or authorised service agent.
Hectaremeter total wrong	Check that calibration factors H1 and H2 are correct
	Is the machine overlapping or underlapping?
	Is the unit counting headlands?
	Switch to SPEED readout and make sure it is reading at a constant speed. Cable or sensor could be damaged if readout is jumpy.
	Is the magnet facing the sensor end to end?
	Is the correct magnet being used?
	Is the magnet too far away from the sensor? (3-5mm gap)
	Is the magnet staying in line with the sensor on corners?
	Is the wheel loose?
	Is the sensor on a non-driven wheel? Tractor drive wheels will cause an over reading.
	Replace wheel / shaft sensor if none of the above.
Decimal point will not flash	This is normal if TOTAL hectares are above 999.9, or it is extremely cold.
Hectare or Speed does not work	Speed must be above 2.0km/h to register.
	Check that the calibration factors H1 and H2 are correct.
	Check that gap between magnet and sensor is 3 - 5mm

The Problem	Probable Cause / Remedy
Trip or Total Hectares fail to reset	Press TOTAL or TRIP key first to select area to be cleared.
	RESET key must be pressed and held down for at least 3 - 4 seconds
	If hectares still fail to reset, return unit to nearest Farmscan dealer or authorised service agent.
Hectares count up on their own without moving or Calibration figures keep changing	Switch off all other electronics to eliminate electrical interference as the cause.
	If switching off other electronics eliminates the fault, ensure the Hectaremeter cables are not running alongside wiring from other electrical devices, and / or physically move the Hectaremeter in relation to the other equipment.
	If petrol engine in close proximity, stop the engine to see if interference is caused by ignition system.
	Note: Carbon ignition leads must be fitted to spark plugs and coil to stop interference.
	Disconnect Sensor from cable at wheel / shaft. If the problem stops, replace the sensor.
	Make sure the Hectaremeter has an independent power cable, wired directly to the battery + and – terminals.
	If unit still counts hectares, return unit to nearest Farmscan dealer or authorised service agent.

Notes:

10.0 Calibration Charts

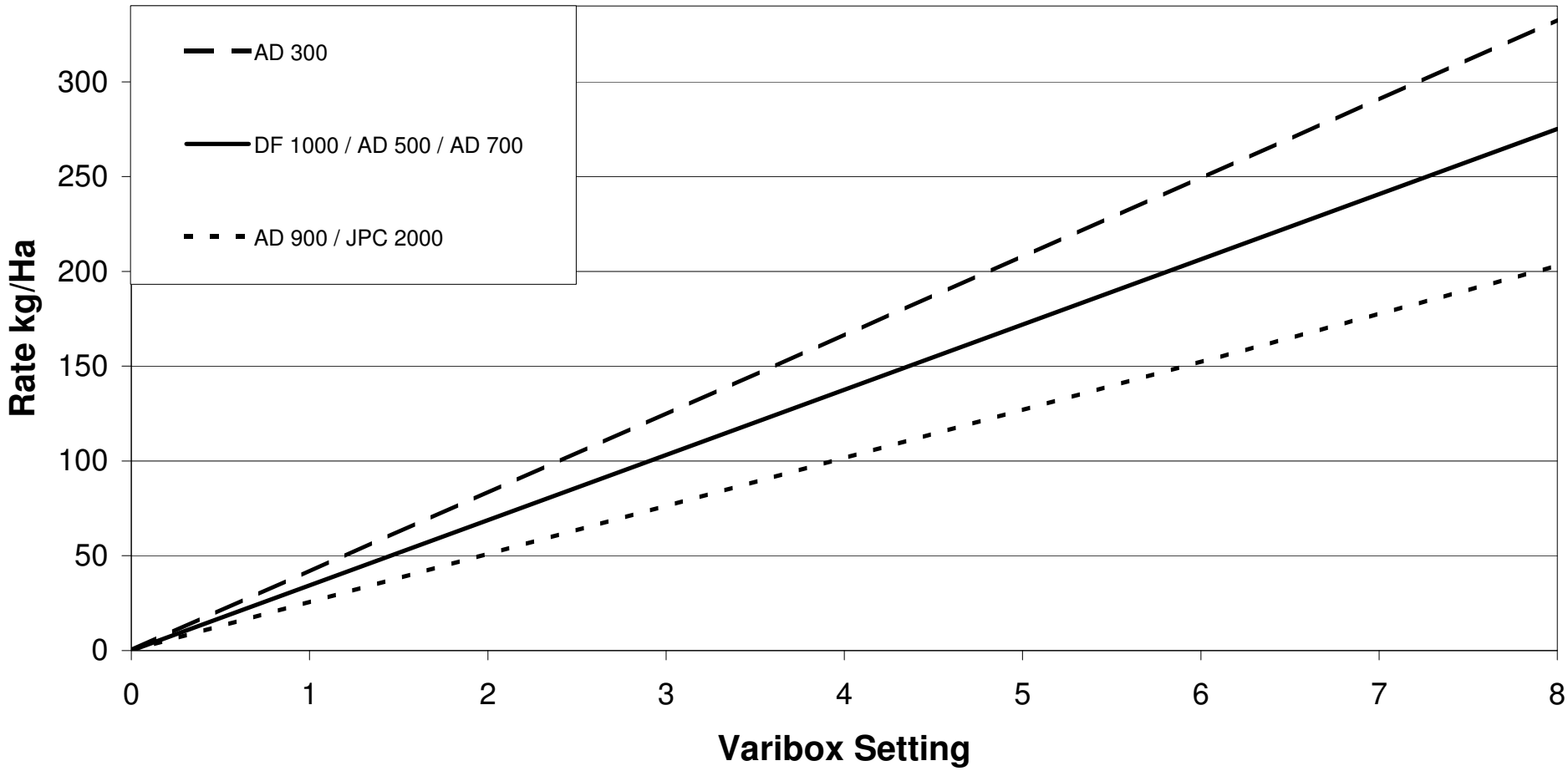
Due to variations in seed sizes that can occur from crop to crop, season-to-season as well as normal variations between varieties, the information given on the following charts should be used as a **guide only**. Cleanliness of samples will also effect actual rates, especially with oaten and some barley varieties.

For total accuracy it is recommended that you check the rate of flow from the metering system for each seed and fertiliser to be used. This will provide very accurate rates of seeding, and can be recorded for future reference. Blank charts have been provided for you to record your own specific charts for future use.

Correctly calibrating the Agrowdrill at each change of seed, fertiliser or application rate will prevent any undesired metering rates. The calibration procedure is outlined in section 6.2.1.

Figure 10.1: Agrowdrill Distribution System

Wheat

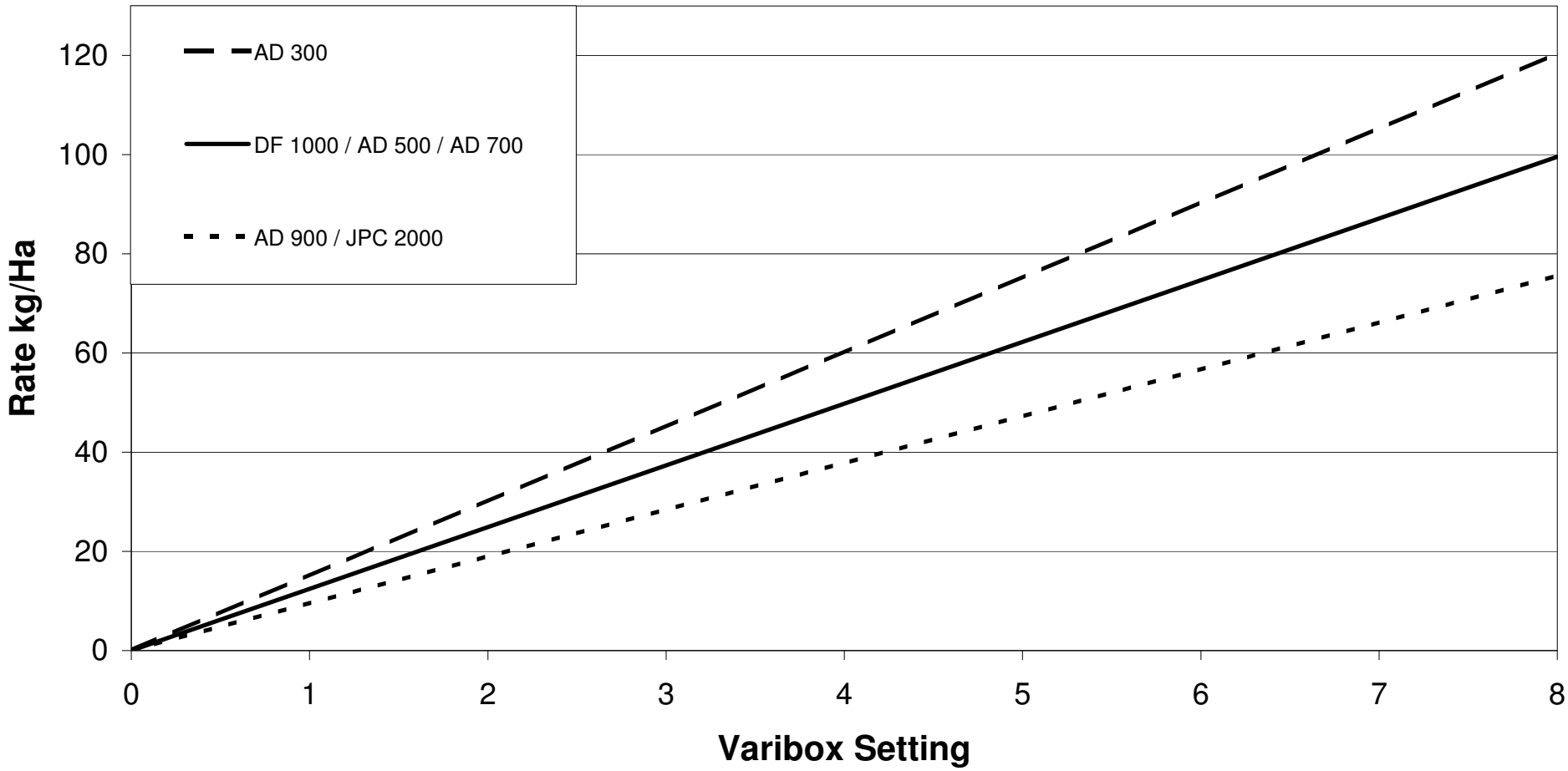


RH Gate Setting: 0.6

Centre Gate Setting: 2

Restrictors: 2 of 4

Ryegrass

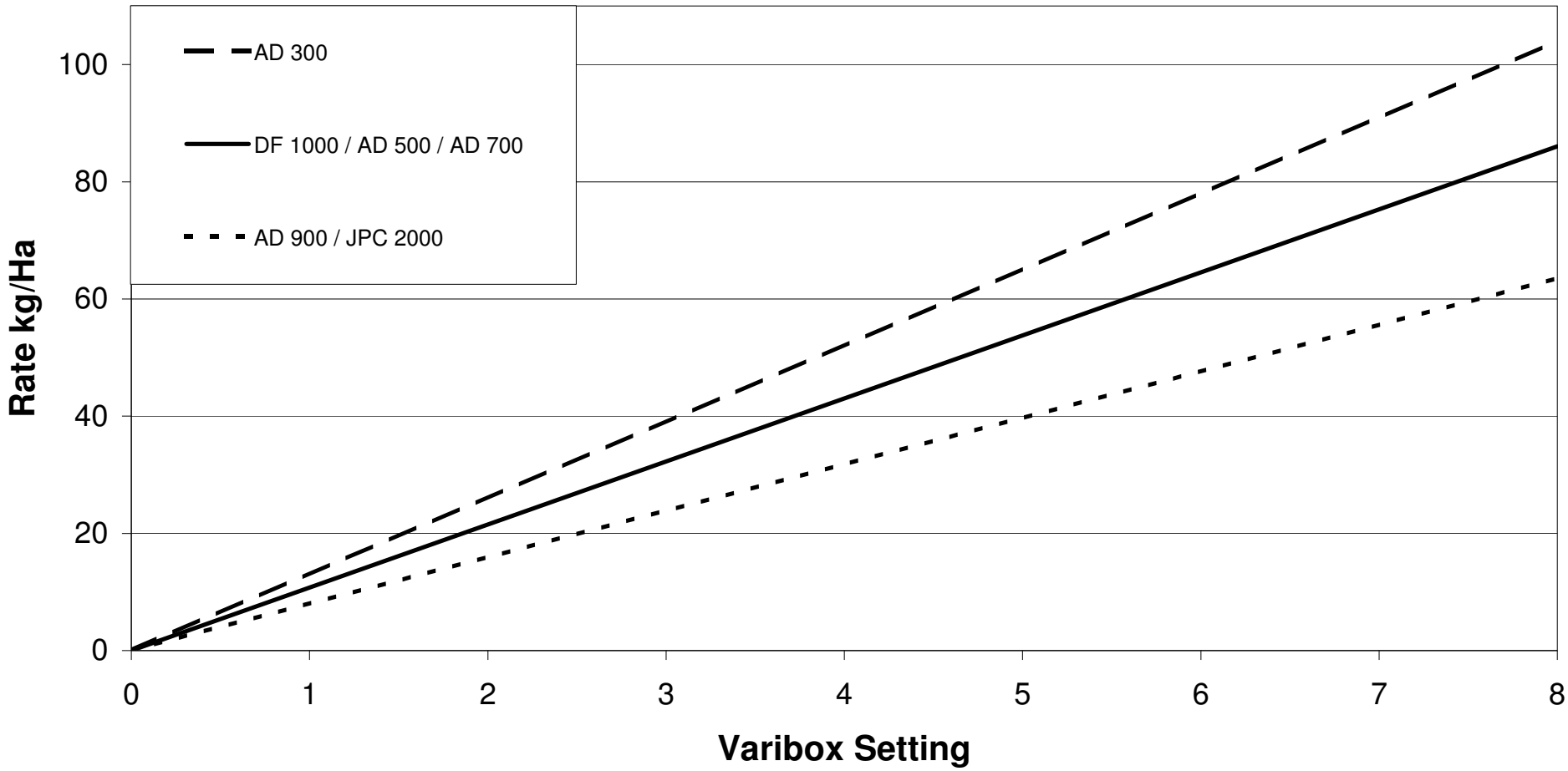


RH Gate Setting: 0.2

Centre Gate Setting: 1

Restrictors: 2 of 4

Clover

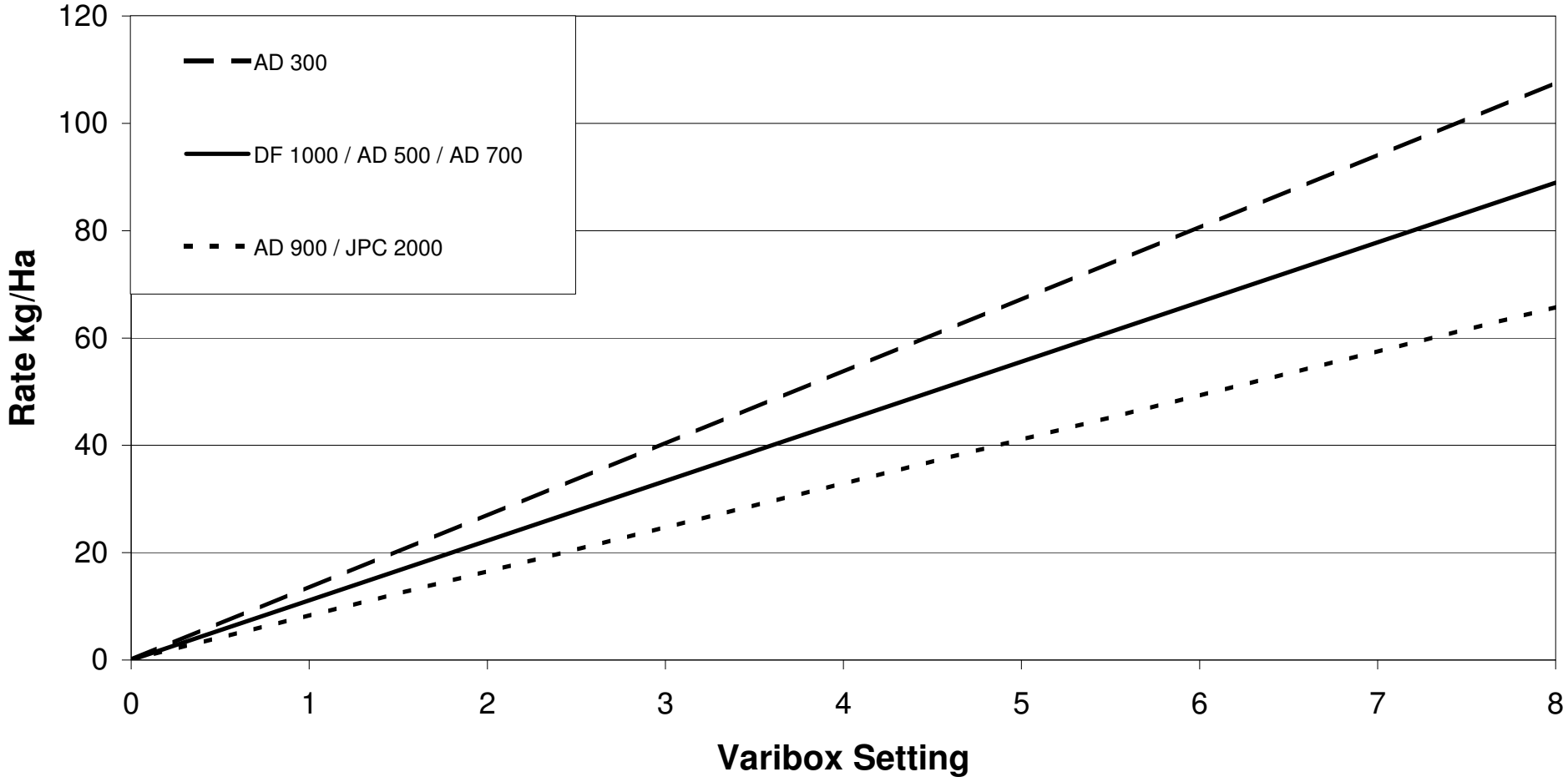


RH Gate Setting: 0.2

Centre Gate Setting: 1

Restrictors: 3 of 4

Lucerne

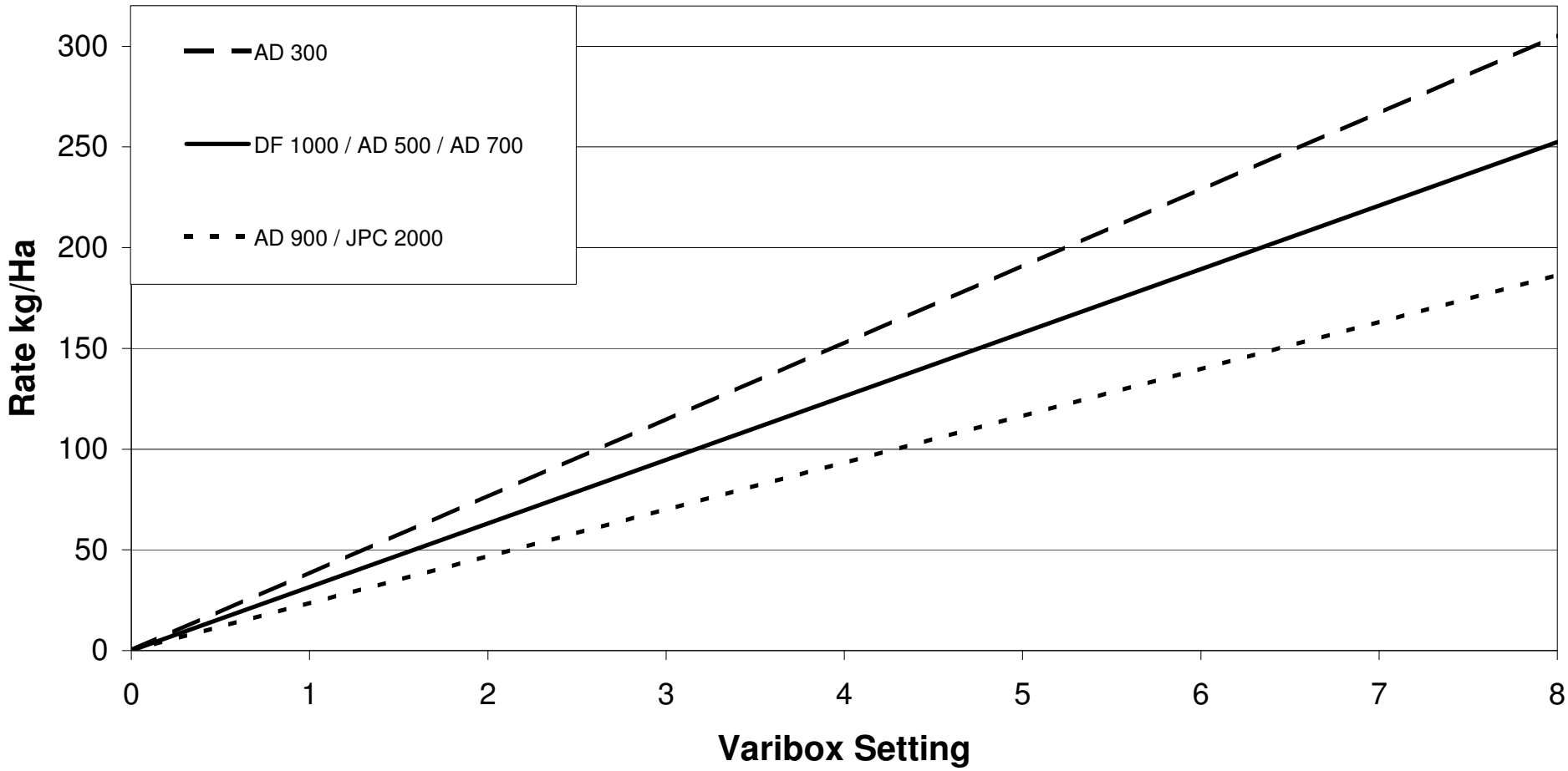


RH Gate Setting: 0.2

Centre Gate Setting: 1

Restrictors: 3 of 4

Barley

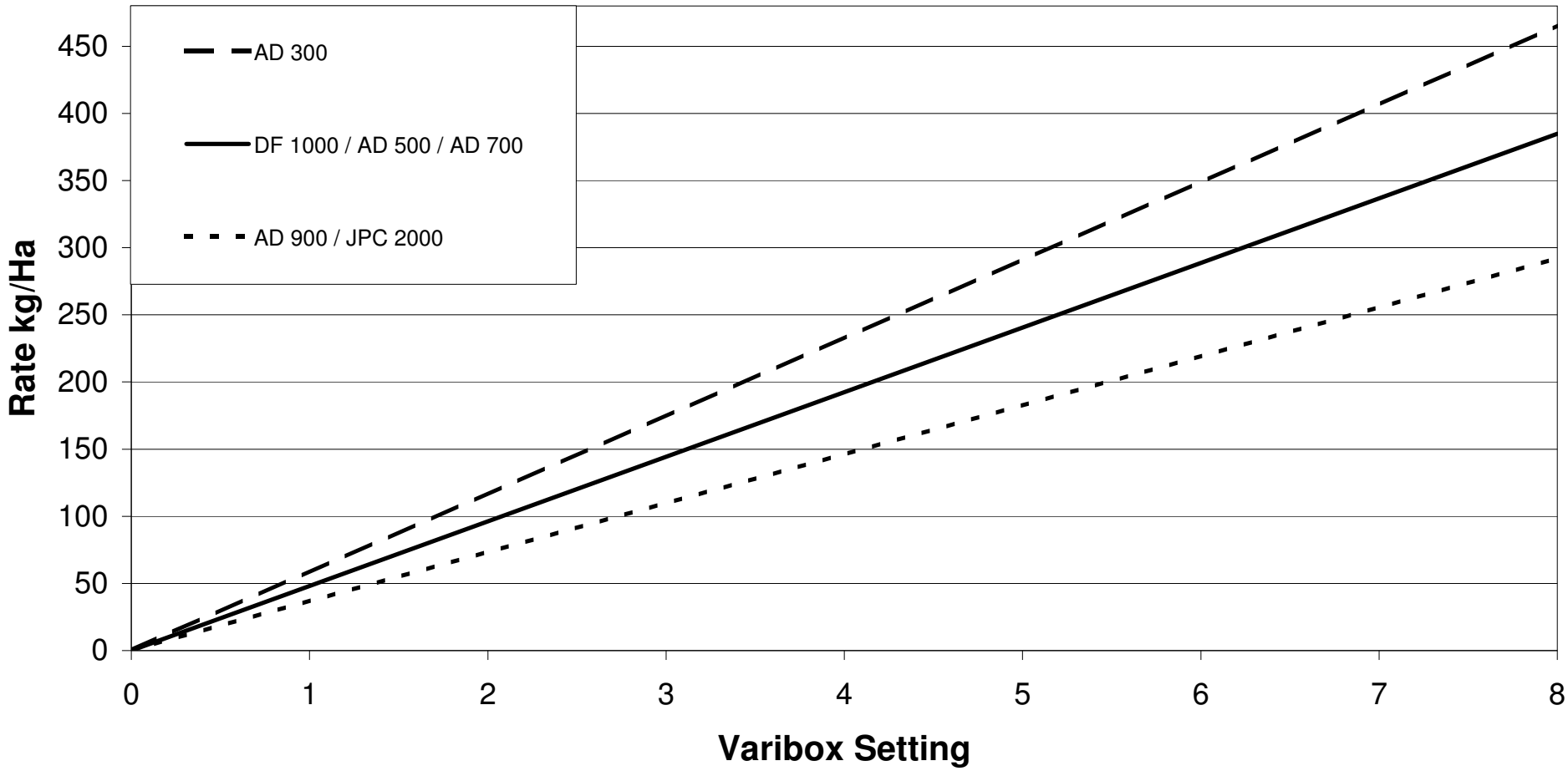


RH Gate Setting: 0.6

Centre Gate Setting: 2

Restrictors: 2 of 4

DAP

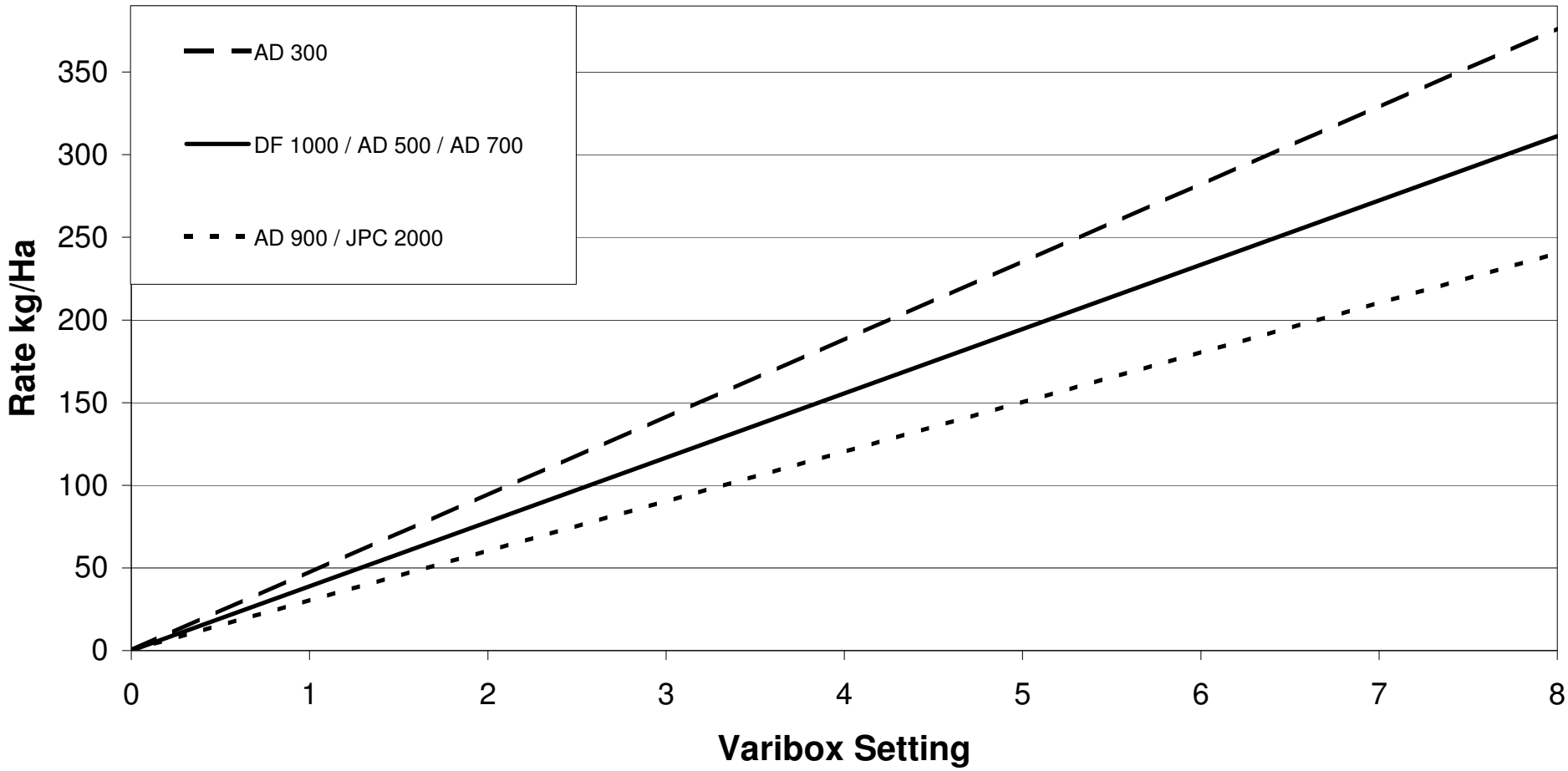


RH Gate Setting: 0.6

Centre Gate Setting: 1.5

Restrictors: 2 of 4

Urea

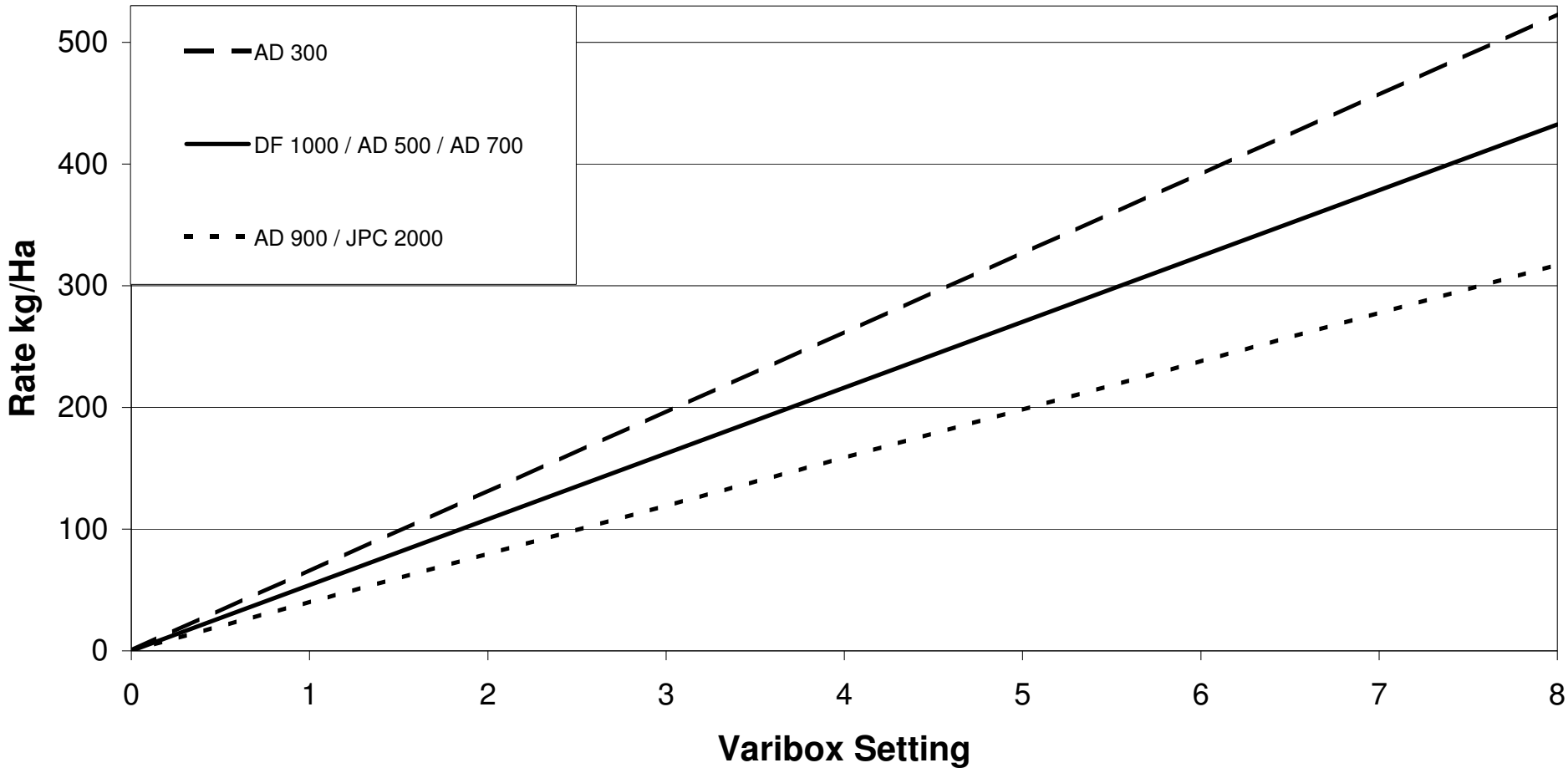


RH Gate Setting: 0.6

Centre Gate Setting: 1.5

Restrictors: 2 of 4

Single

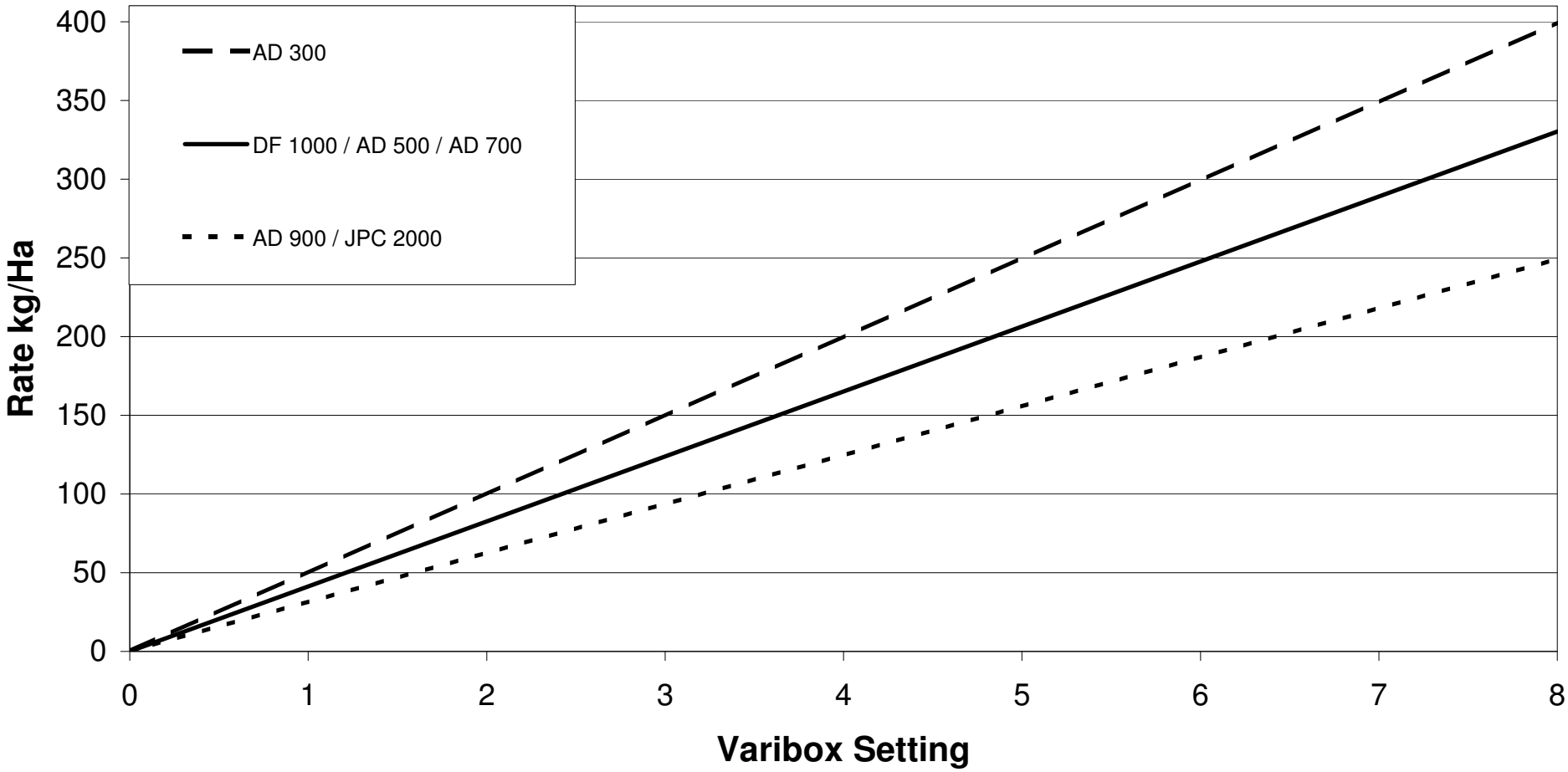


RH Gate Setting: 0.8

Centre Gate Setting: 2

Restrictors: 2 of 4

Oats



RH Gate Setting: 0.8

Centre Gate Setting: 3

Restrictors: 0 of 4